

ST. CLEMENT DANES . . .

All that remains of St. Clement Danes since Nazi bombers sang their hymn of hate over London is its graceful, breath-taking spire. This familiar landmark, designed by Sir Christopher Wren, following the great fire of London in 1666, was one of the finest of the fifty churches he designed. It paid highest tribute to the great architect's genius for invention and decoration. Here Samuel Chamberlain reconstructs with his Typhonite Eldorado St. Clement Danes as it was known for nearly three centuries. Another in a series brought to you by Pencil Sales Department, Dept. 225-J9, JOSEPH DIXON CRUCIBLE COMPANY, JERSEY CITY, NEW JERSEY.

TECHNIQUE USED

A well-sharpened 3B Typhonite Eldorado was used in drawing the spire of St. Clement Danes. Shading and values were blocked in with the flat surface of B and F degrees. The background building was blocked in with flattened H and 2H pencils, the flèche with an HB.

For SURE PROTECTION, EASY APPLICATION...



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New system of cold-applied roofing proves value at low cost for all types of "flat" roof work, new or old

One roofing system that you can specify today or any time is Flintkote Cold Process Roofing. A tested, practical system for cold application of bonded, built-up roofs, it has proved its worth in the busiest construction year in history.

With Flintkote Cold Process Roofing no jobs are held up waiting for equipment. Applied cold, Flintkote Cold Process products require no heating equipment, enable contractors to handle several jobs simulta-

neously... cover a bigger territory in less time.

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Alert industrials everywhere (particularly along the Coast and in defense areas) are fully prepared for possible air raids with Flintkote Blackout Materials and Fire-Retardant Roofs. These products, proved in England, are available in America today. Write for complete specifications.



FLINTKOTE Building Materials



NEW YORK • ATLANTA • BOSTON • CHICAGO HEIGHTS • DETROIT
EAST RUTHERFORD • LOS ANGELES • NEW ORLEANS • WACO • LONDON

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Looking ahead with Asbestos



A "TYPEWRITER" MUFFLER THAT WILL
MAKE TOMORROW'S OFFICES QUIET

Right now, K&M Sprayed "Limpet" Asbestos is busy at many important war jobs. For example, one of its most unique uses today is the sound treatment of gun testing rooms.

Imagine the tremendous noise that would result from a battery of five machine guns, each firing more than 1,000 rounds per minute, were it not for the quieting effect of this remarkable material.

Surely if "Limpet" can smother the bark of these Army "typewriters" today, it can be turned with even greater effectiveness on the bothersome clacking of office typewriters tomorrow.

Nor is acoustical efficiency the only virtue of Sprayed "Limpet". It frees the architect from geometric limitations—any surface can be

treated, regardless of shape or composition. It can also be given as many as ten coats of paint with no appreciable loss in sound absorption. "Limpet's" asbestos composition makes it highly resistant to fire.

You may be sure that when peace returns, anti-noise campaigns will have a strong ally in K&M Sprayed "Limpet" Asbestos. Meanwhile, at K&M's laboratories, the search for new uses for asbestos goes on, grooming this versatile mineral for still greater human service.

* * *

*Nature made asbestos;
Keasbey & Mattison, America's asbestos pioneer,
has made it serve mankind . . . since 1873.*

KEASBEY & MATTISON
COMPANY, AMBLER, PENNSYLVANIA

Makers of

asbestos-cement shingles and wallboards; asbestos and magnesia insulations for pipes, boilers, furnaces; asbestos textiles; asbestos electrical materials; asbestos paper and millboard; asbestos marine insulations; asbestos acoustical material; asbestos packings; asbestos corrugated sheathing and flat lumbars; asbestos-cement pipe for water mains

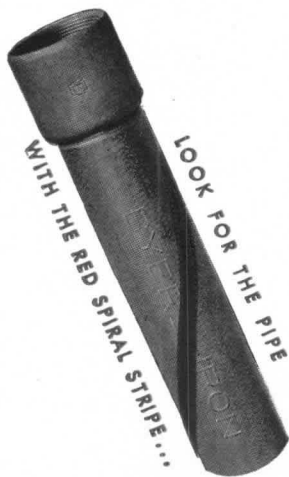


NEW PROBLEMS NEED NEW ANSWERS

... and radiant heating is providing them

Heating requirements for the highly specialized structures needed for war activities and production are often highly specialized also, bringing new problems that cannot be answered in terms of past experience or past practice. Many are being successfully answered with Radiant Heating.

The illustration shows one job in progress in a just completed war production factory addition at the Murray Corporation plant in Towson, Md. The building was 60' x 80', monitor type, and use was made of non-critical materials in construction—such as timber beams and joists. The 60'x60' floor heat-tag coils were made up of 1 1/4" wrought iron pipe, each run resting on an insulating strip placed on the crushed stone.



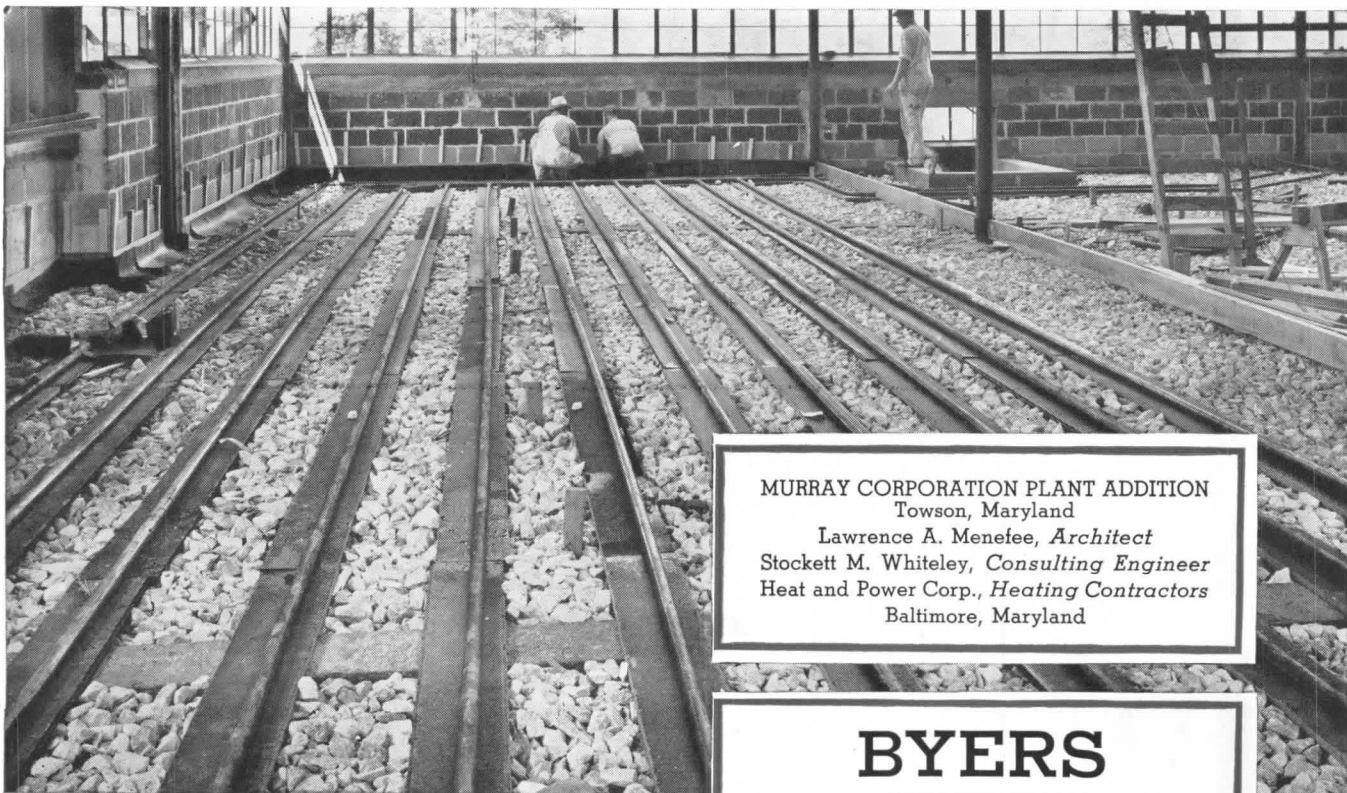
BYERS WROUGHT IRON

Other installations are now in progress, on the boards, or projected, for such diverse applications as an aircraft factory, a hydro-electric power plant, an ordnance plant, a control manufacturing plant, and a chemical plant.

Material requirements for Radiant Heating are extremely modest. Because of the excellent bending and welding qualities of wrought iron, sections can be fabricated quickly and easily. And wrought iron's corrosion-resistance, and desirable thermal properties, contribute to long, dependable service.

You, too, may find in Radiant Heating a complete answer to some difficult problem. For complete information ask for our technical bulletin, "Byers Wrought Iron for Radiant Heating Installations." Also, our "Experience Pool," built up through contacts with dozens of engineers on hundreds of jobs, is at your service. Just write.

A. M. Byers Company. Established 1864. Offices in Pittsburgh, Boston, New York, Philadelphia, Washington, Chicago, St. Louis, Houston, Seattle, San Francisco.



MURRAY CORPORATION PLANT ADDITION
Towson, Maryland
Lawrence A. Menefee, *Architect*
Stockett M. Whiteley, *Consulting Engineer*
Heat and Power Corp., *Heating Contractors*
Baltimore, Maryland

BYERS
GENUINE
WROUGHT IRON
Tubular and Hot Rolled Products
Steel Tubular Products

*Corrosion costs you more than
Wrought Iron*

ARCHITECTURAL

RECORD

COMBINED WITH AMERICAN ARCHITECT AND ARCHITECTURE

VOL. 92

SEPTEMBER 1942

NO. 3

NEXT MONTH

THE war effort is intensified and accelerated by the certain knowledge that Americans are fighting to build a better future for every man, a better environment for all his activities. The vision of the future must be made real and graphic by postwar planning. What architects can do in this planning is told next month in a case-history article by an architect experienced in the Public Works Reserve. The men and methods that will be employed in working out plans for the future are discussed by an educator at one of the leading universities, whose business it is to train men to cope with all the problems of postwar planning.

The need for schools is felt today and will be met in the future. Ideas for modern schools are given in picture and precept in the October issue, useful in planning now for building later. A building type much to the fore in new communities, and in remodeling, to take care of merchandizing changes, is the retail store, the community shopping center. Our Building Types Study will cover the possibilities and actualities of store remodeling within the restrictions imposed by war conditions. The what, why, where, and how of present day store practice.

And practical working details of store building and remodeling under present conditions make a most useful series of Time Saver Standards.

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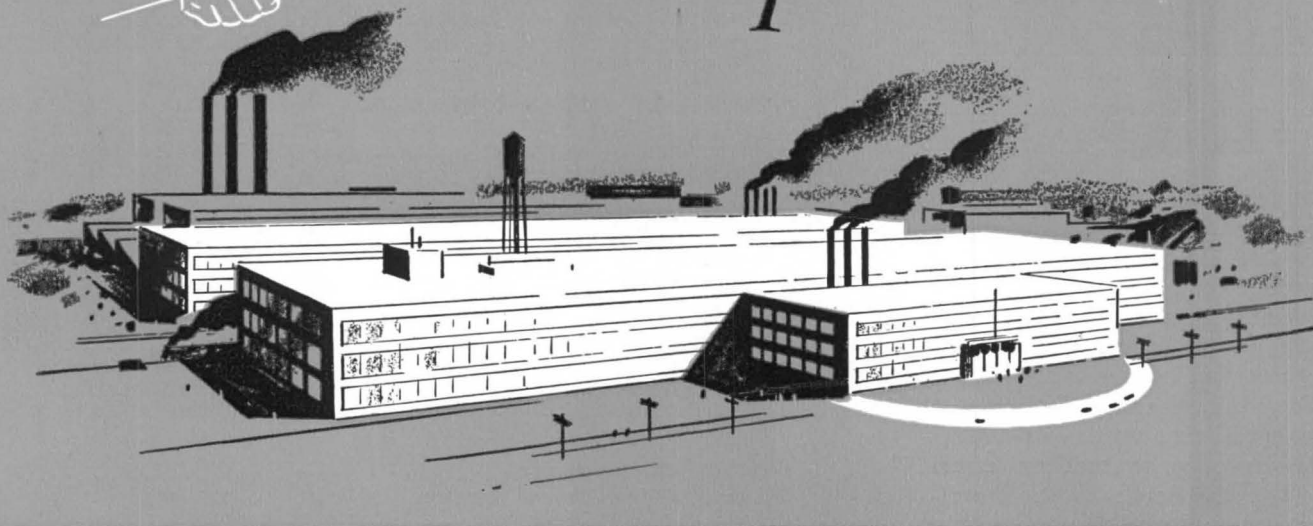
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War plants have an invisible "protector"



It's the refinements...the benefits of patient research...the quality...of the electrical wires and cables upon which uninterrupted operation depends.

In electrical wires and cables, the "tremendous trifles", the never-heard-of-improvements, small as many of them are, are lengthening the period between "begin operation" and "breakdown". They are safeguarding *steady* production... they have been built to keep pace with 3-shift operation.

Anaconda research has developed scores of product improvements and many completely new products that are today meeting these critical demands. Their improved constructions deliver greater capacities with less power loss, their insulations can withstand high heat, corrosion, abrasion. The research that built these wires and cables continues at a fast pace. Now in addition to delving into experiments for improvements in industrial products, Anaconda is devoting much of its

research to wiring for residential and commercial building.

When peace returns, adequate commercial and residential wiring will need your attention.

The electrical future will place greater demands than ever before on those in a position to make wiring selections. Anaconda will cooperate with architects with information and with products measuring up to their specifications.

42223



This familiar trade-mark symbolizes the best efforts of modern research and production.

ELECTRICAL WIRES AND CABLES OF COPPER ARE THE LIFE LINES OF OUR NATION

ANACONDA WIRE & CABLE COMPANY

Subsidiary of Anaconda Copper Mining Company

GENERAL OFFICES: 25 Broadway, New York City • CHICAGO OFFICE: 20 North Wacker Drive • Sales Offices in Principal Cities

WASHINGTON NEWS

By WILLIAM J. CASEY

Curb on Army Building • Substitute Materials • Fuel Oil Rationing • New Lumber Order • Postwar Building • Construction Machinery • Clear Plans • NHA on Shortage • New Defense Housing Areas • When Rent Ceilings Are Raised

BUILDING has a big stake in the current specter of war plants shutting down for lack of materials. It will mean further reorganization of WPB's material control procedure—the most severe tightening so far. WPB will carry on but the Army and Navy will have a bigger say in material distribution. As a result of this there will be more for tanks, planes and guns—less for housing and other home front needs. Military men are hardboiled about more housing except in *extremely* tight areas. At this point it looks as though WPB is going to count on a detailed scheduling job to relieve the material bottleneck. Their men will be sent out into plants to speed up urgent production, hold back production which is going too fast. Better distribution of materials may help housing projects which get cleared, but the attitude on clearing projects will become a lot tougher. Emphasis will shift to spotting projects in acute problem areas like Seattle, Detroit, Norfolk, etc. The intensified need to conserve materials may exert pressure in favor of more public housing, less private housing.

Curb on Army building

The Army has placed stiffer restrictions on the use of critical materials in its \$7,500,000,000 construction program. Restrictions continue severe on copper, rubber, steel, zinc, lead and aluminum. Chromium, magnesium, and nickel are virtually barred. Additional prohibitions limit further the use of drying oils, fuel oil, wool, mahogany and aircraft grades of spruce.

In placing these restrictions the Army proudly points to substitutions already made. Use of copper and brass, along with structural steel and steel plate, has been drastically curtailed or eliminated entirely where possible by the Corps of Engineers, which is in charge of Army construction. Copper flashing for roofs and walls, for example, is replaced by flashing of asphalt-coated steel. Brass in bathroom fixtures has virtually dis-

appeared in Army construction. Various flush valves were re-designed to halve the brass content. On faucets alone some 35,000 pounds of brass will have been saved by the end of 1942.

Substitute materials

A considerable amount of rubber insulation has been eliminated by the use of weatherproofed wiring and open knob and tube insulation. Wire covering of fibrous paper is a promising substitute for rubber sheathing. Slow-drying paints are used in lieu of types requiring quick-drying oils, which are essential in the manufacture of munitions. As a matter of fact, paints and lacquers are eliminated for many conventional purposes. A five-year life span is calculated for many buildings, with stains being applied instead of paint. Stains of creosote, linseed oil, or cottonseed oil are worthy substitutes. Synthetic resins which give body to paints, enamels, and lacquers are eliminated from

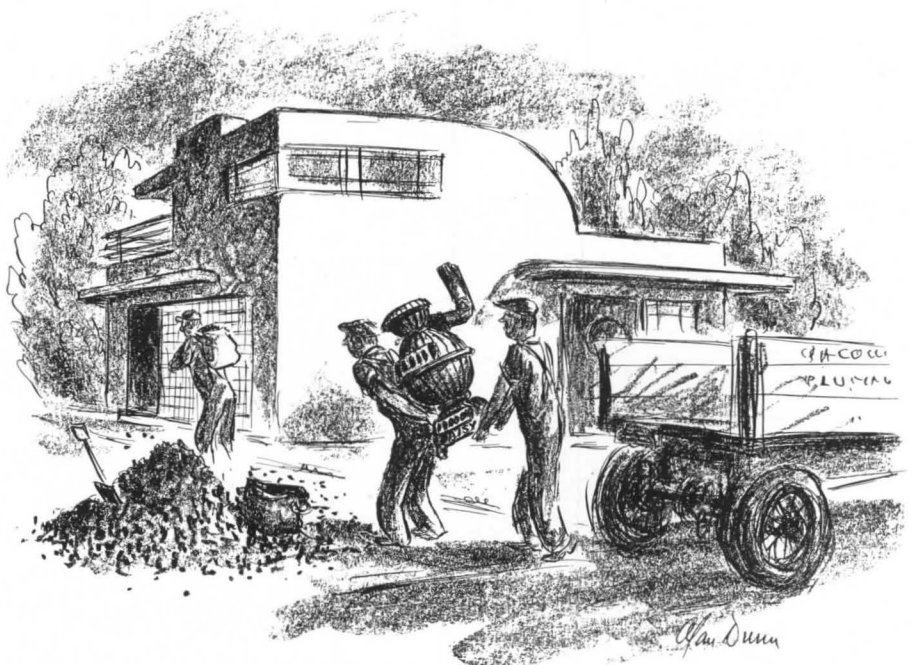
Army construction specifications. Paint specifications underwent a wholesale revision to conserve pigments requiring critical metals. An absolute minimum of cork is being used in refrigeration equipment. Conductive flooring in ammunition plants now uses domestic graphite and asphalt, thus relieving to that extent the stringency in rubber and copper which such flooring formerly contained.

Services of Supply use substitutes

Concrete, wood, and sheet steel have been going into structures of the Services of Supply wherever they could supplant steel plate. There are now wooden spans in airfield hangars and storage plants; concrete in columns; wood and reinforced concrete in storage tanks. Shower cabinets are made of pressed wood wallboard, as are spray cabinets for sterilizing dishes.

Hot water boilers and heaters are being redesigned with a safety factor that is lower, yet adequate. This will cut by one-fourth the total steel requirements needed for such boilers, with an indicated shift from 2,000 tons of plate to 1,500 tons of sheet metal on projects now in sight. Space heating systems are being changed

(continued on page 10)



The homes that can't be built today will be better built tomorrow because of these

ANACONDA

NON-FERROUS product developments which promote efficiency and reduce upkeep will always be the fruit of Anaconda's alertness to changes and resourcefulness in research.

In the past two decades, Anaconda's engineering experience accounted for the major product developments you see on these pages. Through them, thousands of homes have been made more livable, more economical. With peace, these products of Anaconda Copper and Brass... and possibly some new companions... will be ready for a booming building industry.

4213

1900 EXTRUDED SHAPES

Introduction and development of the extrusion process for architectural bronze and nickel silver.

1922 ANACONDA BRASS PIPE

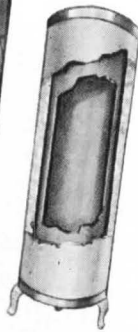
Introduced and promoted Brass Pipe for plumbing. Later developed Anaconda 85 Red Brass Pipe after a nationwide 10 year study of water corrosion.



1927 EVERDUR* METAL

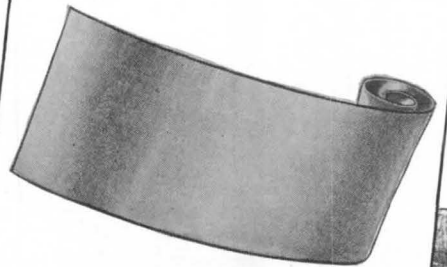
Commercial development of high-strength, weldable copper-silicon alloys leads to use for water tanks.

*Reg. U.S. Pat. Off.



1932 "ELECTRO-SHEET" COPPER

New process makes wide, thin copper available for low-cost, lasting, damp-proofing, weather-proofing and concealed flashing.



The *American Brass Company*

General Offices: Waterbury, Connecticut, Subsidiary of Anaconda Copper Mining Co

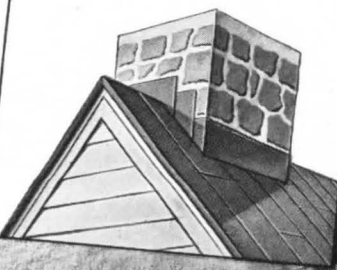
ARCHITECTURAL RECORD

DEVELOPMENTS



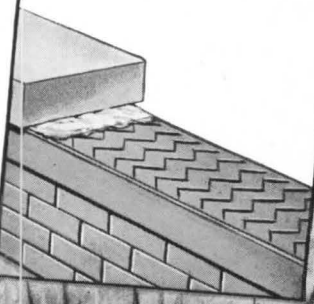
1934 10-OZ. ECONOMY COPPER ROOFING

New narrower, lighter weight roofing sheets make economical, long lasting copper roofs available for small and medium sized homes.



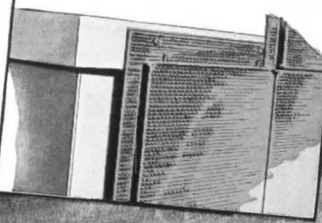
1935 THROUGH-WALL FLASHING

Patented new design provides positive protection and easier installation at reduced cost.



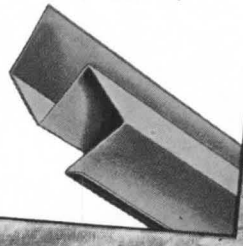
1938 COPPER WALL PANELS

A new dry-construction, patented wall facing; weather tight, non-absorptive; erected without solder or caulking compounds; allows free movement to prevent buckling. Panel walls can be dismantled and re-erected in another location.



1940 ANACONDA COPPER REGLET

Patented reglet to receive flashing in concrete construction—sturdy, efficient and easily installed.



makers of *Anaconda Copper & Brass*

Canada: Anaconda American Brass, Ltd., New Toronto, Ontario

(continued from page 7)

from high steam pressure to low, so that cast iron can be used in lieu of steel plate. Most kitchen equipment is largely of sheet steel or iron coated with porcelain enamel. Substitutions were made long ago on small sizes of utensils. Cooks' tables and pan racks are made of wood. Elaborate dish-washing apparatus is simplified to conserve metal. Stainless steel and monel metal are eliminated, except where indispensable. Jute, which comes primarily from India, has a substitute in twisted kraft paper and cotton braid for caulking pipe lines. Copper screening has been eliminated in favor of zinc-coated steel. A plastic screen fabric, which is apparently superior to metal screening in tropical climates, is also under consideration. Possibly this plastic will also serve in tubing and piping, thus releasing critical metals for other war purposes.

Fuel oil rationing

OPA is studying three possible methods for rationing fuel oil. The first is the heat-loss formula. Engineers will determine the basic ration necessary in various regions to heat a home efficiently. This estimate will be for a home which is well insulated, with a serviceable burner, with proper sashing and storm windows. Basing the ration on a well-insulated house will act as an incentive to insulate and, generally, to get the most out of the fuel oil available. Major objection made is that this is OK when the occupant owns his home but won't work out so well where the occupant is merely a tenant, since the rehabilitation of the home will have to be made by the landlord. With housing at a premium, the landlord is not too much concerned about whether the tenant lives at 55° or 75°. Note that if the landlord converts from oil to coal, he is not entitled to extra rent on the theory that he has made a major capital improvement or is furnishing an added service. OPA's position, a bit unrealistic, is that a landlord is under obligation to furnish heat at any rate, whether by coal or oil.

The second formula is the one currently favored by OPA; it is called the space-heating formula. In this formula no account or allowance is taken for fixing up a home or making it well insulated. You figure the

entire cubic space to be heated in the country. You divide this into the amount of fuel oil used for heating and you get the amount of fuel oil used to heat one cubic foot of space. You then cut by a certain amount. The percentage cut now being considered by OPA is 20 per cent. However, an allowance must be made for the fact that last year's winter was several degrees higher in temperature than an average winter. Therefore, the cut being figured by OPA must be, in turn, reduced by 9 per cent to make allowance for an average winter. Then each home owner gets a ration ticket based on the number of cubic feet in his home.

The third method is to cut deliveries to each retailer or distributor by a certain amount, the figure being about 20 per cent. OPA is unfavorably disposed towards this method because it allows too much leeway to the distributor in allotting supplies to his favorite consumer. Therefore, OPA is swinging towards methods I and II for direct consumer rationing.

Bolstering supply

On other fronts WPB, ODT and the Petroleum Coordinator are trying to bolster the supply of fuel oil. FHA and the Federal Reserve Board are pushing to conserve oil by encouraging insulation and conversion to coal. FHA has worked out a program to finance conversion of oil heaters in cooperation with more than 5,000 private credit institutions. Where conversion is not possible, FHA is ready to make available funds for the purchase and installation of a new coal furnace. As an auxiliary measure FHA will push loans to home owners to improve insulation and weatherstripping. These loans are being offered on the most favorable terms possible, with payments on a monthly basis spread over a three-year period if desired. At this point there is no indication of a limitation of conversion by shortage of materials. WPB recently allocated a small amount of materials for conversion purposes. FHA, at least, expects no difficulty from material.

Relaxed credit restrictions

The Federal Reserve Board has relaxed its credit restrictions to facilitate

the insulation and weatherstripping of houses and the conversion of oil burners to the use of coal. The credit regulation "W"—which limits the repayment period to a year and sets minimum down payment requirements—has been lifted for these purposes. Those who obtain credit to insulate their homes or to change over oil burners need make no down payment and are not bound by the one-year maturity requirement.

When rent ceilings are raised

Factors constituting a "major capital improvement" on the basis of which landlords may petition for increases in rents were defined by OPA as a structural addition, structural betterment or a complete rehabilitation. A structural addition is a clear addition to housing accommodations, such as the construction of an additional room or a new porch or the installation of plumbing, heating or electricity, where such facilities did not previously exist. A structural betterment is a qualitative improvement, even though such improvement is in part a replacement. Within this latter group would be the modernization of an existing bathroom, or the installation of a modern heating plant replacing an antiquated system. A complete rehabilitation is a general modernization reconstruction such as would make the property attractive in a different rental range.

New lumber order

L-121 has been replaced by Conservation Order M-208. This is a detailed distribution order, listing and classifying permitted uses according to their order of importance. This is the first instance of a new type of limitation order which WPB intends to use generally. It takes a positive rather than a negative approach in that it lists permitted uses. All others are outlawed. Most conservation orders list outlawed uses and all others are permitted. This is a much tighter form of control.

Orders bearing preference ratings of AAA, AA-1 or AA-2 get first call. Orders carrying preference ratings of AA-2X or lower, but higher than A-1-a, come next; those carrying ratings A-1-k through A-1-a follow and

(continued on page 12)

TRAP THE NOISE DEMONS

... with ceilings of
Armstrong's Cushiontone

IT'S BAD BUSINESS to let noise demons jangle the nerves of restaurant patrons. Those who like to eat in quiet, restful surroundings are all too apt to stay away—as long as these business-killers are on the loose. But it's easy to trap the noise demons with ceilings of Armstrong's Cushiontone—the new material that puts efficient noise-quieting within the reach of modest budgets.

The 484 sound-absorbing holes in each square foot of Armstrong's Cushiontone give it a noise-reduction coefficient as high as .75 in the 1/2" thickness. Your restaurant clients won't need fine instruments to appreciate the difference this makes when Cushiontone is installed. The effect is positive and pronounced.

Armstrong's Cushiontone is factory-painted, ready to apply to any ceiling which is firm, dry, and reasonably level—in new or old construction. Installation is quick and easy, without undue interruption to business. Maintenance is at a minimum, for Cushiontone is easily cleaned, and can be repainted whenever necessary without affecting its acoustical efficiency in the slightest. Its ivory-colored surface has the excellent light-reflection factor of .73, which helps improve general illumination.

Write for the Facts—Our new booklet gives the whole story of Armstrong's Cushiontone. We should like to send you a copy. Just drop a note to Armstrong Cork Co., Building Materials Division, 1245 State Street, Lancaster, Pa.



Armstrong's Cushiontone

Made by the
Armstrong's Linoleum



Makers of
and Asphalt Tile

THE RECORD REPORTS

(continued from page 10)

those bearing preference ratings lower than A-1-k straggle along last.

Delivery of softwood lumber is prohibited unless the lumber is required for use within 60 days, or in the case of green lumber needing seasoning, 120 days. Softwood lumber delivery will be limited to 60 days' supplies.

The order sets forth permitted uses in Lists A, B and C, which cover ratings as follows:

List A, to which preference ratings of AA-2X have been assigned, covers lumber for Army, Navy, government and lend-lease needs; certain projects in the P-19 series; repair and maintenance of Army, Navy and certain other government structures or projects; boxing and crating materials for military purposes; and replacement in inventories of lumber sold for List A purposes.

List B, to which A-1-a ratings are assigned, covers lumber for certain essential uses such as agricultural equipment, automobile trailers, communications, tanks and vats, and scientific equipment; construction of certain defense projects not covered in List A; certain defense housing projects; maintenance and repair of specific types of structures and equipment including industrial plants, railroads, etc.; boxing and crating of chemicals, agricultural implements, and other equipment and materials; and replacement in inventories of lumber sold for List B purposes.

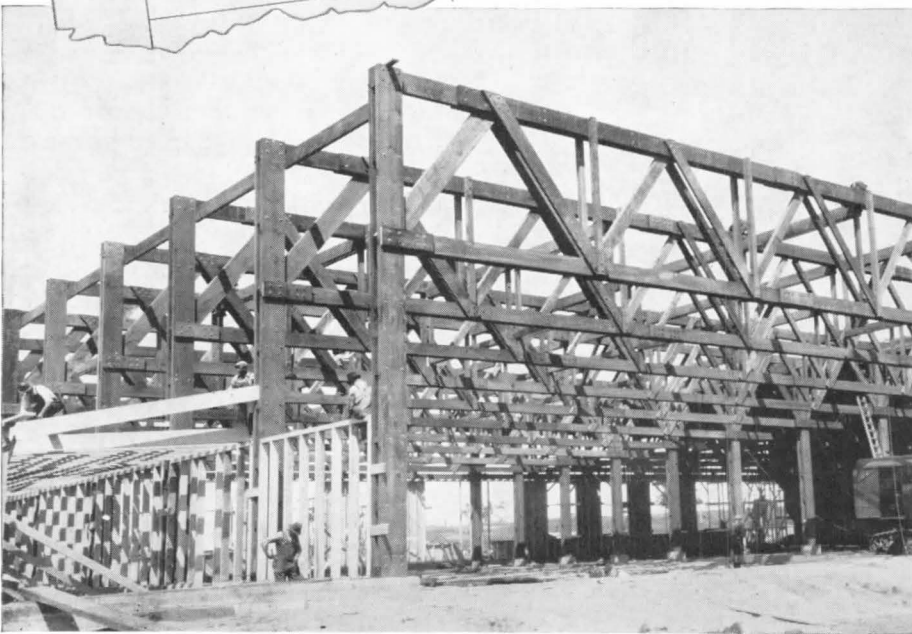
List C, to which A-2 preference ratings are assigned, covers boxing and crating for certain articles not listed in List B; construction of churches, elevators and school buildings when permitted under the Construction Limitation Order L-41; manufacture of specifically listed products; and replacement in inventories of lumber sold for List C purposes.

Postwar building

The idea of a public works preserve and, more concretely, the efforts of Federal planners to get local governments to line up postwar public works projects, at least temporarily, are suffering from lack of funds. The Federal Works Agency and the National Resources Planning Board have been using WPA funds to help municipalities do the preliminary engineering on projects to be undertaken after the war. The small WPA ap-

(continued on page 14)

Available for
essential
construction



WHERE construction jobs demand speedy fabrication with readily available structural material, plan to use "CZC" treated lumber.

With structural metals restricted even for war plant construction, "CZC" treated lumber is one of the most available, durable structural materials.

"CZC" treated lumber is being used in hundreds of wartime construction projects—barracks, bridges, hangars, war plants and other essential buildings.

"CZC" treatment permits the use of less naturally durable woods which become more lasting when treated than the better grades untreated. Properly treated wood suffers no loss of strength. The same values for load and stress calculations are applied as designated for corresponding untreated wood.

By giving lumber dependable protection against decay and termites Chromated Zinc Chloride enables lumber to fulfill the requirements for durability. In addition, "CZC" treatment for fire resistance is frequently specified for essential construction lumber.

For full details write E. I. du Pont de Nemours & Co. (Inc.), Grasselli Chemicals Department, Wilmington, Delaware.

"CZC" treatment is a recognized standard covered by Master Federal Specifications: TTW 551 chemical composition; TTW 571B use specification. Currently available for permissible uses.

DU PONT
REG. U. S. PAT. OFF.

C Z C

CHROMATED ZINC CHLORIDE

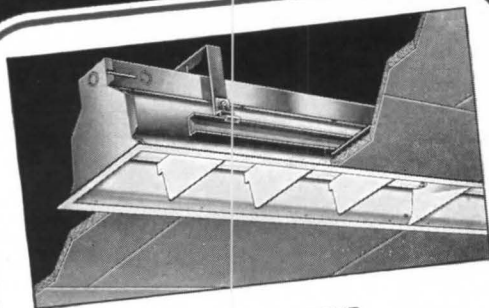
BETTER THINGS FOR BETTER LIVING . . . THROUGH CHEMISTRY

**The DAY-LINE . . .
UNIT and CONTINUOUS**

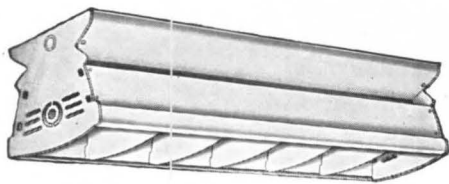
for Industrial installations—
singly, in parallel batteries,
or in long, continuous un-
broken lines. Removable
non-metallic reflectors



NEW
FLUORESCENT FIXTURES



The RECESSED TROFFER
With non-metallic reflectors and louvers—
for unit and continuous run installations



The LITEWAY
Exposed troffer, with non-metallic sides,
top and louvers—for direct ceiling mount-
ing in single units or long continuous runs

THE VICTORY SERIES
WITH
Non-Metallic Reflectors

THERE ARE THREE FEATURES that distinguish the fixtures comprising the Day-Brite Victory Series: (1) Day-Brite Super-White baked enamel assures high reflection values and longer life; (2) Speed in installation, and ease of servicing, are achieved through simplified mechanical design; (3) Truss-like construction assures maximum rigidity of the entire installation . . . Bulletins on request.

DAY-BRITE LIGHTING, INC.
5430 Bulwer Ave., St. Louis, Mo.

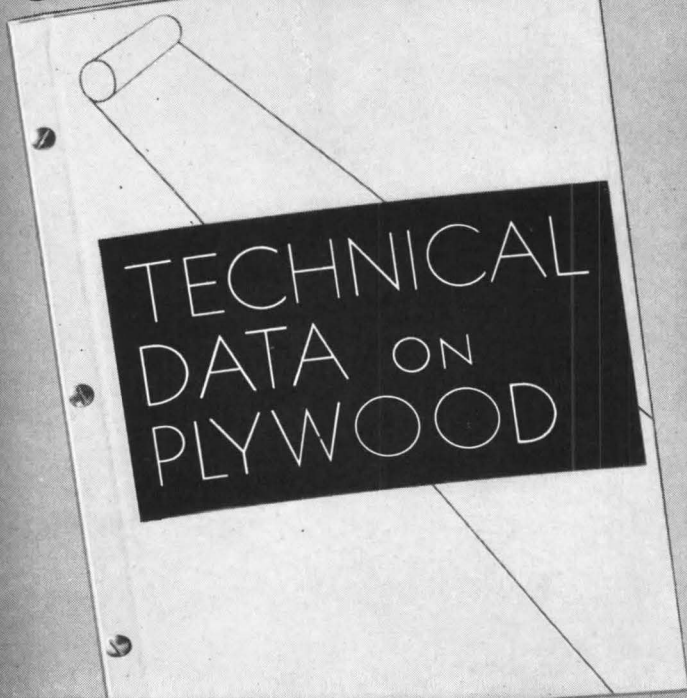


Patent Nos. 2,281,346, 130,740
Other Patents Applied For

Day Brite
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**FLUORESCENT
FIXTURES**

The **COMPLETE LINE OF FLUORESCENT LIGHTING FIXTURES** Nationally distributed through all leading electrical supply houses

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... the first 2 chapters of a new engineering handbook on Douglas Fir Plywood

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• This engineering handbook contains data on the mechanical properties of Douglas Fir Plywood never before available to engineers and architects. You will find that this data makes Douglas Fir Plywood far more useful to you . . . that it will enable you to specify this "miracle wood" as a pinch hitter for unavailable materials, as a structural material and for countless other purposes.

Write now for your free copy of "Technical Data on Ply-

wood." It is in loose-leaf form, and you will be sent additional chapters as they are published. Douglas Fir Plywood Association, Tacoma Bldg., Tacoma, Washington.

**DOUGLAS FIR
PLYWOOD**

Real Lumber
**MADE LARGER, LIGHTER
SPLIT-PROOF
STRONGER**

"A PRODUCT OF AMERICA'S ETERNALLY REPLENISHING FORESTS"

THE RECORD REPORTS

(continued from page 12)

appropriation and tight restrictions on non-relief personnel have put an end to this. Nobody has been able to figure out an interpretation of the Lanham Act which will permit use of defense public works funds for this purpose. Senator Wagner's bills authorizing this type of advanced planning—once rejected by Congress—will come back again with more force. The Federal planners will point out that local governments just can't plan a backlog of work projects without Federal help.

Construction machinery

In six weeks or so, anyone who wants to buy a piece of used construction or industrial machinery will find that OPA has compiled a fairly complete catalog of second-hand equipment held for sale either by dealers or industrial firms. The primary purpose of this file is to check on compliance with price ceilings on used machinery, but as a by-product, the catalog will aid in finding needed machinery. Some 35,000 pieces of machinery are listed in the OPA file. They estimate an eventual catalog of 500,000 pieces. WPB will carry a duplicate file and if you are looking for a particular piece of machinery, write to the WPB Priority Section and ask if such a piece is found in the "OPA-WPB Used Machinery Index." Also ask if it is subject to a limitation order. If it is, you have to get WPB's permission before buying it.

Clear plans

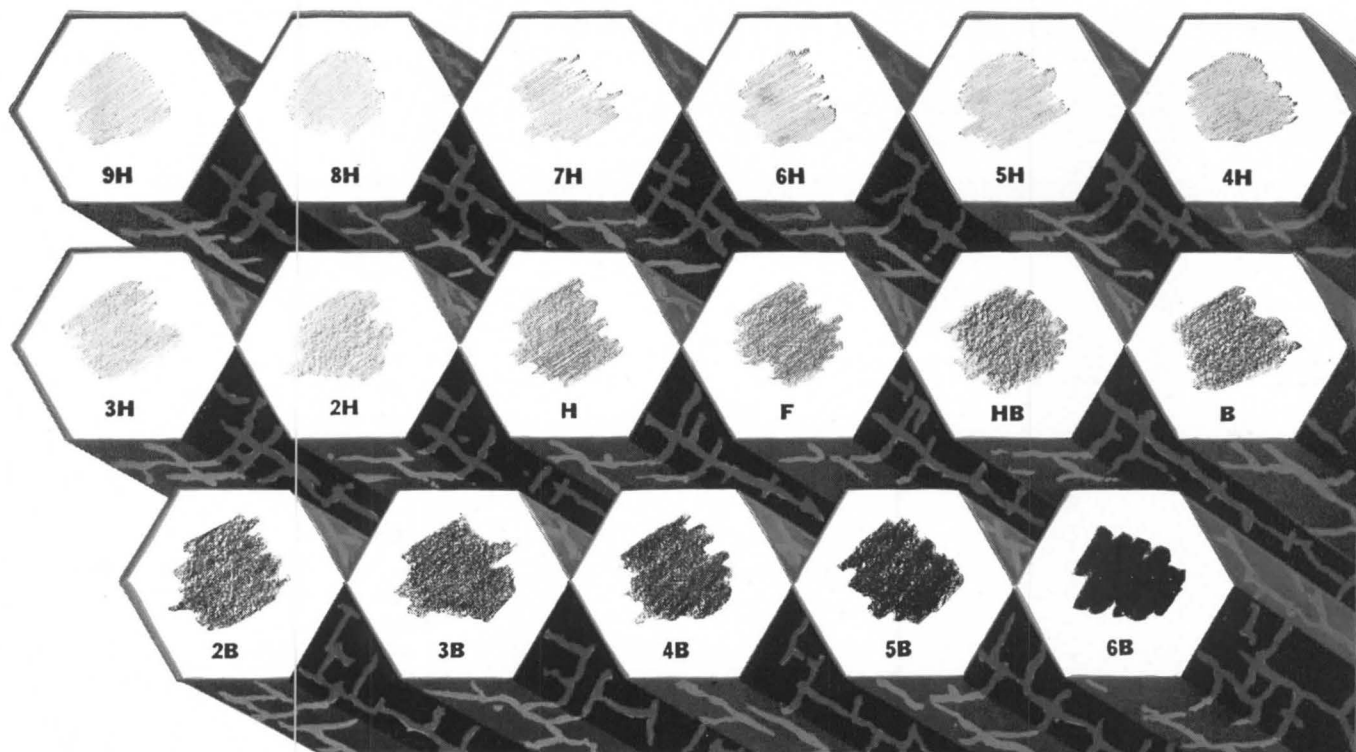
WPB is becoming interested in architects, engineers and builders to go over big-job plans with either its Construction Division or Conservation Bureau. The idea is to go in for preliminary discussion with a view to cutting down on critical materials. They recommend studying the list of critical materials in the order of their scarcity, which is put out every month or so by the Bureau of Industrial Conservation, before drafting plans and specifications.

NHA on shortage

NHA just put out a brief formula for beating material shortages.

Standards for permanent and for temporary housing have been issued. Temporary housing will predominate for the duration of the war because

(continued on page 16)



NAME _____ TITLE _____
 FIRM _____
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YOU DO THIS: Just put a circle around the two pencil degrees you most generally use on the above chart. Mail this advertisement along to us with your name, firm name, and address. (Or drop us a line with the same information).

WE DO THIS: We'll send you samples FREE of charge.

YOU'LL DO THIS: Discover why more Draftsmen, Engineers, Architects, Artists use VENUS than any other drawing pencil.

Discover how smooth and grit-free VENUS lead is. That's because of our patent Colloidal* process.

Discover what you've been missing if you aren't already using VENUS in your work.

*U. S. Pat. No. 1,728,888



VENUS

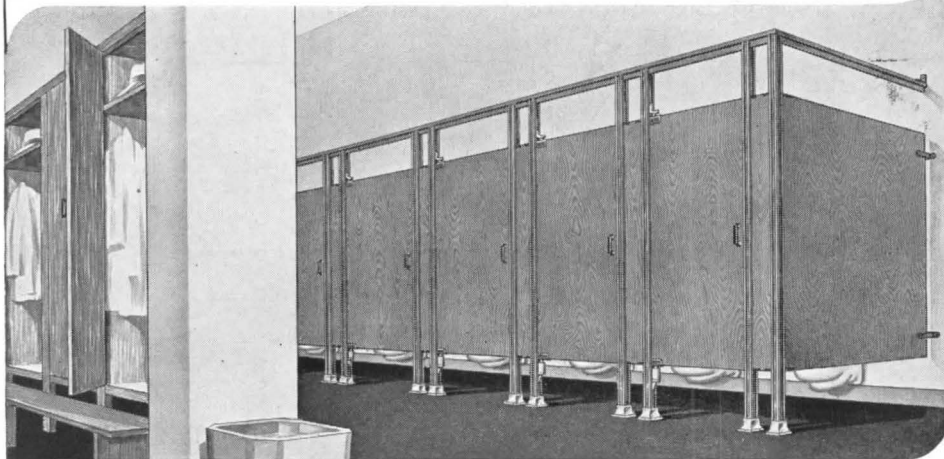
The AMERICAN Drawing Pencil

AMERICAN-MADE FOR 35 YEARS

AMERICAN PENCIL COMPANY, Dept. B4, 500 Willow Avenue, Hoboken, N. J.

Sanymetal* ALL-WOOD TOILET COMPARTMENTS

with Complete Door Hardware and Partition Fittings
NOW AVAILABLE...READY TO INSTALL



Provide the kind of toilet facilities that will encourage good habits of health and personal hygiene for workers in war production plants. A toilet compartment that barely meets the essential requirements of privacy isn't enough. A type of toilet compartment that provides and encourages cleanliness, orderliness and good housekeeping is more in keeping with the American standard of conveniences for all workers. It isn't just the physical aspects of a toilet compartment that determines its utility. The effect of its appearance and conveniences upon the sensitive natures of workers is of utmost importance. Such a toilet compartment is the "engineered" type that provides so much more than personal privacy.

For both men and women workers in wartime production plants Sanymetal provides a wartime toilet compartment "engineered" of all wood construction that possesses the exclusive features of Sanymetal steel toilet compartments.

Sanymetal all-wood toilet compartments are standard flush type compartments with or without front panels (installation with front panels illustrated). These all-wood compartments come to the job ready for immediate installation. Doors, partition panels, posts, headrail bracing, complete door hardware and partition fittings arrive on the job in the right quantity and laid out for quick, grief-free installation. No delays for assembling materials or for experimental erection. Doors and partition panels are 7-Ply Douglas Fir Plywood. Sanymetal's famous four-way design posts, panelled on all four sides and headrail bracing of all wood, make a substantial and rigid installation.

The engineered features built into Sanymetal's all-wood toilet compartments embody the results of 27 years of research and experience in making over 53,000 toilet compartment installations. There is no need to speculate with the sensitive attitudes of workers, nor to forego the installation of toilet compartments that will prevent degrading experiences.

Discuss your toilet and washroom requirements with a Sanymetal Representative (see telephone book—classification "Partitions") who is qualified by years of experience to offer many constructive suggestions. He will show you samples of substitute materials which are being used in Sanymetal Wartime Toilet Compartments. Write direct for Bulletin No. 900.

*TRADE MARK REG. U. S. PAT. OFF.



Sanymetal

THE SANYMETAL PRODUCTS CO., INC.
1689 Urbana Road • • Cleveland, Ohio



TOILET AND OFFICE PARTITIONS

THE RECORD REPORTS

(continued from page 14)

of the demands of the war emergency. Temporary housing projects are those on which there is an administrative finding that there was no reasonable prospect of disposing of such housing to meet a need beyond the emergency.

In conserving materials, metals are most critical; lumber next; those putting the greatest strain on transportation the next.

Lumber will continue to be a critical material for at least another year.

NHA points out that many lumber types are available despite the order. Where progress upon a war housing is delayed by the inability to obtain lumber, consideration should be given to the following exemptions from WPB's Limitation Order L-121:

(a) Hardwood lumber. No hardwood lumber has yet been restricted. Such soft hardwoods as aspen, basswood, chestnut, magnolia, willow, yellow poplar and oak can thus be adapted to general use.

(b) Products of small mills. Lumber produced by mills with a daily output amounting to less than 5,000 softwood board feet is not frozen.

(c) Bevelled siding. Use of bevelled siding has not been limited. For economy, bevelled siding in 7/16 in. by 3/16 in. by 6 in. can be made from a 1-in. strip of wood, while the same strip makes only 1 3/4-in. piece of drop siding.

(d) Retail stocks. Lumber stocks in retail yards are not covered by L-121.

(e) Short lengths. Lengths of lumber measuring less than 8 ft. even among the frozen grades are not subject to limitation.

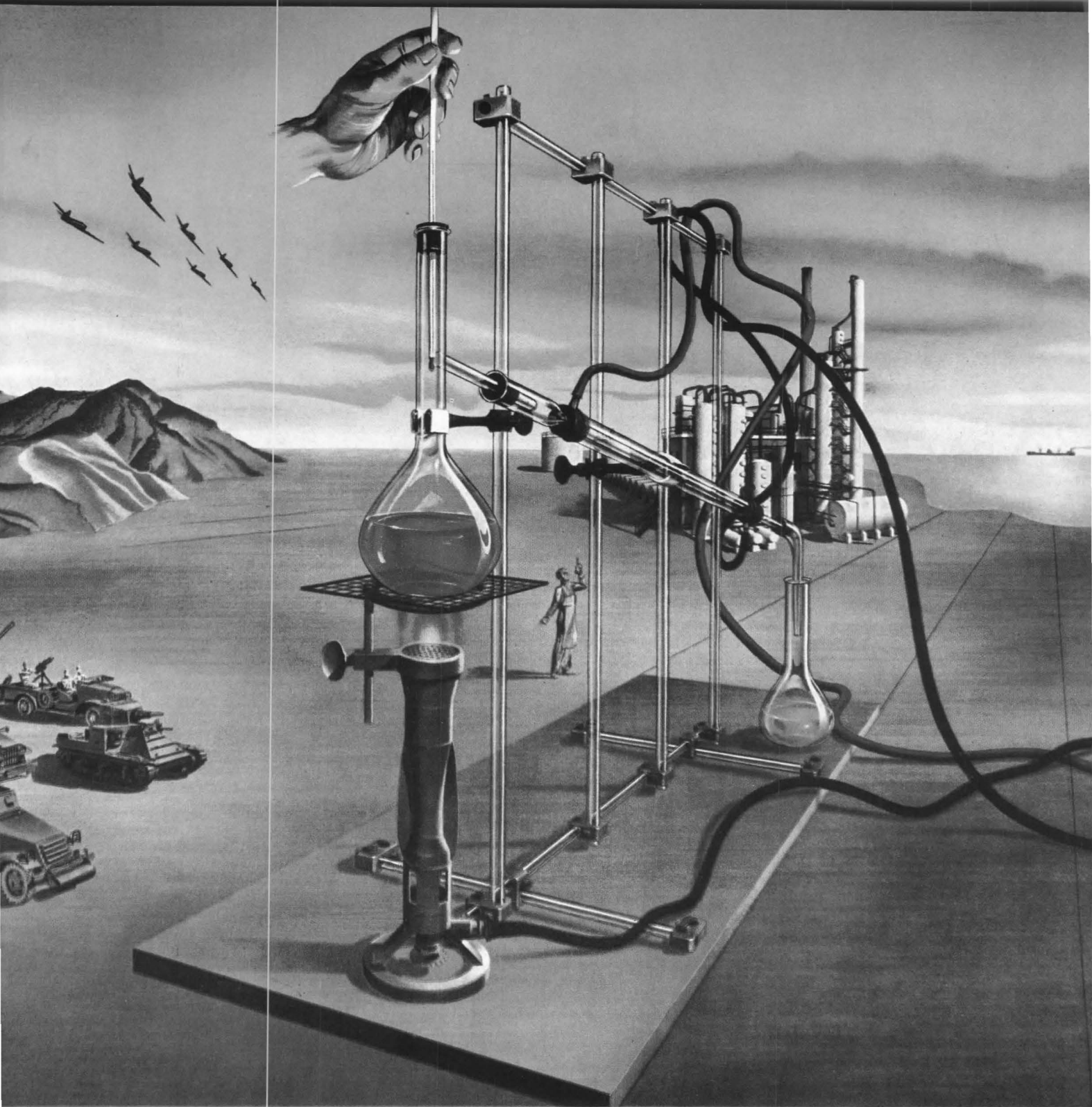
(f) Low grade lumber. Low grade lumber if carefully culled and selected can in many cases be used for war housing.

(g) Oak flooring. No. 2 and No. 3 grades of end-matched oak floorings are not frozen and should be used instead of soft wood flooring.

New defense housing areas

There have been eight new areas added to the Defense Housing Critical List. These new areas are: Jacksonville, Florida; Lockport, Illinois; Piqua, Ohio; Troy, Ohio; Eagle Pass, Texas; Algoma, Wisconsin; West Bend, Wisconsin; and Waterloo, Iowa (for rehabilitation and conversion purposes only).

(RECORD REPORTS continued on page 92)



Chemistry is putting miracles on a mass production basis

If ever a "secret weapon" does emerge from all this welter of war, it will most likely be a chemical development. And the American chemical industry has as good a chance of discovering it as any other, for America now has the greatest synthetic organic chemical industry in the world.

This industry looks to coal tar chemicals for almost half the raw materials it uses. Koppers is at the very roots of these chemicals.

Koppers toluene goes into TNT, the principal military bursting charge. Koppers benzene is used in the manufacture of explosive stabilizers, and "boosters" for primers. Koppers naphthalene helps minimize the flash in powders.

Most explosives are made using combinations of nitric and sulfuric acids. Koppers coke ovens produce ammonia and this helps meet the extraordinary demand for fixed nitrogen and increases the amount of nitric acid available for the war effort.

The Koppers Phenolate Process helps the petroleum and the coking industries recover more sulfur which is converted into sulfuric acid.

Koppers tar acids and naphthalene find use in synthetic plastics for airplanes, tanks, etc.; naphthalene is used in chemicals for synthetic and natural rubber. Pyridine is an ingredient in the new process for waterproofing military fabrics for jeep tops, tents, etc. Flotation sulfur is one of the

principal spray materials for fruit crops.

Koppers serves the chemical industry in peace as well as war. Of the hundreds of coal tar intermediates, dyes and medicinals, about 87% are produced in greater or less degree from benzene, toluene, naphthalene, and phenol. Koppers is one of the principal sources of these and other basic materials. —Koppers Company, Pittsburgh, Pa.

Buy United States
War Bonds and Stamps

KOPPERS
THE INDUSTRY THAT SERVES ALL INDUSTRY

Workers in our Bartlett Hayward Division are now privileged to wear the Navy "E" emblem



LOUVREX



FLUTEX



DOUBLEX

REMEMBER THE
3 EX'S
IN *Decorative* GLASS

Wherever Soft, Diffused Light,
Smart Decoration...and Complete
Privacy are Desired

"Design interest" combines with soft, restful diffusion of light in Blue Ridge patterned glasses, manufactured by the Blue Ridge Glass Corporation, Kingsport, Tenn., and sold by Libbey-Owens-Ford through leading glass distributors. For interior and exterior glazing—for partitions, screens, illuminated panels and door panels—these 3 "EX's" sparkle with decorative interest.

Unightly areas may be excluded from view in smart interiors, while an abundance of soft light is filtered through. Striking effects may be created by illuminating decorative panels from behind. Complete privacy, plus natural illumination, for offices, restaurants, bars and shops.

YOU CAN GET GLASS—Decorative glass is replacing many materials no longer available. It is not only beautiful, but practical . . . for glass never needs refinishing, is easily cleaned, does not quickly go out of style. For information, write Blue Ridge Sales Division, Dept. 1278, Libbey-Owens-Ford Glass Company, Toledo, Ohio.



BLUE RIDGE *Decorative* GLASS

Sold Exclusively Through Libbey-Owens-Ford Distributors



**STEAM Heats
America -**

at war!



TO break the shipping bottleneck...

750 new merchant ships in 1942...

1,500 new merchant ships in 1943...

That is America's promise to the Victory Program—and America is going to beat that promise.

It calls for huge new shipbuilding facilities . . . thousands of plants to turn out ship parts and equipment—steel plates, ship fittings, propelling machinery.

Low cost, controlled heat is essential to all-out production. Light, compact equipment is vital for shipboard heating.

Steam is universal for heating at sea because it requires less space and weight than any other heating medium. Steam, harnessed and brought under control with Webster Equipment, is fast, sure, safe and economical.

In this war emergency, Ordnance production has first call on our facilities. But, we are still producing Webster Steam Heating Equipment for use wherever it will help the war effort.

Essential repairs for Webster Systems are available on A-10 priority, under W.P.B. Emergency Repair Order P-84. Orders should be limited to actual needs.

Warren Webster & Company, Camden, N. J.
Representatives in 65 principal Cities

Webster
Steam Heating

This is one of a series of advertisements that will tell the public of the part that Webster Steam Heating and the Webster organization plays in the war effort. . . appearing regularly in leading business, industrial, engineering and technical publications.



Charles S. Leopold, Philadelphia, Consulting Engineer. Member of American Society of Heating & Ventilating Engineers, American Society of Refrigerating Engineers. B.S., E.E., University of Pennsylvania.

"Steam is a basic method of heating for other than the simplest structures," in the opinion of Charles S. Leopold, who adds: "Space requirements for generation, transmission and utilization, and first cost lead to this conclusion. Other means of conveying heat have their field of application as a sole means of heating and as an adjunct to steam. In air conditioned structures, where the year-round use of some heat is desired, analysis may indicate the desirability of hot water for booster service. In these cases the use of steam is usually still indicated for the major heaters and miscellaneous standing radiation requirements . . . The development of reasonably priced controlled steam heating has substantially eliminated the objectionable over-heating so prevalent ten or fifteen years ago. Buildings in which controlled heating was installed in the late twenties, still maintain an enviable record for fuel consumption and over-all economy."

Under Mr. Leopold's direction as consulting engineer, the "Controlled-by-the-Weather" Webster Moderator System was installed in 1929 in the 1616 Walnut St. Building, Philadelphia; and since then in the Evening Post Building, New York; 1700 Walnut St. Building, Warwick Hotel and Stern & Company Store, all in Philadelphia.

WARREN WEBSTER & COMPANY
CAMDEN, N. J., EST. 1888, PIONEERS OF VACUUM STEAM HEATING

REQUIRED READING

By ELISABETH COIT, AIA

DESIGN OF MODERN INTERIORS. By James Ford and Katherine Morrow Ford. New York, Arch. Book Pub. Co., 1942. 130 pp., 8½ by 10¾ in., illus., \$5.00

THIS is not merely a picture book. The authors, well known for their many-sided work in housing the nation: The monumental "Slums and Housing" of 1936, the 12-vol. report of the President's Conference on

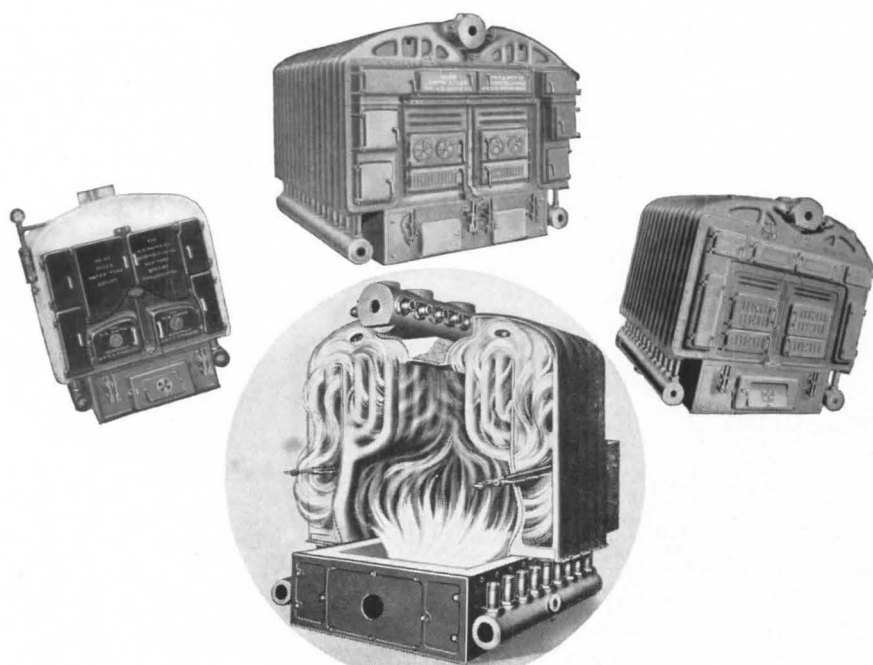
Home Building, the several "Better Homes in America" competitions, and the recent companion work to the present one, "The Modern House in America," give us here a keen, analytical study in pictorial form.

Of profit and delight, alike to the reader already appreciative of the "modern" in interiors and to the one who wants to be shown, is the skill



Alan Brown and Cushing-Gellatly

Library of house in Lincoln, Mass., C. Holmes Perkins, Architect. From "Design of Modern Interiors"



SUBSTITUTION *in Name Only*

H.B. Smith LOW-PRESSURE BOILERS
for Heating Service Hot Water
Process Steam . . . Air Conditioning

MANY Heating Engineers who formerly thought of Cast Iron Boilers strictly in terms of commercial and residential heating have recently found that the larger types of H. B. Smith Cast Iron sectional boilers are even better suited to industrial low pressure heating requirements than were the boilers which they had previously specified, for not only do SMITH boilers possess the required flexibility of operation, but they also combine high efficiency with the features of extremely low maintenance cost and long life which are found only in good Cast Iron Boilers.

SMITH performance is, of course, no new discovery to those architects and engineers whose experience over a long period of time has conclusively proved that H. B. Smith Cast Iron Boilers can adequately handle any industrial low pressure requirements at a lower cost, overall, than can any other type of equipment.

THE H. B. SMITH CO., INC., WESTFIELD, MASS.
BOSTON NEW YORK PHILADELPHIA

with which some 400 photographs illustrate complete rooms, folding walls and partitions, furniture, and other equipment, in the solution of many types of problems ranging from the modest to the luxurious. Plans, dimensions, names of architects, manufacturers, designers, or craftsmen, notes on materials or colors—or all of these—clarify the particular solution, and there is a compact introductory chapter to outline the whole problem of achieving satisfying interiors.



Margaret Noyes

Facade of the New Block, Lowell, boarding houses built about 1845. From "Mill and Mansion"

MILL AND MANSION . . . Lowell . . . 1820-1865. By John Coolidge. New York, Columbia Univ. Press, 1942. XI, 261 pp., 6 by 9 in., illus., \$3.75. (Columbia Univ. Studies in American Culture, No. 10.)

FROM scores of books on American architecture one can trace the evolution of the society which gave that architecture its being. Here is a book showing the inevitableness of a people's architecture as mirroring its life. Lowell is an outstanding example of the early 19th century industrial town, and this study, well illustrated with nearly a hundred photographs and plans, shows the necessity of the town

(continued on page 86)



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MAIL TODAY FOR YOUR
FREE COPY

Dept. 7-N,
Westinghouse Electric & Mfg. Co.,
East Pittsburgh, Pa.

Gentlemen:
Please send me _____ copies of the new 1942-1943
Architects and Engineers Data Book.

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READY NOW

Expanded to 178 pages . . . including new and useful information to help save time planning, selecting and specifying steam and electrical equipment of all types. Information includes: APPLICATION, FEATURES, HOW TO SELECT, DIMENSIONS, TYPICAL SPECIFICATIONS; and in addition, a special new Engineering Data Section with handy tables, formulae and price curves. Use the coupon above. Send for your FREE copy today.

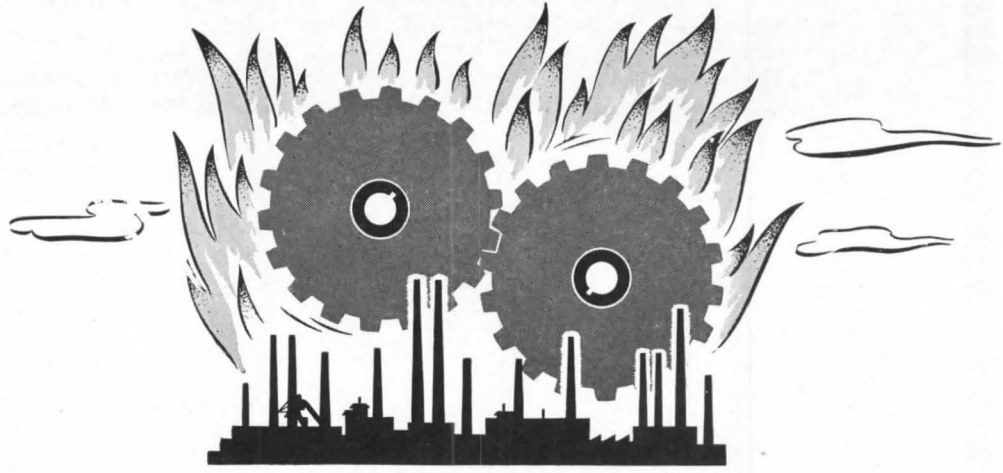
WESTINGHOUSE ELECTRIC & MFG. CO.
EAST PITTSBURGH, PA.



ARCHITECT'S AND ENGINEER'S

DATA BOOK

1942 . . . 1943

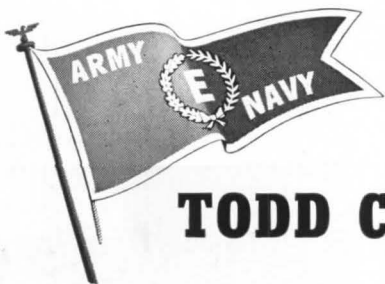


MAKING IT HOT FOR THE AXIS

ON AMERICA'S MIGHTY PRODUCTION FRONT

WANT to know what "Made in America" means in Tokio, Berlin and Rome, these days? Ask Doolittle! Ask the flying Tigers! Ask our fighting men and allies everywhere! With each passing day, more American-made planes . . . guns . . . tanks take their toll on every battlefield — and plenty more are on the way! In a war of machines, America's production front smashes ahead at top speed — is rapidly strengthening American armed might for the final all-out assault on the Axis.

Behind today's manufacturing achievement is the story of America's *power* production—for mine, mill, factory, assembly line. In power plants of every type, as well as in fighting and merchant ships, over 50,000 Todd units are contributing their full share of this basic horsepower — hanging up new records everywhere in the efficient combustion of liquid and gaseous fuels.



Todd technical service staffs, stationed in key cities . . . with parts and replacements instantly available . . . are helping to maintain uninterrupted power for America's mighty production line.

TODD COMBUSTION EQUIPMENT, INC.

(Division of Todd Shipyards Corporation)

601 West 26th Street, New York City



NEW YORK MOBILE NEW ORLEANS GALVESTON SEATTLE BUENOS AIRES LONDON

For Victory . . . Buy U. S. War Bonds and Stamps



• Typical of the many war plants where Watrous Flush Valves are in service is the plant of Republic Aviation where the Republic P-47 Thunderbolts are built.

Albert Kahn, Inc., Architects and Engineers
Fred Brutschy Co., Inc., Plumbing Contractors

So that YOU can help plants like this get EXTRA water, man-hour and power savings from their flush valves

ADVERTISING in these days, as pointed out by the War Production Board, should be informative, factual and of practical value to the reader. And it has been with such considerations in mind that a new educational manual on flush valves has been developed by the Imperial Brass organization. This manual, "Keep 'Em Flushing," has been designed to be of practical help to anyone who has anything to do with the selection, installation or maintenance of flush valves.

As this manual points out, flush valves

already are widely known for their economies—that's one reason why they are used in virtually all industrial plants, cantonments, hospitals and the like.

But there are certain kinks—certain points to watch in maintenance—that will often help get EXTRA savings from flush valves.

In time of war these EXTRA savings are especially important. Water saved means fuel and power saved; maintenance saved or speeded means man-hours saved.

The manual points out that by making

sure that each flush valve is properly regulated to the actual water needs of the fixture, frequently as much as an EXTRA gallon of water can be saved per flush. Importance of such savings over a year is indicated by the table below.

You'll find the manual helpful in your own work and you may wish to pass copies along to the men responsible for plumbing maintenance on projects you have completed. It is a manual especially valuable for use at Army, Navy and Air Bases. We shall be glad to mail one or more copies to you.

Estimated annual savings of water obtainable through proper regulation of flush valve to actual water needs of fixture*

	Building with 100 Flush Valves Gallons saved	Building with 500 Flush Valves Gallons saved	Project with 1000 Flush Valves Gallons saved
When average of 1/2 gal. saved per flush	292,000	1,460,000	2,920,000
When average of 1 gal. saved per flush	584,000	2,920,000	5,840,000

*Savings vary somewhat with type of building in which valves are installed.

THE IMPERIAL BRASS MFG. CO.
1240 W. Harrison Street, Chicago, Illinois

★ ★ ★

See Catalog 47, Section 27 in Sweets' Catalog File for specification information.



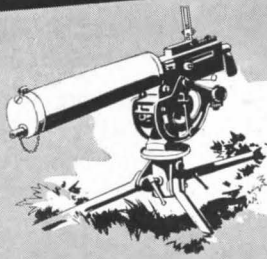
"KEEP 'EM FLUSHING"

With simple diagrams this manual shows how a flush valve operates. Tells how to reduce maintenance time to a minimum; tells how to get "all-out" water savings; includes other practical data.

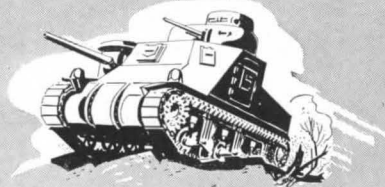
Watrous Flush Valves

Standard and Special Types are furnished with SILENT-ACTION equipment

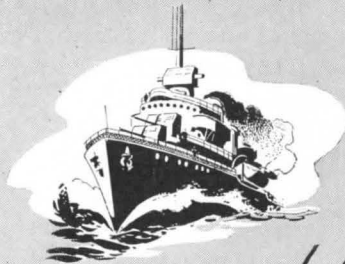
How much **SCRAP** can you mobilize every week?



50 POUNDS... enough for a
.50 cal. machine gun



12 TONS... enough for a
medium tank



750 TONS... enough for a
destroyer

War production must
have 140,000 tons
of scrap a day!



UNITED STATES STEEL

THE plain fact is—we can't win this war without plenty of steel. But if we are to have plenty, all factories, mills, shops, mines and other units of American industry must organize at once to turn in every available pound of scrap metal—and keep on turning it in regularly. At least six million tons more scrap must be collected than last year!

Where is this "extra" scrap?

It is certain that vast quantities of precious iron and steel lie idle in unsuspected hiding places throughout the country. Part of it may be on your premises. The usual methods of collection will not release enough to meet present demands. It will take special diligence on the part of management and workers alike to put the 1942 Scrap Drive over the top. To check the efficiency of your salvage methods, see if you are turning in all three of these classes of scrap:

"BREAD-AND-BUTTER" SCRAP—The kind most plants sell regularly — filings, shavings, stampings, rejects — metal scrap created in the process of manufacture or construction.

DORMANT SCRAP—Unused or abandoned equipment, broken or worn-out machine parts, old boilers, moulds, dies, pipe, valves, electrical equipment, engines, trucks, etc.—the "junk" that accumulates but often misses routine scrap collection.

"RAINY-DAY" SCRAP—The hardest of all to part with. Includes obsolete machinery, unused metal buildings, stacks, outdated tools, fixtures, patterns, stocks, etc.—idle now because they're being saved for possible use in some indefinite future emergency. The emergency is here! This metal should be scrapped, unless it can be reconditioned and put to work now.

If you haven't already, we suggest you organize your own scrap drive. Your local Industrial Salvage Committee will help you plan a forceful program. Put some one individual in charge of salvage in all departments of your business, and give him authority to act. Promote the drive to your employees with posters and prizes. Emphasize speed and continuous effort. Make them all "scrap conscious." If you need more information, contact the Bureau of Industrial Conservation, War Production Board, Washington, D. C.

YOUR SCRAP IS WORTH ITS WEIGHT IN VICTORY

★ ★ ★
AMERICAN STEEL & WIRE COMPANY, Cleveland, Chicago and New York · CARNEGIE-ILLINOIS STEEL CORPORATION, Pittsburgh and Chicago · COLUMBIA STEEL COMPANY, San Francisco · NATIONAL TUBE COMPANY, Pittsburgh · TENNESSEE COAL, IRON & RAILROAD COMPANY, Birmingham



SAFLEX

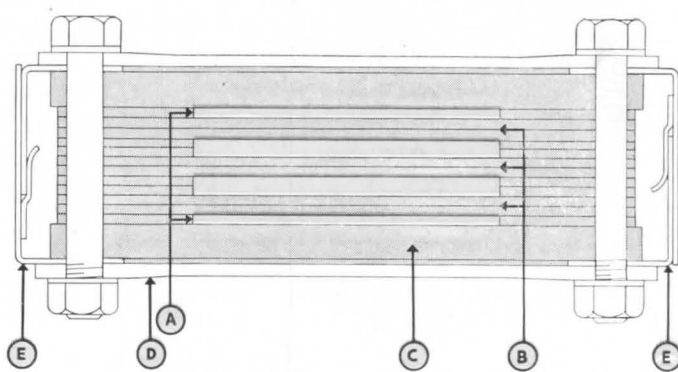
(LOW REACTANCE) FEEDER DUCT

- ✓ Only 1.8 Volts drop per 100 feet
- ✓ Phases balanced at all points
- ✓ Only 38° C. temperature rise

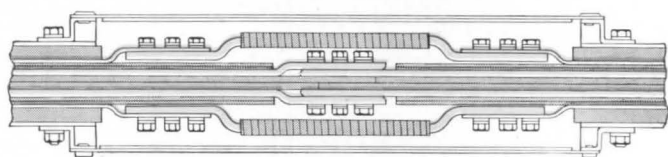
Square D Saflex (Low Reactance) Feeder Duct is designed to serve as the feeder between transformer banks and main switchboard or as feeders to branch circuits where minimum voltage loss is essential. Because of its low reactance and consequent low voltage drop, it is ideally suited for welder circuits and, as a result, conductor size may be kept at a minimum.

The special non-critical insulation of Saflex Feeder Duct also constitutes approximately 80% of its housing, thus eliminating large use of vital war materials such as steel. Saflex Duct is available in standard 10-foot sections with special fittings to meet all types of building structures.

Let a Square D Field Engineer give you the complete story.



- A Split Bus.** Assures uniform and low voltage drop because it provides close spacing and electrical symmetry of phases.
- B 1/4" Insulated Space** between opposite busses also helps to keep voltage losses at a minimum.
- C Special Insulation** totally encloses busses. Has high mechanical and dielectric strength, is impervious to moisture and resistant to an arc. Conducts heat readily and thus insures low temperature rise.
- D Surge Clamps** every 24 inches give structural and mechanical strength to withstand 50,000 amperes short circuit with a substantial factor of safety.
- E Steel Channels** at top and bottom complete the housing which totally encloses the busbars.

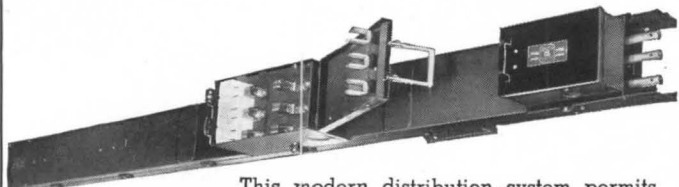


Connection between Bus Sections (top view)

Note that all bolts for joints face outward and are accessible through hand hole openings which provide ample working space. Steel cover plates over hand holes are easily and quickly removed.

SAFLEX PLUG-IN DUCT

Perfect running mate for Saflex Feeder Duct



This modern distribution system permits plugging in machines just as you would appliances at home. Busses are rigidly supported, round copper bars and tubes with expansion couplings every ten feet. Units are easily attached and disconnected. 100% salvage value for re-use. 2, 3 and 4 wire services, 600 Volts or less.

SQUARE D COMPANY

DETROIT - MILWAUKEE - LOS ANGELES
KOLLSMAN INSTRUMENT DIVISION, ELMHURST, NEW YORK
IN CANADA: SQUARE D COMPANY CANADA LIMITED, TORONTO, ONTARIO

CALL IN A SQUARE D MAN

The name is new...the Purpose is not Changed



On July 30, 1942, the stockholders of
HYGRADE SYLVANIA CORPORATION
voted to change the company name to
SYLVANIA
ELECTRIC PRODUCTS INC.

● There's little in a name beyond what men put into it by their sincere effort and their determination to give it significance.

There has been a great deal, though, in the name Hygrade Sylvania because of the high standards that have marked the manufacture of its products — Hygrade Incandescent Lamps, Hygrade Fluorescent Lamps and Fixtures, and Sylvania Radio Tubes.

But there are advantages in simplicity, and in a single title that stands for single-

minded insistence on the highest quality possible in any field with which it is linked.

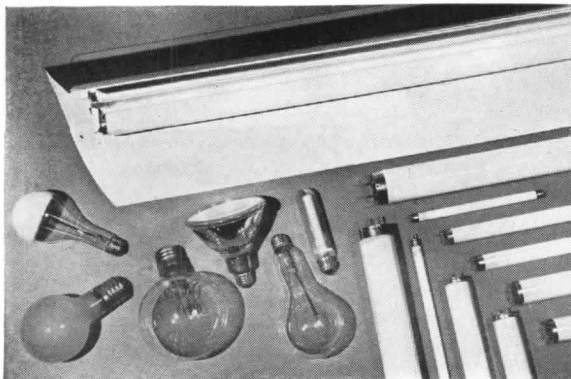
So as of July 30, the name of the Hygrade Sylvania Corporation, adopted in 1931, became Sylvania Electric Products Inc.

Largely as a matter of conserving stocks of cartons and scarce packaging materials, changes in the trade names of Hygrade products will be made gradually.

Eventually, however, all products of the company will take the name *Sylvania*,

which will become the single emblem of our one and unchanged purpose to produce the best in our field and to make our products widely known.

You who have known the quality of Hygrade Lamps and Sylvania Tubes will continue to find that same superlative quality in those products. The only change will be in the name, to which we intend to add new luster at every opportunity that is given us to improve on the quality and performance of our products.



Hygrade Incandescent Lamps, Fluorescent Lamps and Fluorescent Fixtures have established themselves by the quality which has always been held at highest standards. These quality standards will remain unchanged, but gradually, as present stocks of cartons and scarce packaging materials are used up, their trade name will be changed to Sylvania.

E. J. Poor.
CHAIRMAN

SYLVANIA ELECTRIC PRODUCTS INC.
Salem, Mass.

Hygrade Incandescent Lamps, Fluorescent Lamps, Fixtures and Accessories, Sylvania Radio Tubes

MAHON

Rolling STEEL DOORS

WILL CONTINUE TO

Protect

- from FIRE
- from WEATHER
- from INTRUSION

LONG AFTER THE WAR IS WON

Because of the greater protection they give and their proved serviceability, many hundreds of Mahon Rolling Steel Doors have been installed in buildings devoted to war production and service. They are functioning in outside walls, in partition walls, in corridors, in elevator shafts and as automatically-closing fire doors—wherever, in fact, complete protection from fire, weather and intrusion is essential. Based on actual records of previous Mahon installations over long years of daily operation, it is a safe prediction that each of these doors will protect and serve throughout the duration and continue to do so long after the war is over and won. Mahon Rolling Steel Doors are built to last a lifetime. See Sweet's for information on Mahon improved design and construction—or write for the NEW Mahon Rolling Steel Door catalog.

THE R. C. MAHON COMPANY
DETROIT • CHICAGO

Manufacturers of Steel Roof
Deck, Rolling Steel Doors,
Shutters and Grilles, Kolamain
Doors, Tin Clad Doors, Cast
Iron Roof Sumps and Roof
Sump Recesses.

MAHON

POLARIZED PLUGS and RECEPTACLES



H & H Products to help energize War-production plants

Give more power to MAN-power through more *Outlets* for portable tools. Add to flexibility of plant-equipment with additional power connections for light machines . . . Here's a way for the architectural specifier to extend production facilities, — to "energize" assembling operations or plant-conversion.

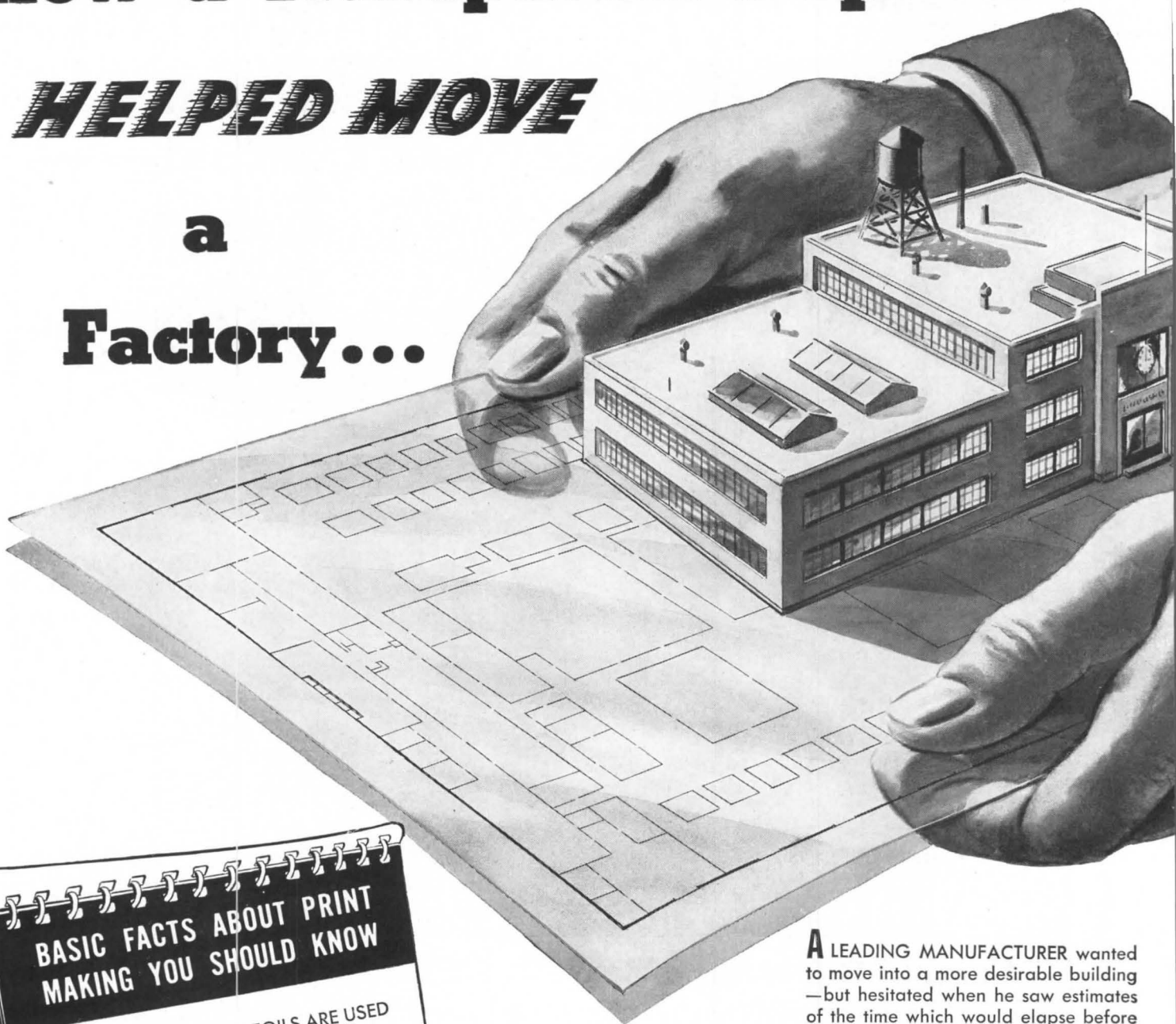
H & H provides all types of Polarized Receptacles and Plugs, ruggedly built for rough handling in war-driven manufacturing. Two, three and four-wire Receptacles, Plugs and Connectors in 10, 20, 30 and 50 Ampere capacity. Above-shown are a few representatives of our *complete line* for Industry's current needs.

HART & HEGEMAN DIVISION
THE ARROW-HART & HEGEMAN ELECTRIC CO. HARTFORD, CONN.

How a Transparent Duplicate

HELPED MOVE

a Factory...



BASIC FACTS ABOUT PRINT MAKING YOU SHOULD KNOW

OZALID TRANSPARENT FOILS ARE USED TO MAKE COMPOSITE PRINTS—The extreme transparency of Ozalid foil allows using multiple layers at one time to make a composite print. Thus, if you have separate details—each on a different foil—which you want brought together in one print, merely place the foils, one on the other, and feed with a piece of Ozalid sensitized material into the whiteprint machine.

Consequently, you can make prints which will show such details as plumbing and heating, power and pipe lines, etc., either separately or combined.

Foil copies of original drawings are made the same as standard whiteprints.

SPECIFY *Ozalid* WHITEPRINTS

A LEADING MANUFACTURER wanted to move into a more desirable building—but hesitated when he saw estimates of the time which would elapse before he could begin production.

Ozalid then showed how five hundred hours could be saved in drafting time alone! First, instead of making multiple drawings of the master floor plans—Ozalid transparent duplicates were quickly made. The draftsman then added—direct to the duplicates—the plans for machinery layout, ventilating and heating, transmission and beltings, electrical and plumbing connections, etc. These duplicates were used to produce the desired number of work prints. Thus, in changing over . . . time and labor were saved.

Today, many manufacturers are reorganizing factories and assembly lines . . . making frequent changes in product design. And the Ozalid Process is giving them a "head start" in vital war production. An Ozalid whiteprint machine turns out standard and transparent prints in two quick steps—Exposure and Dry Development . . . without the wasteful tie-ups which are a part of "wet" developing methods. And Ozalid's wide variety of sensitized materials allow you to: cut drafting time . . . speed the making of corrections . . . turn out whiteprints which will have the most "back bone" in the busy shop or sun-baked field.

Write for new catalog. See how the Ozalid Process can help you!

OZALID PRODUCTS DIVISION
GENERAL ANILINE & FILM CORPORATION
JOHNSON CITY, N.Y.

Ozalid in Canada • HUGHES OWENS CO. LTD., Montreal

CEMESTO OFFERS 3 BIG ADVANTAGES

for Fast Factory Construction With Steel Framing or Wood Framing!



Combines Strength, Insulating Efficiency, Good Looks

NO OTHER FINISH NECESSARY—INSIDE OR OUTSIDE!

ARCHITECTS are finding Celotex Cemesto a practical and versatile material for enclosing many types of industrial structures which must be rushed to completion. It has repeatedly demonstrated its ability to replace combinations of materials in hangars and ordnance plants, ammunition depots and storage buildings, assembly shops, machine shops, etc.

This product may be used with steel or wood structural framing, or reinforced concrete framing. It combines in one material—erected in a single operation—structural strength, proved insulation, resistance to

weather, and resistance to fire. Its gray asbestos-cement surfaces do away with necessity for painting or other surface treatment. Its core is Celotex insulation board with a thermal conductivity of 0.33 per 1" thickness.

Standard thicknesses are 1 1/8", 1 9/16", and 2"; width 4'; lengths, 4', 6', 8', 10', and 12'. Weight, 3.8 pounds to 5.3 pounds per sq. ft.

Write for detailed application sheets and sample!

The word Celotex is a brand name identifying a group of products marketed by The Celotex Corporation.

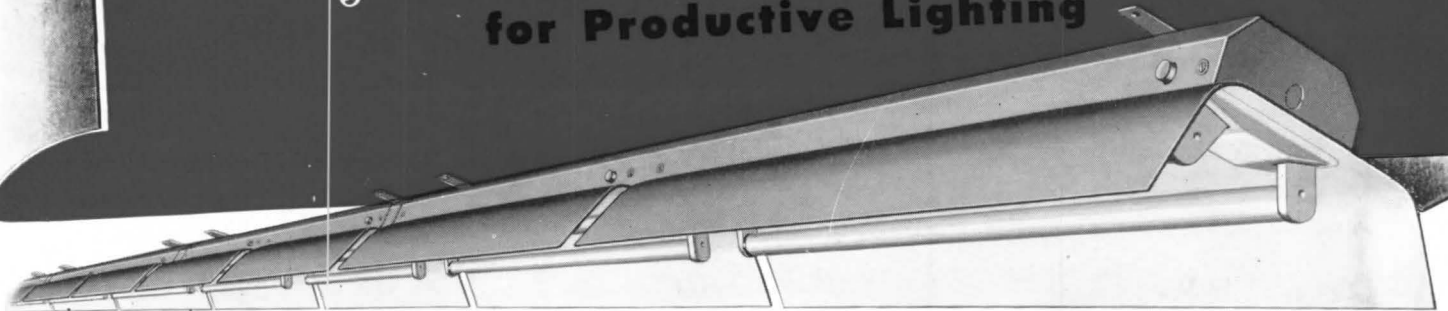


THE CELOTEX CORPORATION • CHICAGO

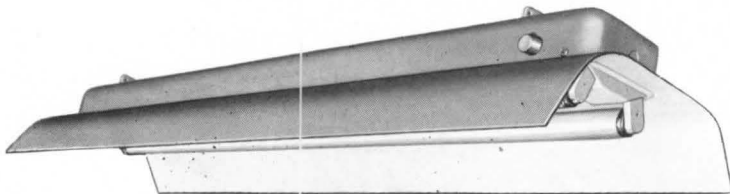
Now Specify the

NEW *Type V* Benjamin Fluorescent Units

for Productive Lighting



New Reflector Specifications Provide Efficient Lighting for War Production Plants . .



IN keeping with the program to conserve steel vitally needed for ships, tanks and other war materials, it is now recommended that you specify the new Benjamin "Type V" Fluorescent Lighting Units which utilize a new, highly efficient, non-metallic reflector. These new units are available for either 48" or 60" fluorescent lamps in both the individual open end units (Twin-Flo, Triple-Flo) and the continuous channel, open end units (Lite-Line System).

High Lighting Efficiency

"Type V" units can be depended upon to meet, efficiently and economically, the needs of plants engaged in war production for the high lighting levels and the exceptional seeing comfort that is provided by fluorescent lighting.

Guaranteed by Benjamin

These "Type V" units meet war production plant requirements for good fluorescent lighting. The lamps are adequately shielded for eye comfort. The reflection factor is 80% or more. The reflectors, auxiliary control equipment, sockets and other component parts are engineered for coordinated operation to provide maximum light output and trouble-free operation. "Type V" units are warranted to comply with all recognized illumination, electrical, mechanical and performance standards.

Let Benjamin Help You Meet Productive Lighting Needs

Through these new "Type V" units, Benjamin fluorescent lighting equipment is available to solve many lighting problems confronting plants engaged in, or converting to, War Production. Keener eyes are vital in the produc-

tion drive, because basic to all production is the ability of the employees to see quickly, accurately and easily. Never has the need for good seeing been greater. Night shifts, six and seven day weeks, and sustained high speed production, have put a tremendous tax on the eyes, health and energy reserve of the worker.

Importance of Fluorescent Lighting to Production Drive

Benjamin "Type V" units provide the amount of light and the quality of lighting needed by the employee to perform efficiently, the seeing task which is part of the work he performs. Such lighting plays a most important part in alleviating the tax on the eyes, in improving the seeing ability, and in minimizing fatigue.

Send Today for New "Type V" Bulletin

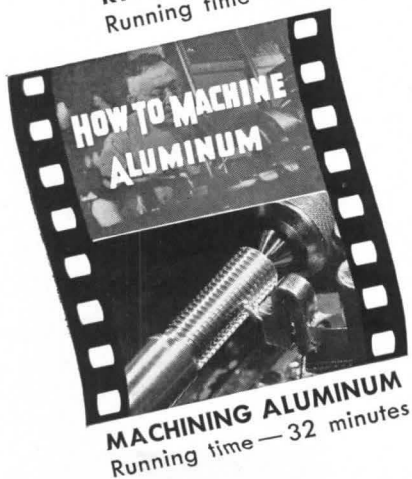
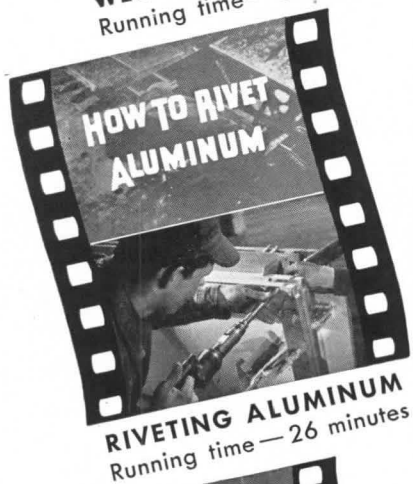
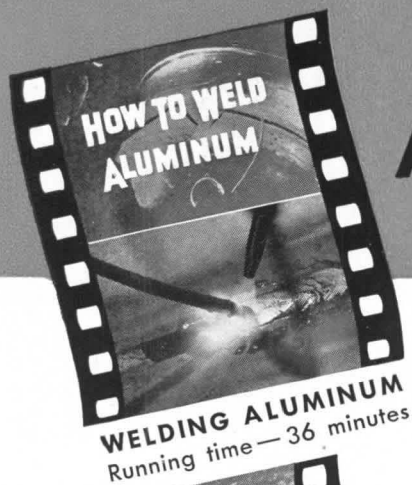
For more details concerning the new "Type V" Benjamin units, write for new "Type V" Data Bulletin and a copy will be sent you promptly without cost or obligation. Address Benjamin Electric Mfg. Co., Dept. B-1, Des Plaines, Illinois.

BENJAMIN
TRADE MARK

Type V
FLUORESCENT LIGHTING EQUIPMENT
DISTRIBUTED EXCLUSIVELY THROUGH ELECTRICAL WHOLESALERS

3 NEW FILMS

FOR TRAINING ALUMINUM WORKERS



Valuable "how-to-do-it" data on Welding, Riveting and Machining Aluminum is contained in these three, brand-new sound motion pictures. Designed to supplement texts and teaching, these films are offered for your assistance in training war workers in the fabrication and assembly of Aluminum Alloy parts and structures.

No drama, no humor, no romance! Every foot of these films is packed with hard-hitting task instruction.

"How To WELD ALUMINUM" describes and demonstrates the various essentials of torch and arc welding, brazing and resistance welding. "How To RIVET ALUMINUM" portrays the making and testing of rivets, preparation of the work, actual rivet-driving techniques and inspection. "How To MACHINE ALUMINUM" discusses alloys usually used, the kind and shapes of tools, cutting compounds, speeds and feeds.

Task instruction is made easier.

35 mm. and 16 mm. SOUND PRINTS AVAILABLE FOR LOAN OR PURCHASE

Prints of these black and white, sound motion pictures are loaned free.

List the titles of the pictures you want . . . your first and second choice of dates when you want them . . . whether you want 35 mm. or 16 mm. prints . . . and the approximate number of days you expect to use them. (NOTE: These films can be shown *only on sound projectors.*)

If you want to purchase prints for your permanent library, they are available at cost, shipping charges prepaid. Prices follow.

	16 mm. with fibre container	35 mm. with metal container
How To RIVET ALUMINUM	1200-ft. reel . . \$42.80	2000-ft. reels . . \$103.80
How To WELD ALUMINUM	1600-ft. reel . . 62.70	2000-ft. reels . . 176.30
How To MACHINE ALUMINUM	1200-ft. reel . . 50.70	2000-ft. reels . . 123.55

Send your requests for loan or purchase to ALUMINUM COMPANY OF AMERICA, 2167 Gulf Building, Pittsburgh, Pennsylvania.

See these films at the National Metal Exposition, Cleveland, October 12-16.

ALCOA ALUMINUM



AMERICA'S MAJOR INDUSTRIES

SPEED WAR CONSTRUCTION

with **APS**

**ASPHALT PROTECTED STEEL
ROOFING AND SIDING**



Here's a Roofing and Siding that has won the instant favor of the country's leading industries for speedy, economical war-time construction. **A. P. S.** is an asphaltic coated product . . . rugged, durable, weather resistant, easy to erect and quickly available! Its resistance to extreme climatic conditions is proven by A. S. T. M. laboratory test methods, and in addition it is impervious to acid fumes and acid gases.

A. P. S. is obtainable either flat or corrugated. Corrugating and forming operations are performed after the application of the protective coatings. It is furnished in all types of flashing, ridge roll, gutters, etc.

A. P. S. complies with Army specifications and is being used for U. S. Army Ordnance Construction.

• Write for our latest illustrated engineering hand-book and samples!



Triple Protection

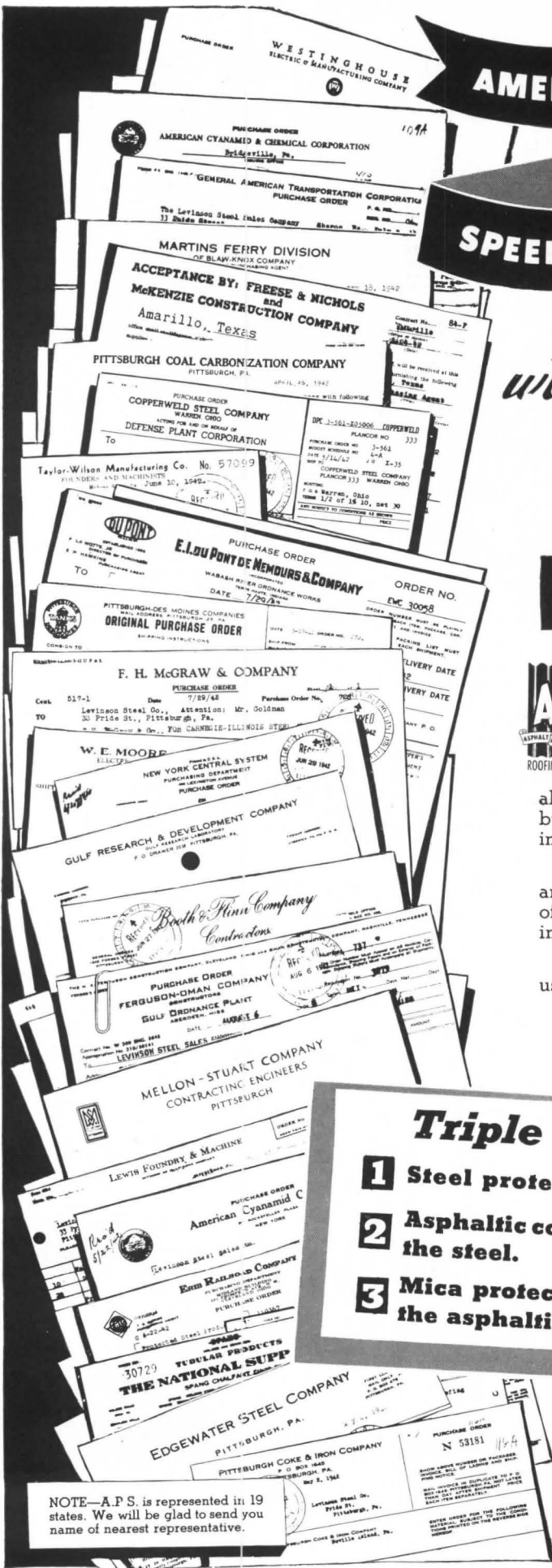
- 1 Steel protects the structure.**
- 2 Asphaltic compound protects the steel.**
- 3 Mica protects and reinforces the asphaltic compound.**

LEVINSON STEEL SALES CO.

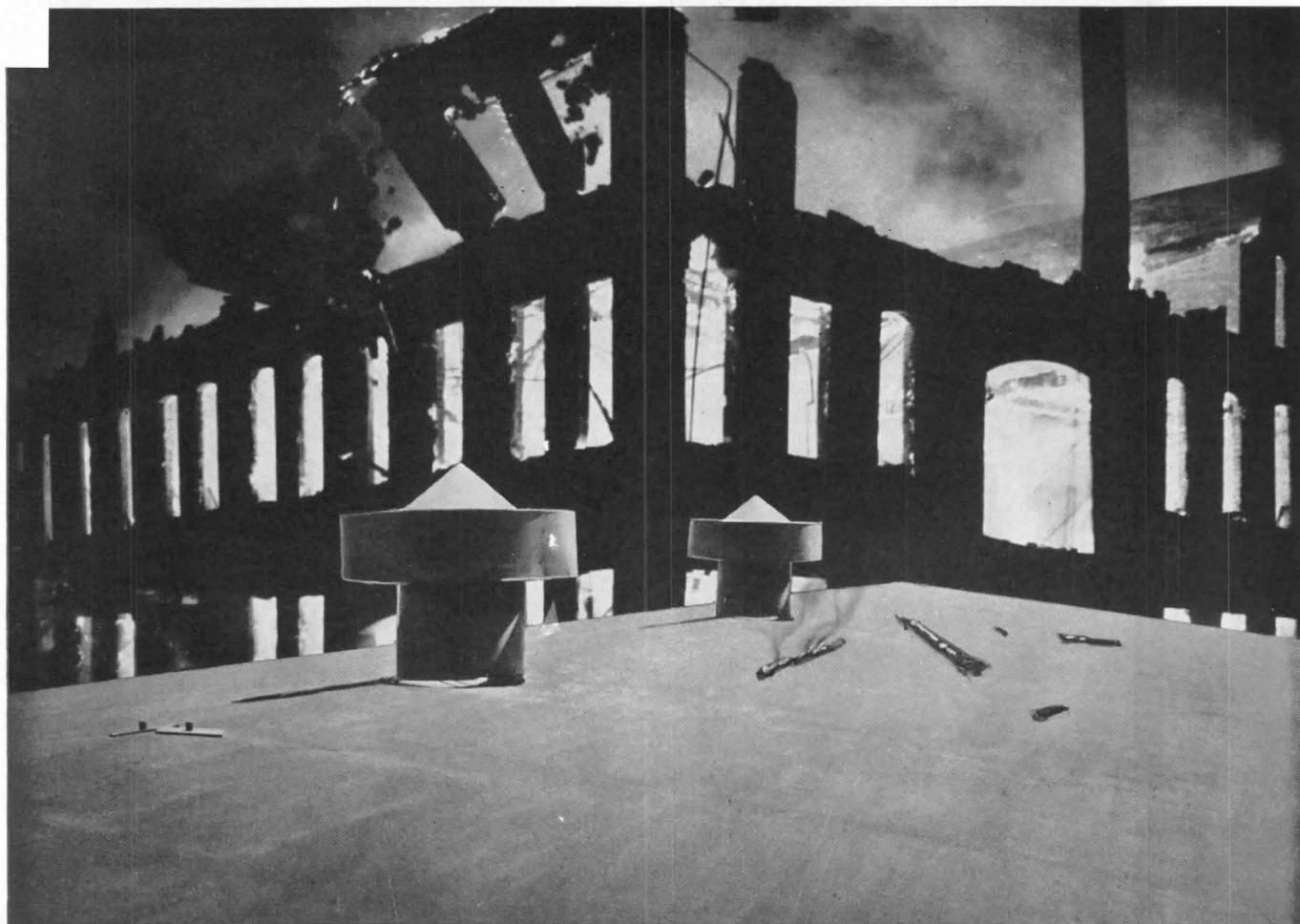
National Distributors for A P S Roofing and Siding

33 PRIDE STREET · PITTSBURGH, PA.

NOTE—A. P. S. is represented in 19 states. We will be glad to send you name of nearest representative.



MORE THAN 60,000 ROOF-COMMUNICATED FIRES A YEAR!*



Make sure your buildings have the fire protection of ASBESTOS!

TODAY, no plant operator can take chances with fire. This is particularly true of fire caused by embers from a nearby fire which fall on an inflammable type of roof.

The hazard of roof-communicated fires can be minimized by applying a Johns-Manville ASBESTOS Built-Up Roof. That's a fact that's backed up by hundreds of instances in our files in which just such a roof saved buildings from almost certain destruction by outside fires.

THE REASONS ARE LOGICAL. The felts used in Johns-Manville Smooth-Surfaced Roofs are ASBESTOS Felts . . . they cannot burn. Because this mineral has the durability of stone, Johns-Manville Asbestos Roofs provide other important advantages as well. They safely withstand long exposure to sun, rain and weather. They are rotproof . . . need no peri-

odic coating. Result: a built-up roof that's as maintenance-free and fire-safe as it can be made!

Before you specify built-up roofing for any type of building, investigate the advantages of these *safer* roofs. For details see our catalog in Sweet's, or write Johns-Manville, 22 East 40th Street, New York, N. Y.

Johns-Manville
Asbestos
Built-Up Roofs



*The National Fire Protection Association has estimated that in 1940, 62,000 fires were caused by sparks falling on inflammable roofs.

The World's Largest Hangar



Equipped with Byrne Canopy Doors . . . twelve other large Byrne doors are in operation throughout the rest of this plant.

★

Byrne Canopy Doors are used by Curtiss-Wright Corporation, General Motors Corp., Brewster Aeronautical Corp., North American Aviation, Inc., Goodyear Aircraft Corp., Ford Motor Company, Nash-Kelvinator Corp., and others.

Consult Byrne Engineers without obligation

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Conserve MAN-POWER for WAR EFFORT



ARMY

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Outstanding Achievement

☆☆ In the air — on land — on the sea and under the sea — precision tools of war manufactured by Minneapolis-Honeywell are proving their accuracy and dependability — just as M-H peace time temperature controls have done since 1885 . . . In recognition of outstanding achievement in war production, the Minneapolis and Wabash plants of Minneapolis-Honeywell were awarded, on July 27, the coveted Army-Navy "E" . . . This tribute to the Minneapolis-Honeywell organization is more than mere recognition. It is a challenge to produce new post-war miracles which will follow the research and engineering achievements produced to meet the war demands.

Minneapolis-Honeywell Regulator Company, 2804 Fourth Avenue S., Minneapolis, Minnesota.

☆

MINNEAPOLIS-HONEYWELL
Regulator Company

THEY PLAN FOR THE FUTURE



PLANS for the immediate future center on production for winning the war. Nothing can be built that does not contribute to that effort. Materials are not available for any other purpose.

◆ Yet there will be a future beyond the immediate war effort—no matter how long the war lasts. The winning of the peace will follow. An essential part of winning the peace is the formulation of a clearer picture of postwar plans for producing better environments and higher standards of living. We are fighting for the future, a better future. It is the realization of that fact that spurs the war effort, that strengthens us for the sacrifices that must be made.

◆ Statements of postwar aims, programs for postwar planning should be made now. This is recognized in England. "The necessity for a clearer official statement on postwar aims has been stressed. . . . The energy now being put into the immediate war effort would be vastly increased by such a statement, and a new energy created . . . a definite constructive aim at providing a better social environment for all who have hitherto failed to secure such a thing would give new hope and confidence." So, recently, said W. H. Ansell, President of the Royal Institute of British Architects. The R.I.B.A. is working on a program for reconstruction.

◆ In England also the Secretary of the Planning Department of the Minister of Works and Planning states, "The object of the Government's policy is to secure the right use of the land of the country for all purposes." And further, "It is necessary in all planning schemes to consider not only health and convenience, but the future appearance of town or village. Architectural advice is therefore essential. From an early stage thought must be given to such matters as the practicable size and shape of building blocks, the relation between streets, buildings and open spaces in respect to height and scale, and the appearance of new development seen in association with, or as a contrast to, the old.

"The value of architectural advice taken at an early stage will amply prove itself when rebuilding takes place; and no planning scheme can be regarded as satisfactory, which does not provide opportunities for good building in every area in which building is contemplated."

"Planning and reconstruction of town and country are matters of immense importance to the well-being of the nation. If they are to be well done, early thought must be given to the many problems involved."

◆ Are we more pressed for time, money and men than England? Are we less alive to the needs of the future, even if we have not suffered the bombings they have endured? Are we lacking in the vision that moves our allies to action in planning for a future worth fighting for? Do we lack the courage of our convictions on the necessity of planning now—or have we such convictions? Or are we as a nation (and as architects) going to be caught without galluses or cincture?

◆ The plans being made and the legislation being written to implement the immediate study of city and town improvement deserve the active support of all architects and engineers. This is an opportunity for the profession to demonstrate its capacity for leadership and to prove that it can be "of ever increasing service to society."

Kenneth F. Stowell

EDITOR-IN-CHIEF

GETTING RESULTS WITH WPB



You can expedite your project along the path of priorities to production by observing these pointers from men who have been through the WPB mill

ARCHITECTS and engineers can save themselves considerable time, money and effort and can speed the production of needed buildings by all-out cooperation with the War Production Board from inception of the project. Many a headache, heartache—and worse, the loss of valuable man-hours of war production—can be saved by observing a few simple rules:

1. Know what kinds of building are permitted under WPB.
2. Become familiar with all the rules, regulations, orders, procedure and documentary forms that must be employed before you start a drawing.
3. Know exactly what materials you think you must have for the job, whether a new building, an addition or a remodeling.
4. Use utmost ingenuity to eliminate every possible ounce of critical material from your project.
5. Ask questions of WPB before proceeding rather than get into difficulties and delays by not knowing your ground. Before asking, however, make sure the information is not already covered in printed orders, and regulations or critical lists.
6. List for WPB the type, size, weight, quantity, cost and use of all critical materials you think you must have. The list should be an itemized breakdown, not just so many tons of steel or pounds of copper. Be specific.
7. Before making any actual working drawings or filling out and filing the application form, go over your project, personally if possible, with the appropriate WPB office. A discussion of your problems with the WPB and its Division of Conservation in New York or in Washington will disclose many things you cannot do and will suggest solutions and substitute materials that will save both time and delay.

From your preliminary rough sketches and lists of materials, WPB experts will put you straight on the path to working-drawing production, and no elaborate drawings will have to be junked because you went ahead on your own only to find they did not meet the requirements. Accepted architectural and engineering practices must go by the boards to conserve the critical materials for their most essential uses. Consult the Division of Conservation for their latest suggestions regarding both materials and methods of construction and equipment. (We assume you are familiar with "The Conservation of Critical Materials in Construction" issued by the Cooperating Committee of the American Institute of Architects and the Producers' Council, Inc.).

You will then be in a position to speed your working drawings and to fill out the necessary forms completely

and accurately. You may not get approval for all of the material you request, but be sure your list is complete, as you will not get any material not called for on your application form. This will save both your time and the time of the WPB experts in putting through the proper Preference Rating Orders and Certificates.

Essential documents:

First, read the "Directive for Wartime Construction," issued by the War Production Board and the War and Navy Departments. This is the general covering order which describes what can be built. If your project does not meet the requirements as here listed, postpone it until after the war.

Next in order of importance for your thorough understanding is Number L-41 (deferring certain classes of non-essential building). Familiarity with this document is a "must." In its "Schedule A" it lists the preference rating orders for various types of permitted construction and also the proper application form which must be used for each type. A careful reading of L-41 discloses that certain types of civilian building can be done without priorities, such as maintenance and repairs, residential construction costing less than \$500 in any one year, all other types of civilian construction up to a maximum of \$5,000 in cost.

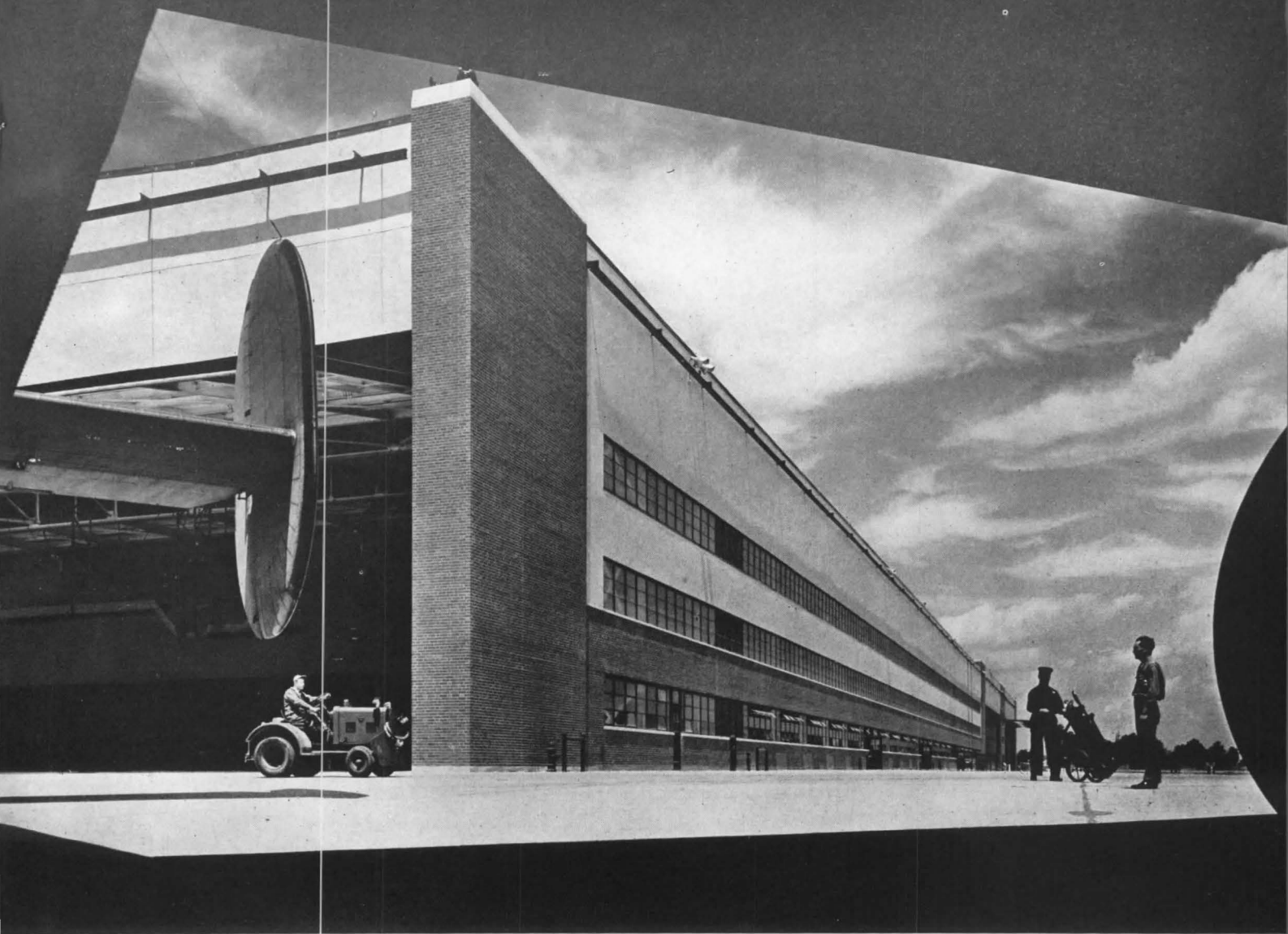
A supplementary conservation order, Number L-41, assigns high preference ratings on low-cost remodeling projects in defense areas, provided the cost of critical materials does not exceed an average of \$100 per room for each dwelling unit, or more than \$800 for each structure.

Plumbing and heating equipment use so much critical material that they are covered by the special limitation order, L-79, with which, in its amended form, every architect and engineer must be familiar. This order stopped the sale and delivery of many types of heating equipment.

If your job involves housing for war workers, you must consult and observe the "Defense Housing Critical List," which describes all the materials and equipment for which you will need priorities. Be sure that you are on the list to receive all new rulings or amended old ones from WPB.

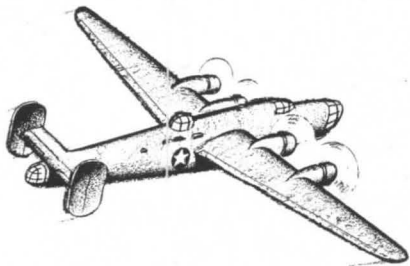
See our Washington news letter each month. In this issue, for instance, the New Lumber Order L-121 is discussed, as well as other late rulings.

To summarize, know what you want, know what WPB wants (through familiarity with their orders) and consult and cooperate with them from the earliest possible moment. Then both you and WPB will be doing the one all-important job—speeding the war effort.



Hedrich-Blessing

WILLOW RUN BOMBER PLANT



Albert Kahn

Associated Architects & Engineers, Inc.

Ford Motor Company Engineers

By now it is trite to state that the urgency of the war task has produced industrial miracles. And yet, confronted with this greatest of all the new bomber plants—a plant that only a year and a half ago was just an idea on paper—with its magnitude and swift construction, miraculous seems the only appropriate term. In fact, of course, it is not. It is the product of complete collaboration between alert production minds, architects and engineers geared to the terrific pace of war construction, and contractors who carried through the project on schedule. Three times during construction, the production order from the government was stepped up sharply, and three times the plans were changed to meet the new demand. Today the finished structure stands as a gigantic symbol of our determination to win the war in the shortest possible time and to establish and make real our new concept of Freedom and Democracy which is the expressed purpose of the struggle to which we are dedicated.



ORGANIZATION

DUE TO WAR censorship, information as to placement, size and operation of the various buildings that make up the vast plant is not available; but a general description of the main units may be of interest. The factory proper is, of course, the major unit, with hangar building and test field adjacent.

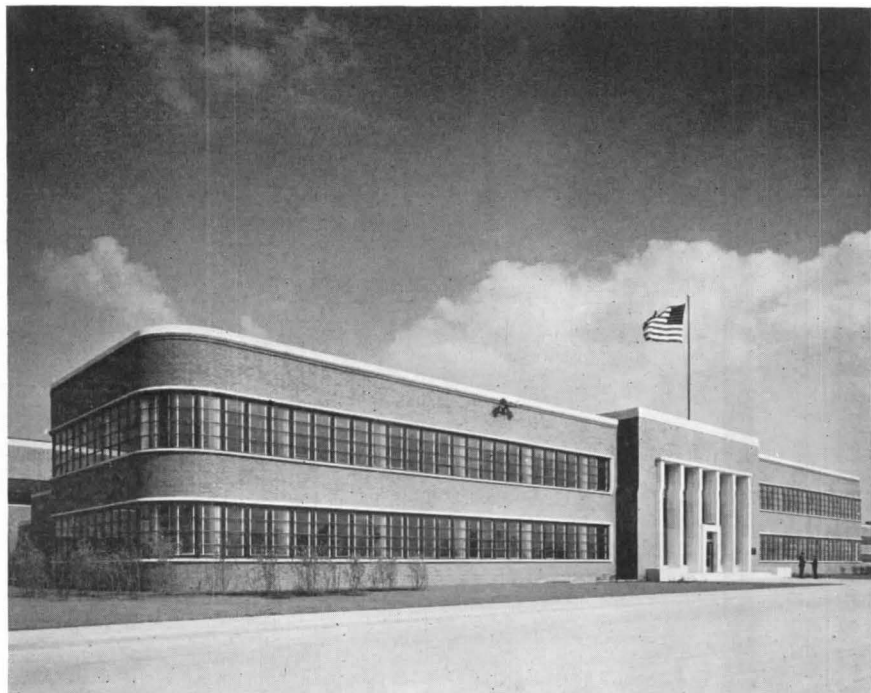
The factory is of the semi-black-out type, with no daylight in production areas. Exterior sash light and ventilate only office and utility areas.

A vast precision tool in itself, the factory is so organized that raw materials enter at unloading platforms, sub-assembly operations fabricate parts in adjoining areas, and these are all coordinated to feed into the main assembly lines, at the end of which finished bombers roll out onto the test field under their own power.

The final assembly lines occupy bays with clear spans extending the length of the building. Sub-assemblies and other operations take place in adjacent bays. Aisles between work lines are 12 ft. in width and

ADMINISTRATION BUILDING

Typical of the accessory structures that serve the huge plant, this two-story *building* houses the administrative and business offices. Of reinforced concrete construction, the building has finish walls of face brick with stone trim. In the office area, partitions are standard stock type; floors are surfaced with linoleum, and ceilings are acoustically treated. In the main lobby, terrazzo is the floor surfacing. The building is year-round air conditioned.



are serviced by standard automobiles and motor trucks, cranes and conveyors.

The hangar building houses a first-aid department, flight hospital, pilots' training school and offices. Hangar doors are of the overhead type and electrically operated.

Secondary structures, connected with the main factory by bridges, include the two-story Administration Building (facing page) and a Training School, also a two-story structure. The connecting bridge gives the school—which contains classrooms, laboratories and a large lecture room—actual connection between theory and practice.

A Personnel Building at the entrance to the plant serves also as the traffic-control point; a gate serves bus and auto arrivals and departures, and a passageway is provided for pedestrian employees and visitors. Other units of this building are interview rooms, a medical-inspection department and write-up, identification-photograph and fingerprinting rooms.

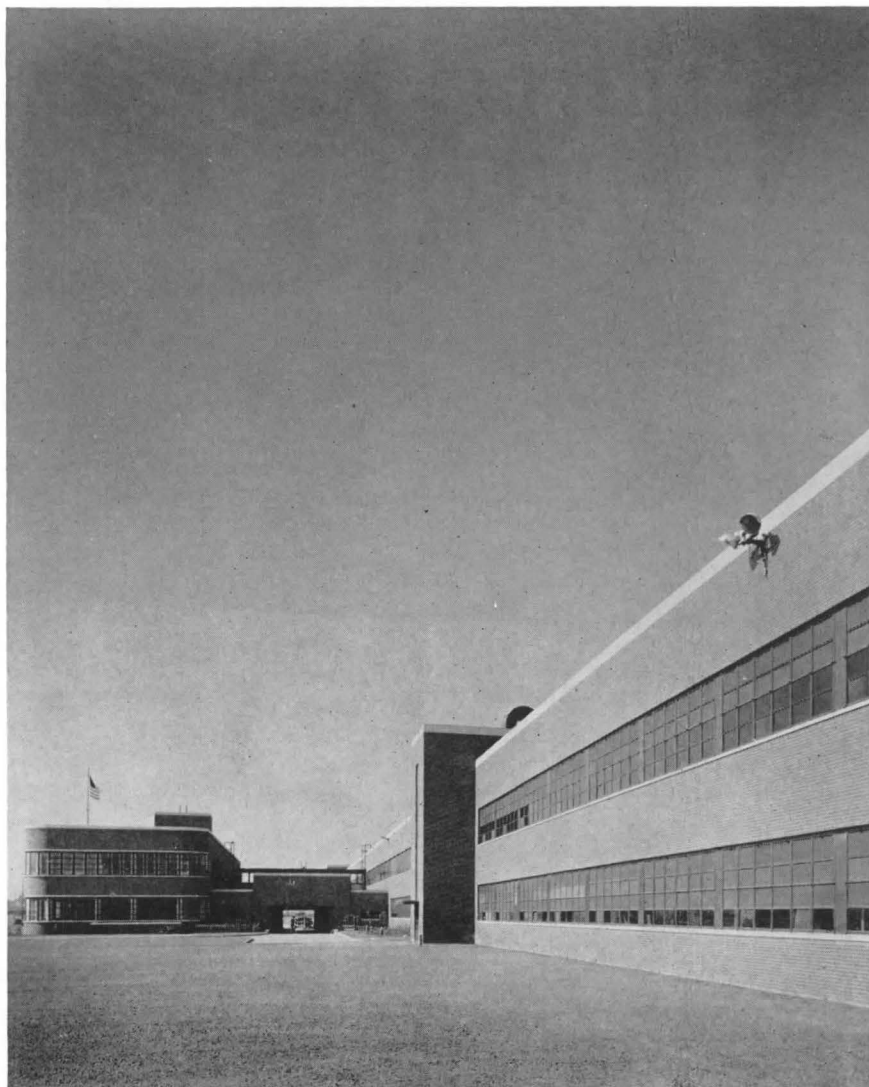
In addition to these buildings are many small, special-purpose structures—a commissary, powerhouse, garage, storage sheds, etc.

CIRCULATION

THE PARKING area is across railroad tracks from the factory itself. Employee entrance and exit is handled by a series of towers which connect by overpass to the mezzanine level of the factory where washup and locker rooms are located. Access to work-station points is by means of stairs both near the building perimeter and at the center. This system enables workers to reach their respective positions without cross traffic.

An interesting feature of the tower-and-overpass device is that it is also a part of the commissary system. Instead of a central cafeteria, a lunchbox system of serving

Bridge between the Training School (left edge of photograph) and main factory



Bridge connects Administration Building and factory



Hedrick-Blessing

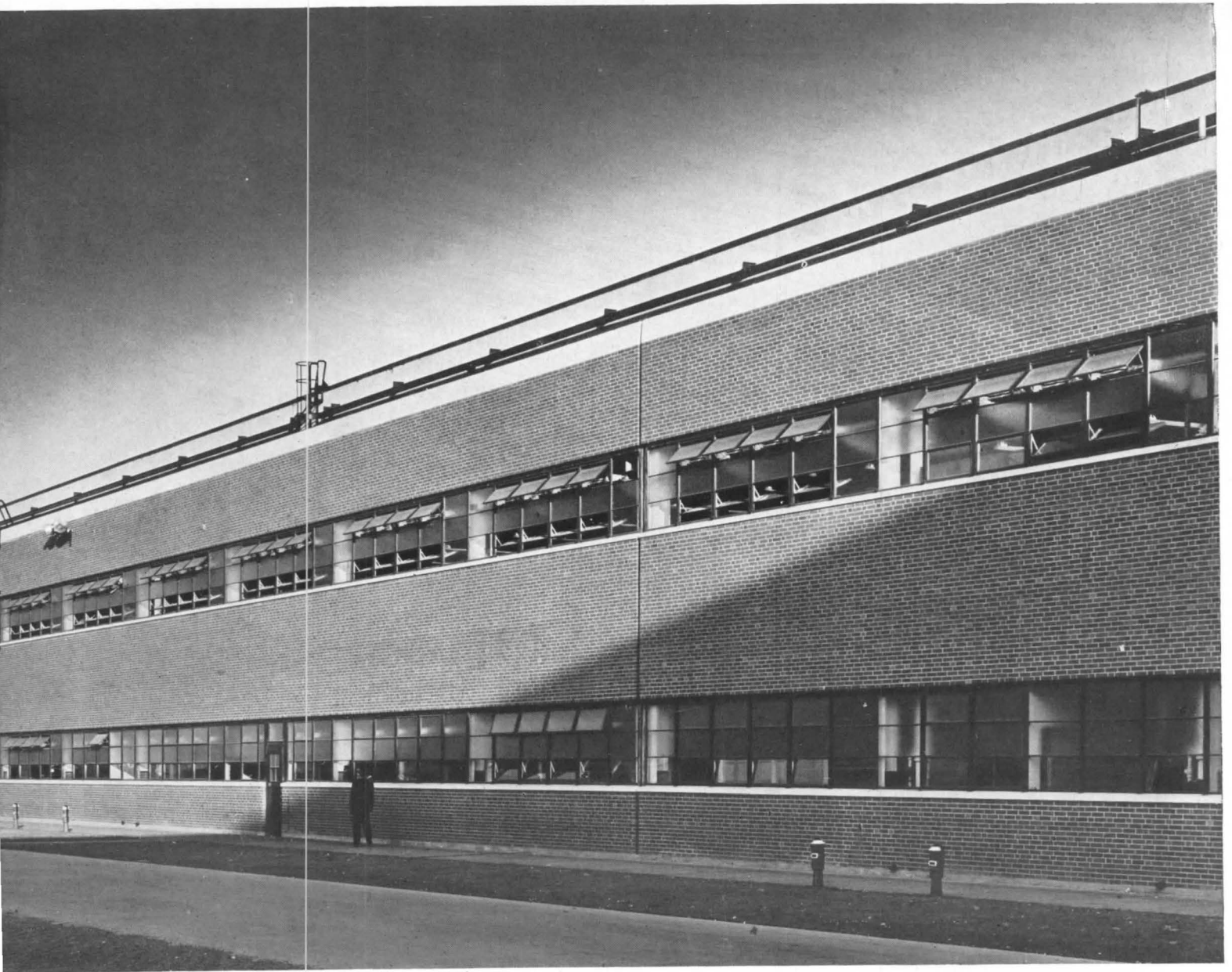


meals is employed, avoiding the heavy traffic problem of a central eating place. At lunch periods, lunch wagons are brought from the commissary building to the entrance towers, hoisted in special elevators, and rolled across the bridges, where the individual boxes are distributed to the workers who use this station point.

STRUCTURE

THE MAIN factory is framed in steel. Initial portions utilized members specially made up from limited sizes and shapes which a local concern happened to have on hand.

The envelope is of face brick with sand-lime back-up brick. Upper portions of walls of certain units—such



as the hangar block—are of gun-applied concrete. Steel sash are used throughout.

The roof is of 16-gauge, enamel-dipped sheet steel, covered with insulation, 4 plies of asphaltic felt membrane and hot pitch and slag. Factory floors are concrete-slab construction, reinforced with two layers of wire mesh and surfaced with 2½-in. creosote wood blocks.

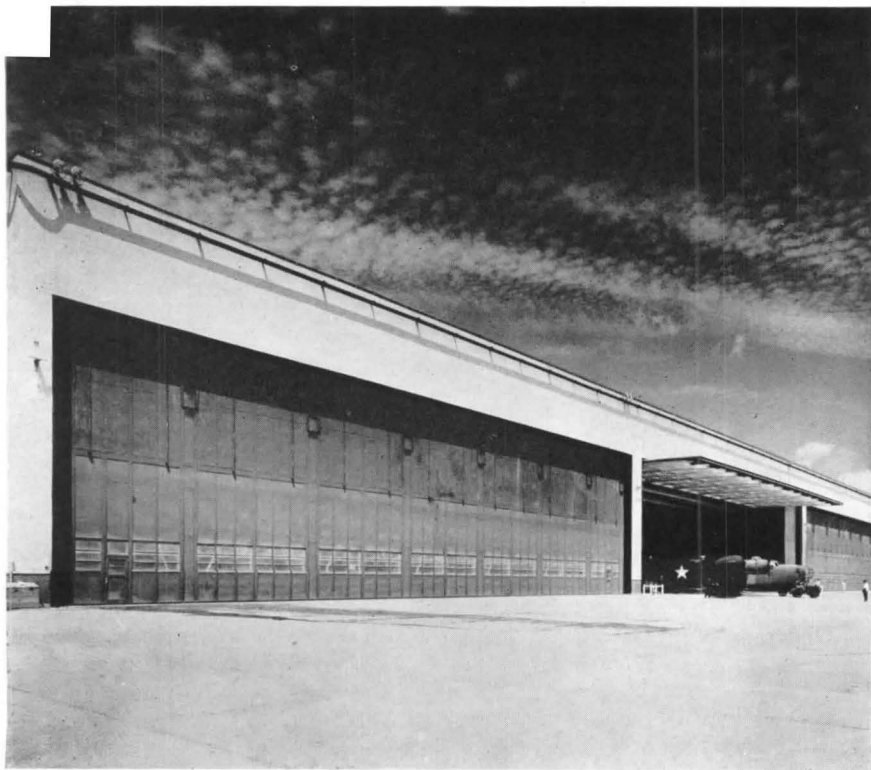
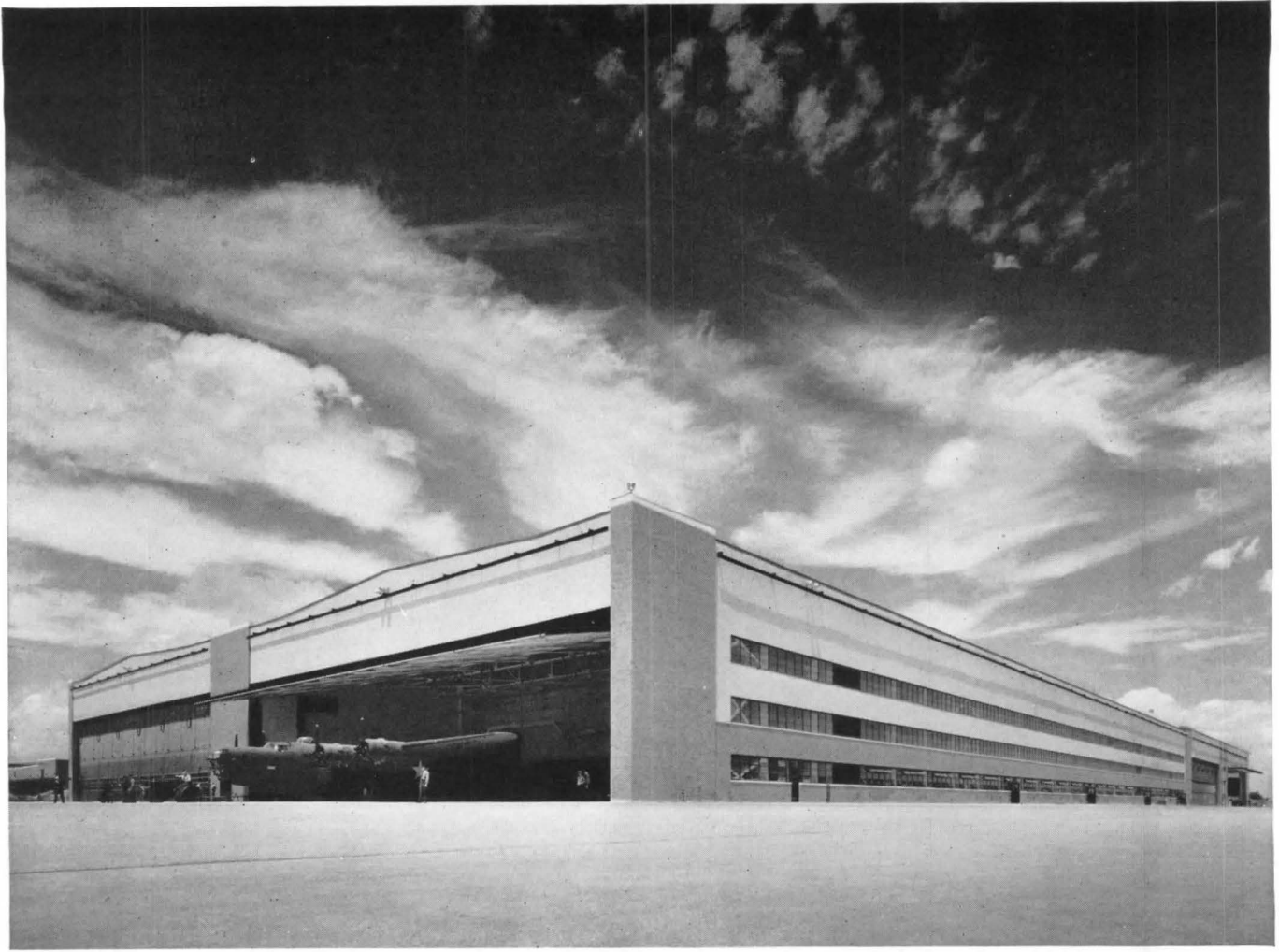
HEATING, VENTILATING AND AIR CONDITIONING

VARIOUS types of systems are used in the different areas. Steam for heating is supplied from oil-fed boilers in the boiler house. The steam is piped through a tunnel across the main building, with branches running



Overpass employee entrance

Hedrich-Blessing



the entire length of the building and to the several other buildings. All condensate flows into pump and receiver units and is pumped back into a receiver in the powerhouse.

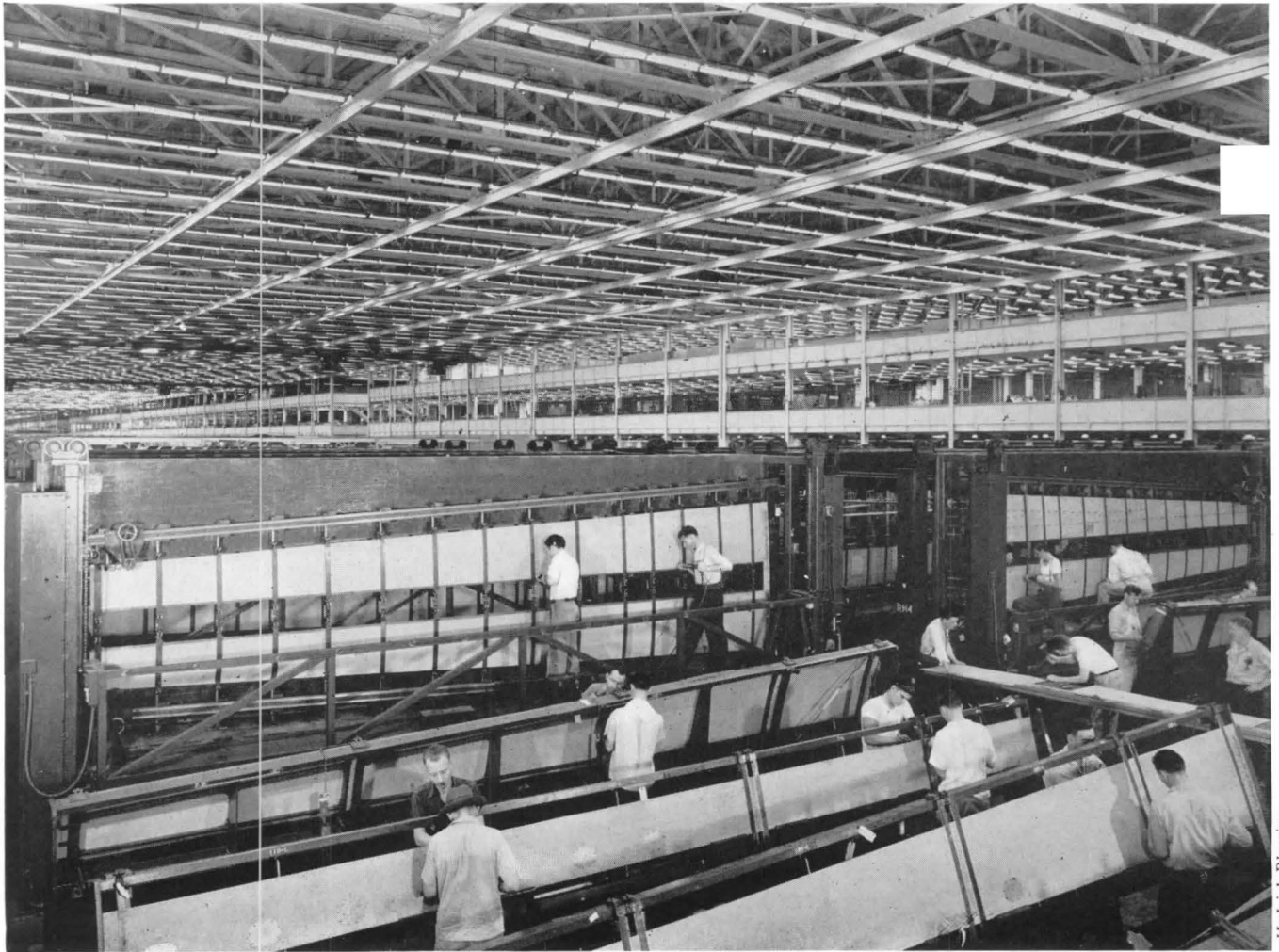
A hot-blast system is used in the factory, and a combined hot blast and radiators are used in the engineering section. Fan rooms are equipped with units with two-speed motors. The hot air is distributed through duct work located in the truss space; temperature is governed by thermostats.

Using low-speed in winter, the system supplies approximately two complete air changes per hour for the total height of the building.

In summer, the high speed is used, and the system is supplemented by roof exhaust ventilator fans to provide about 4 changes of air per hour for the entire building height, or ten changes at 12-ft. height.

In offices, operating rooms, laboratories, wards, etc., radiators are wall-hung convectors with sloping grilles in the top.

The whole system is designed so that future cooling equipment can be added to any area or in the entire building group. At present, cooling is employed only in the administration building, engineering laboratories, drafting rooms and certain special-purpose rooms.



Hedrich-Blessing



Engineering drafting room



Conference room



Hospital and first-aid facilities

WIRING AND LIGHTING

POWER is brought to the plant by separated utility lines, from which it is distributed underground to a series of underfloor plant substations. All bus sections are inter-connected by means of an emergency tie bus so that power may be supplied by either utility service to any bus section in case an outage should occur. In addition, turbo-generators on the bus sections can be synchronized with the utility lines and paralleled with either. All substation transformers for both power and lighting are interconnected on the secondary sides. There are no overhead conduit or bus systems in the plant, and the underground system is so designed that in case of damage only the relatively small area served by the damaged part would be cut off—and that, only temporarily.

Lighting is of the fluorescent type throughout, the current supplied by underground feeders. In the general assembly area, which is wholly artificially lighted, units are mounted end to end in continuous rows on approximately 10-ft. centers at a height of 36 ft. The maintained intensity on the working plane is 30 foot-candles or more.



Hedrick-Blessing

POSTWAR POTENTIALS FOR BUILDING

By THOMAS S. HOLDEN, President, F. W. Dodge Corporation

THE CONSTRUCTION MARKET today is a dual market comprising the current market dominated by war construction and war production and the future market being built up by current postponement of buying and by the expected emergence of new needs, new products and new opportunities for business expansion.

The deferred construction market came into being on October 9, 1941. That was the date when SPAB (the old Supply Priorities and Allocations Board) issued a policy statement declaring that priorities for scarce materials would not be issued for any public or private construction projects except those essential for defense or those essential for civilian health and safety.

Development of the deferred construction market was accelerated by Conservation Order L-41, issued by the War Production Board, forbidding new construction projects except those essential to the war, those essential to civilian health and safety and certain other specified types of small operations.

The effect of these orders is shown in the decline of private construction contracts since October, 1941 (see chart).

The decline in private construction contracts since October, 1941 was solely due to these restrictive orders. Since industrial production, national income and every other index of business prosperity have increased continuously, it can be said with certainty that private construction contracts would have continued on the upgrade if it had not been necessary to give war construction the right of way by ordering deferment of nonessential projects.

It is possible to obtain a rough estimate of the accumulating volume of deferred work.

If unrestricted, private construction contracts might have continued on the upgrade to reach a rate of \$3,000,000,000 a year by the end of 1942; actually, it may get down as low as a \$1,500,000,000 annual rate by December 31. This would leave a theoretical gap of \$1,500,000,000.

This would represent only a portion of the deferred work because many public projects of the customary types for civilian use have also been deferred. Furthermore, the contract figures are recorded for the 37 Eastern states, and a sizable figure should be added for the 11 Western states.

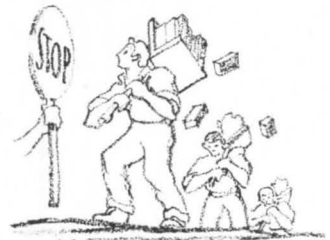
Allowance for these two additional factors makes \$2,500,000,000 a reasonably conservative figure for the deferred demand in the entire country as of the end of this year. Naturally, this is a broad sort of estimate and not an exact measure; but it indicates the existence of a continually growing volume of deferred demand.

Consequently, this chart illustrates two markets: 1. The war construction market, which is still rising; 2. The apparently declining private construction market, which is actually a postponed market and not, as the curve would ordinarily indicate, a market that is dwindling because demand is declining.

The deferred construction market consists, actually and potentially, of all types of projects that cannot be undertaken today, such as: residences over \$6,000 (including land), apartment buildings, hotels, theaters, hospitals (for civilians), educational buildings, commercial buildings, industrial plants (for civilian goods), public improvements, etc.

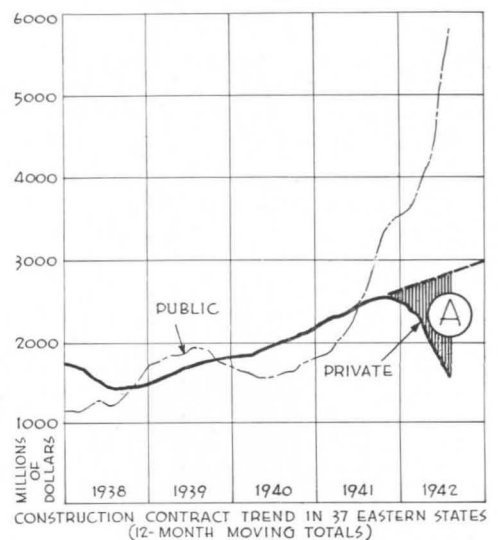
Added to the deferments occasioned by war restrictions there will also be improvement projects by railroads, public utility companies and many other industrial organizations which were deferred during the long depression preceding the war.

After World War I, it took until the end of 1924 to make up shortages brought about during the war period. However, the postwar recovery of the early 1920's was interrupted during a period of nearly two years by a postwar



CHAMBER OF COMMERCE OF THE UNITED STATES (in *Washington Review*, its weekly bulletin):—"Government leaders, from the President down, are looking to the time when the task of rebuilding a shattered world is taken up."

"Business, too, is looking ahead. A special committee of the Chamber of Commerce of the United States is giving earnest attention to the part that business will play in that vast undertaking."



Shrinkage of private non-essential building (area A) represents a tremendous and ever-growing post-war building market



NATIONAL ASSOCIATION OF MANUFACTURERS:—*“Now is the time to plan for the postwar readjustment period, to establish present and future policies which will permit and encourage the highest degree of postwar productive effort and the largest amount of postwar employment and wages—as high as postwar conditions warrant—all with the objective of contributing, so far as it is possible to do, to the postwar economic prosperity and reconstruction of the United States.”* Committee on Postwar Problems.

DAVID C. PRINCE, Vice-president, General Electric Co.:—*“A detailed analysis shows that it should be possible by keeping the country busy and employed, to make full use of our expanded productive machinery and provide a high standard of living for all America. The only way we can fall short of the goal is to sit down and not arrange to have work for those people to do.”*



price inflation (1919 and early 1920) and a consequent deflation accompanied by a severe depression (1920 and 1921). So, the deferred demand was enough to cause a rising construction trend for a net period of three years.

The amount of deferred construction demand that will accumulate during World War II will obviously depend upon the duration of the war; that is, upon the number of months during which nonwar construction is restricted. The volume of accumulated demand at the time of removal of restrictions, plus the question of whether a postwar price inflation similar to that of 1919-1920 will this time be avoided, will determine the period of that part of the postwar recovery which will result from deferred construction demand.

Will Construction Activity Expand After Deferred Demands Have Been Met?

1. Historical Background: After World War I deferred construction demands had been substantially met by the end of 1924. Following 1924, however, construction demands did not fall off, but increased greatly, producing four record-breaking annual volumes (1925-1928).

New construction demands arose in connection with a great wave of economic expansion. This was a many-sided development, but perhaps its most important phase was the expansion of the automotive industry and allied industries (rubber, petroleum, etc.).

The automotive industry, by developing cheap cars and installment credit, created a revolution in transportation. This expansion demanded factories, service stations, filling stations, private garages, hard-surfaced highways, etc.

It enlarged the daily cruising radius of the average man three-fold, from 5 miles to 15 miles. This meant that the effective area of urbanization increased nine-fold, from less than 80 square miles to more than 700 square miles. Commercial and industrial prosperity was bringing people to the cities and the cities were overflowing into suburbs and outlying commuting areas. These population movements created demands for various types of construction.

The record-breaking construction volume and the general prosperity of the late 1920's accompanied a great wave of economic expansion.

2. The Nature of Construction Demand: Construction demand arises from two important sources: a) needs for replacements, modernization, repairs; b) needs for new facilities.

The first category of needs is always present even in a static economy or a depression period. It employs the construction industry on a moderate scale only.

The second category of needs arises when new developments encourage vast investments of capital in new facilities—facilities for industry, trade, family and community life. Expansion periods are periods of prosperity and full employment of the construction industry.

3. Potential Expansion Factors: It is almost impossible to measure in advance the significant developments that make for general economic expansion. People were skeptical about the first steam railroads; the early automobiles were rich men's toys. Few people knew in 1919 what the automotive industry would accomplish in the following decade. In the deep depression that preceded these and other tremendously vital expansion factors, people were very pessimistic, freely predicting long periods of stagnation and distress; up to now people have generally not been able to forecast what the next big expansion factor would be.

However, a period of great business and construction activity, in which shortages are made up after an extended period of stagnation or postponement of buying, builds up national income, savings and investment confidence, thus paving the way for expansion.

So, when the deferred demand for construction and automobiles and household goods and machinery for peacetime production has been taken

care of in the coming postwar period, the stage will be set for expansion. In order to carry our big debt load, to maintain reasonably full employment, and to utilize our vastly improved and augmented industrial plant capacity, government will be obliged to adopt policies that will encourage wide-scale investment in new enterprises.

A. Revival of the Automotive Industry: The transformations in our modes of living and our community patterns wrought by the automobile have not been completed. Much is yet to be done in developing bus and truck terminals, hard-surfaced highways, revamping street and open-space patterns of cities and towns.

B. Aviation: Commercial aviation, including fast freight service, is due for a vast expansion; the private plane may become a really important transportation factor. Whether this development in transportation, practically certain to come on a large scale, will become as great a stimulus to general industrial and business expansion as railroads and automobiles have been remains to be seen. In any case, hangars of many varieties and sizes, airports, passenger and freight terminals and many as yet unknown accessory buildings will be required.

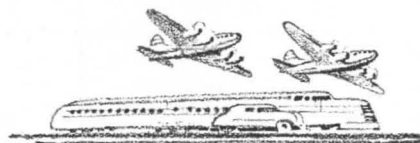
C. Light Metals and Synthetic Materials: War needs have caused enormous expansion of aluminum production; they have practically created a magnesium industry; they have brought into being new plastic materials and expanded production of others; they are creating a synthetic rubber industry. Producers of all these materials are at this moment conducting product and market research in peacetime uses of these goods. These materials will be used in industrial products, airplanes, automobiles, household conveniences, art objects and in many other ways. Their development as structural materials may conceivably revolutionize construction methods, architectural styles and furniture design. It is very difficult to see any limits to the expansion possibilities of these materials newly available in vast quantities at low prices.

D. New Construction Materials and Methods: New materials and new construction methods, producing greater values per building dollar, will inevitably increase demand for low-cost buildings of every classification, particularly houses. War construction requirements, with the paramount needs of speed and economy in use of scarce materials, are daily modifying traditional design ideas and construction procedures.

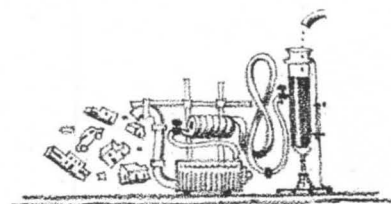
Among other things, the makers of prefabricated houses have for the first time found in the war housing program quantity orders for houses, creating an opportunity for practical development of techniques and demonstrations of potentialities that did not hitherto exist. Undoubtedly, such developments will have some lasting effects upon construction methods and procedures; though the importance of the prefabricated house itself as a factor in the future housing market is still problematical. It will probably depend more upon future possibilities of quantity orders for houses in reasonable continuity than upon technical developments.

In any case many of the technical developments of the war period will persist. To the extent that they will provide better buildings for less money, they will contribute largely to expanding the construction market of the future.

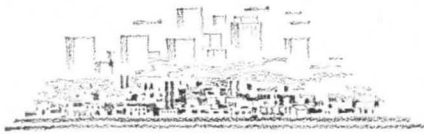
E. Housing: The housing revival of the late 1930's, interrupted during the period of war restrictions except for buildings in the war housing classification, will doubtless be resumed. In part, the housing program will make up deficiencies of the last depression period; its continuation will depend upon the degree of general prosperity (high national income and full employment) the country will enjoy. If national income averages over 100 billion dollars annually in the 1940 decade, as seems highly probable, housing demands will be very great and will continue for an extended period. There will be a much greater demand, proportionally, for houses to cost (with land) over \$6,000 than in the 1930 decade; not only because there will be some surpluses of lower-priced houses directly after V-day, but also because higher national incomes mean more families moving into higher income brackets and demanding better houses than they lived in before. The



SUMNER WELLES, *Under Secretary of State (Memorial Day, 1942)*:—" . . . I believe that here in our own country we will continue to find the best expression of our own and the general good under a system which will give the greatest incentive and opportunity for individual enterprise. It is in such an environment that our citizens have made this country strong and great. Given sound national policies directed toward the benefit of the majority, and not of the minority, and real security and equality of opportunity for all, reliance on the ingenuity, initiative and enterprise of our citizens rather than on any form of bureaucratic management will in the future best assure the liberties and promote the material welfare of our people."



HERBERT HOOVER, Ex-president of the United States:—*"In the last war we made little advance preparation to cross the precipitous mountains of after-war disorganization or of methods to recover the lost freedoms. We were then ignorant of what lay ahead. We know more about it this time. We need to think out economic reconstruction. We must think out the recovery of freedom. And that preparedness can come only from organized objective research and public debates. It must come from many sources and many places and not from government alone. It is a safe area for vigorous speech."*



LEWIS H. BROWN, President, Johns-Manville Corporation:—*"We are, after all, only a little way across the threshold of the technological age. We will need to rebuild America to fit the tempo of the airplane just as we rebuilt it after World War I to fit the tempo of the automobile. Our greatest obstacle is that we have not yet learned how to couple government fiscal policy and the productive genius of American industry to provide full employment—This goal is not impossible."*

expanded housing market will be largely a market for private builders and investors. The possible extent of any government housing program is purely conjectural at this time.

F. Urban Redevelopment: Redevelopment of blighted urban areas, talked about a great deal during the past decade, is more than likely to develop into real large-scale programs. A number of people are advocating that this should be done on a national scale, with subsidies for local communities by the Federal government. Other people, equally impressed by the necessity of doing this job on a large scale, believe that it can be done and done more soundly through local initiative and private investment; to this end four states (New York, Illinois, Michigan and Kentucky) have enacted enabling legislation to encourage private initiative and private investment.

Since these state enactments were all passed shortly before the dimout on private construction, projects planned to function under them have not materialized; consequently, it is still an open question whether the job can or will be done with local initiative and private capital without Federal financial aid. Under one method or another the job will undoubtedly be done. Urban redevelopment would create large-scale projects including housing, commercial and industrial buildings, open spaces, public facilities, etc. Some projects would call for immediate demolition of old buildings and replacement with new ones; some would combine modernization of existing buildings, new construction and gradual replacement of old buildings over a programmed period. The urgent necessity for urban redevelopment is based upon the need to restore the balance between central districts and outlying areas, to recreate real estate values, strengthen the security underlying mortgages and improve the financial status of cities.

G. Public Works Reserve: Federal, state and local governmental agencies customarily responsible for planning and executing public improvement projects have been obliged, like private investors, to postpone those projects of civilian character which would, under other circumstances, have been carried out this year. Regular improvement projects postponed during the war period thus became part of the deferred construction market.

These agencies, however, are now engaged in developing long-range programs for projects to take care of the future needs of their respective communities. They have been encouraged to do so by the Federal Works Reserve, a unit of the Federal administration set up under the joint auspices of the National Resources Planning Board and the Federal Works Agency, whose field representatives have made contacts with state and local government agencies, helped them to study their financial resources, set up capital budgets and develop long-range programs for future community improvements.

Up to this time 35 state governments, 270 counties, 755 municipalities (ranging from quite small towns to some of the largest cities), 63 independent school districts and education boards, and 18 other local jurisdictions have started long-range programs. Some of these are in the preliminary study stage, some fairly well along, some in the stage of completed programs formally adopted, some with appropriations for preparation of blueprints and specifications. For example, the State of New York has set up a Postwar Public Works Planning Board, with a special appropriation of \$450,000 (to supplement funds available in the budgets of various state agencies) for preparing plans and specifications; the City of New York has appropriated something over \$22,000,000 for preparation of plans and specifications for future projects with an estimated total construction cost of \$660,000,000.

It is today an open question as to whether these projects will go ahead entirely on the basis of local financing, or whether there will be a program of Federal aid and, if so, how much. Solution of that question will depend on two important factors:

1. The capacity of states and local government agencies to finance their improvement needs out of their own tax and credit resources.
2. The extent of any future unemployment emergency that would be of a character to demand emergency legislation by Congress.

(continued on page 90)



How long will Willow Run workers fight for seats on the busses? How long will busses continue to run? With almost no new housing ready in the whole area, the army of bomber plant workers must commute over long distances or live in trailers or tents. How long will housing be delayed?

WHAT HOUSING FOR WILLOW RUN?

Questions of Priorities and Pipe, Politics and Personalities, Policies and Production Programs, Water and Walking Distances, Town Lines and Party Lines, Time and Tires Muddle Thinking and Delay Effective Action. Time is Short, Houses Lacking.

THE Battle of Willow Run still rages on the home front after many months, with housing for bomber plant workers making virtually no progress at all. Casualties have been heavy—mostly in burnt fingers—and housing is caught in a cross-fire of propaganda. Meanwhile the thousands of in-migrant workers for the greatest of bomber plants are left to find such accommodations as they can—trailers or tents or shacks. The alternative is to spend long hours and consume untold quantities of gas and rubber commuting from Detroit, a city already crowded to the bursting point.

It is clear that design and construction problems are the least of the issues that have so long kept things at a shameful impasse. Even priorities problems have been waiting on the settlement of issues that seem still more critical than material shortages. The drama of Detroit has about all of the characters and plot complications that could possibly be crowded into one pageant, and is different from many less spectacular war housing productions only in degree. And if war housing does have any relation to war production, it is obvious that this prolonged struggle is not bringing V-day any closer.

First act of the drama began more than a year ago, when the mammoth plant was planned for an open field 25 miles west of Detroit. That was before Pearl Harbor, and perhaps there was much logic in placing the plant out in Washtenaw County, away from the congestion of Detroit, and away from its mercurial atmosphere. Whatever thought was given to the housing of its thousands and thousands of workers perhaps did not contemplate troubles

in tires and building materials and utility services. Granted that these shortages did arise to thicken the plot, the fact remains that the drama has taken more than a year to get only through the second act.

Delay is certainly not due to lack of schemes or plans for housing. Nor is it due to any lack of willingness on the part of either private builders or public housing officials. Private builders say they are willing, indeed anxious, to supply all of the housing required, in any part of the area. National Housing Agency has given intensive study to the whole situation, and has plenty of plans of its own. The most spectacular, and most argued, element in its plans calls for a permanent and complete new town of Willow Run, the so-called Bomber City. It has also announced other plans, including less spectacular public projects and various types of "duration dormitories."

Priorities clearance, necessary to either government or private enterprise, has been repeatedly delayed. Besides considerations of actual material shortages, which in themselves have caused revisions of plans, other factors are gasoline, tire and other transportation difficulties, lack of utilities and services to the areas proposed, confusion over the number of workers to be housed, and continual changes in housing proposals.

All of these matters have been argued interminably. Plans for the new town have been bitterly opposed—by farmers, builders, real estate men, local citizens, and especially by Ford officials—until the whole situation was investigated jointly by the Truman Investigating Committee of the U. S. Senate and the WPB.

Currently the Bomber City scheme is being held for further study, but other portions of the NHA plans are recommended for approval. Also clearance is being arranged for privately financed projects. As one reporter puts it: "WPB is definitely putting the heat on NHA

to adapt its public housing program to use improved land in adjacent communities. The club being held over NHA is an increase in the number of private housing units and a corresponding decrease in the public housing program unless this adjustment can be made."

THE BATTLE OF BOMBER CITY

OPPOSITION to the new town of Willow Run (Bomber City) may or may not be fully explained by the arguments presented in the Truman Committee investigation. Those arguments dealt with water supply problems, transportation difficulties, cost to government, material shortages, possibility of a future ghost town, vulnerability to bombing, and so on. But in-the-know observers say that while the opposing forces speak of these things their ultimate concern is deeper.

Anybody working in housing must face the social and political implications of a completely new town dropped suddenly in the midst of any active area. As originally proposed the town would contain 6,000 units, housing a population of perhaps 25,000. It would be, in Washtenaw County, larger than any existing community, and consequently important both politically and socially. It is small wonder that the battle of Willow Run quickly got beyond the realm of technicalities of housing and town planning.

One reporter says bluntly, "I think the basic trouble at Willow Run is an underlying struggle to prevent the leadership of UAW-CIO (United Automobile Workers Union) from asserting itself. Putting the new plant outside of Wayne County looks like a grand maneuver to escape CIO. But at that the eastbound production line got so long that turntables had to be put in to divert it south at the county line. If labor follows the plant to Washtenaw County instead of continuing to live and vote in Wayne, the maneuver is lost."

Other comments run in the same direction, if not so openly. At any rate Ford did eject surveyors working for FPHA from his land, and has expressed his determination to fight it, his remark variously reported: "resist by every legal means," "to the last ditch," "to the last nickel."

And the UAW, at a recent convention in Chicago, passed a resolution denouncing Mr. Ford for his opposition to the Willow Run town idea and calling upon the President and the NHA for immediate action to revive the plan.

Meanwhile housing of Willow Run workers is important

to the war effort. The war is not waiting for all of the implications of Bomber City to be aired and decided. For many months, nevertheless, Bomber City has held up virtually all other housing projects in the whole area. Only in the last few weeks has there been any sign of breaking this bottleneck to allow other housing to proceed.

Bomber City took its dominant place in the picture last April with the announcement of FPHA that it would build an ideal city. Of themselves, plans for the town were both ambitious and logical. It was to be a model for city planners of the future. Each home was to have grounds for a victory garden. Schools, churches, public buildings and recreation facilities were included in the plan. Around the city there was to be a green belt which would prevent springing up of shack communities such as are making unsightly the approaches to Detroit and other industrial cities.

Houses in Bomber City would be permanent and temporary at the same time. There would be no bathtubs until after the war. There would be shower stalls instead. The floors probably would be concrete instead of wood. There would be no basements. The houses were to cost an average of \$3,750 each. There were to be 6,000 permanent dwellings, which would be so attractive that the workers would wish to keep them. Ten thousand temporary units were to be built between the city and bomber plant.

It was pointed out that for the sake of the safety of war workers no dwellings would be constructed within a mile of the bomber plant. Bomber City would be, in effect, a gift of a permanent community of 25,000 or 30,000 people to Washtenaw County, a community larger than Ann Arbor, largest city in the county.

The announcement evoked protests from several groups in Washtenaw County, including the board of supervisors, city councils and real estate boards, so a meeting was held at which representatives of the Federal Public Housing Administration explained the project. The descriptions of the city were received in silence. FPHA men reported to Washington that opposition was disappearing. Architects



Only a few private housing developments for Willow Run workers have been able to go forward. This one, by Fabricated Homes, Inc. and Edwin S. Smith, has recently been built in nearby Wayne



Now becoming rare in defense housing is brick veneer construction. This group of

and engineers went ahead with plans. It turned out later that the opposition merely had remained silent until it could collect sufficient facts to wage battle.

Chief of the fact collectors was Henry E. Riggs, a consulting engineer, former head of the civil engineering department at the University of Michigan and one of the organizers of the Huron-Clinton Metropolitan Authority which proposes to beautify the valleys of the Huron and Clinton rivers in Wayne and four adjacent counties. Professor Riggs supplied the ammunition with which opponents of Bomber City bombarded the Truman Investigating Committee of the United States Senate and a special committee of the War Production Board.

Meanwhile, FPHA surveyors aroused the anger of farmers by entering their lands without asking permission, and FPHA real estate agents were accused of "brow beating" land owners into signing options. Opposition became active when it was learned that FPHA surveyors had been ejected from land in the area owned by Henry Ford, which is used for a farm trade school. Surveyors were driven off several farms. During May and June there was heated correspondence between Col. F. Charles Starr, FPHA representative in Detroit, and I. A. Capizzi, attorney for Ford. Col. Starr described the act of ejecting the surveyors as "unthinkable on the part of any American in wartime." Capizzi accused Col. Starr of failure to exercise common courtesy when he sent in surveyors without asking permission. Ford's threat to "resist by every legal method at his disposal not only the acquisition of his property but continuation of this project" still stands.

Most of the opposition to Bomber City has been based upon the permanence of the housing. In a letter to William K. Divers, regional representative of the National Housing Agency, Professor Riggs said:

"I am opposing this project because I cannot see where the building of 6,000 or more *permanent* houses in what is now purely a farming district is either necessary or justifiable, and because I am sure that this project cannot be completed and supplied with the necessary services to make it habitable before late in 1943.

"There must be very substantial provision made for *temporary* housing in the vicinity of the plant at the earliest possible moment, and the plans for such housing, as announced, have not been objected to . . . so far as I know."

Bomber City was planned on the information, or assumption, that the Willow Run plant would employ between 100,000 and 125,000 workers when it reached peak production. FPHA officials said they obtained this estimate from the Ford Motor Company. Ford officials denied that any estimate of the number to be employed was asked or

given and stated that maximum employment would be 60,000. The FPHA assumed that 25,000 or 50,000 workers would be employed in the plant after the war. Capizzi denied that there were any plans to use the plant after the war. If used as an assembly plant, Willow Run would employ about 5,000 workers in peacetime.

Arguments in favor of building Bomber City included:

1. The Willow Run plant is a permanent manufacturing establishment. Even if the Ford Motor Company should fail to exercise its option to acquire the plant from the Defense Plant Corporation, it is to be expected that the government would find some other use for the large investment which is made in the plant and its service facilities.

2. The proposed city would offer "the finest living conditions" available to industrial workers within the reach of the plant and would share with Ypsilanti the advantage of being within easy commuting range. Therefore, it never would become a "ghost town."

3. Houses would be so dispersed that the danger of bombing would be minimized. It would be considerably safer than older, more closely built cities.

4. The decision to build Bomber City was made only after the situation had been studied and other possibilities discarded as being less well fitted to serve the program.

Opponents of the project advanced the following argument against building a permanent city:

1. The Willow Run plant will reach peak employment in December, 1942, long before the city could be built; therefore residents of Bomber City would be the last hired and the first laid off. With little prospect of employment in the area after the war, they would create a permanent welfare problem.

2. The site is 15 miles from the end of Detroit water mains. It is five miles from the Huron River. Great amounts of critical materials would be needed for water and sewage systems. The Huron River has been made clean at great expense, and under Michigan law a sewage disposal plant would be required. There are an ample number of vacant lots in Ypsilanti, Ann Arbor, the City of Wayne, Inkster and other nearby communities where public utilities are available already.

3. The size of the lots in the proposed city, 50 ft. by 100 ft., is not large enough to make it attractive as a permanent home for people who long for living space outside Detroit.

4. The distance from the Willow Run plant, an average of five or six miles, is too great to solve any transportation problem but not sufficient for safety from bombs aimed at the plant. Furthermore, workers concentrated on 50-ft. lots would be an attractive target for enemy bombers.



homes, built by Garling Construction Co., is in West Dearborn, west of Detroit



More representative of the type of housing proposed by private builders for the towns near Willow Run are these frame houses done in Evergreen Village by Frischkorn Construction Co.

They might better be scattered in near-by communities.

5. The city would be Federal-owned but State-governed. It could not be incorporated under Michigan law for at least three years because there must be at least 100 residents of three years standing to incorporate a city or village. Therefore, Bomber City would have to depend on township government, a very weak unit in Michigan.

After the arguments pro and con were made, opponents of the project appealed to the Truman Committee to investigate the project. They also asked the War Production Board to deny priorities for construction materials for a permanent new city. A special committee was appointed by the WPB to study the project.

With its estimate of the peak number of employees at

the Willow Run plant reduced from 100,000 or 120,000 to 50,000 or 60,000, the Federal Public Housing Authority made a new proposal to build 2,500 instead of 6,000 permanent homes in Bomber City.

The opponents still objected. They wanted no permanent city whatever. The Ann Arbor Real Estate Board obtained pledges from 30 builders to complete construction of 2,500 houses in established communities before July 1, 1943, if they were granted priorities.

Whether Bomber City ever is to be built awaits the decision on priorities by the War Production Board. If these priorities are granted, the Federal Public Housing Authority still will face the threat of Henry Ford to block the plan "by every legal means."

A BREAK IN THE BOTTLENECK

FORTUNATELY there are signs that the bottleneck of Bomber City is being broken, and other housing projects, private and public, will be allowed to proceed.

The NHA program, which includes the private building under FHA as well as the public program under FPHA, has been revised according to changing facts and circumstances. The over-all NHA program originally called for a total of 43,000 units. When the estimates of Willow Run employees dropped from around 100,000 to 60,000 the NHA total program was cut to 13,000 units. As presented to the Truman Committee, these totaled 8,500 public housing units made up of 3,000 in dormitories, 1,000 temporary dormitory apartments, and 4,500 family dwelling units. The private housing program includes another 4,500 family dwelling units.

John B. Blandford, Jr., Administrator of NHA, has described the program thus:

"The revised program constitutes what we consider a minimum and it is possible that a greater quantity of housing may become necessary due to a revision upward in the estimate of peak employment or increasing difficulties in providing transportation. Any additional housing which may become necessary for the above mentioned reasons will in all probability be of a temporary nature.

"Of the 4,500 family dwelling units to be constructed

with public funds, we propose to locate approximately 2,500 in the vicinity of the plant and 2,000 in the Wayne-Inkster area. The 2,500 to be located in the vicinity of the plant will be able to use, at least temporarily, the community facilities available at Ypsilanti and will probably be located as close to Ypsilanti as it is possible to find suitable sites. These 2,500 units, together with the dormitories for 3,000 workers and the 1,000 temporary dormitory apartments, will constitute the nucleus for any future temporary additions which may become necessary. By dividing the public housing between Ypsilanti and the Wayne-Inkster area the 2,000 units located in the latter area will also be able to use existing community facilities, at least temporarily. In this way it may become unnecessary for us to furnish all of the various facilities which would be necessary if a large new town site were developed at either location.

"The private housing programmed to serve the plant will be located principally in Wayne, Inkster, Ypsilanti and Ann Arbor on lots which have all or some of the utilities presently installed. It is estimated that such a plan will probably require all lots for which any substantial part of the utilities has been installed."

After the Truman Committee investigation the special Willow Run Committee of WPB recommended that the private building program be allowed to proceed, but that the Bomber City part of the public program be held for further study of the possibility of saving critical materials in the extension of utilities lines.

Raymond Foley, Michigan FHA director, has announced that the Willow Run district has been designated as a separate critical housing area. The new area includes Ann Arbor, Ypsilanti, Inkster and the City of Wayne. The designation was accompanied by unofficial assurance that utilities will be installed in at least part of the area. On that basis private builders are now preparing plans and priority applications indicating that the whole quota of 4,500 units will be accepted by them, with at least 50 per cent of the units for rent.

Bomber City itself has now been cut to 2,500 units and is the only major part of the housing program still to be decided.



Detroit News

Herman Gardens, an FPHA project for 2,100 families, might have helped the housing shortage, but the Army may take it

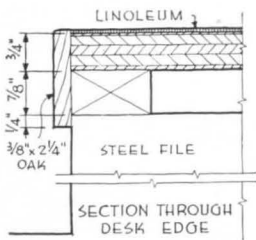
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INTERIOR DETAILS

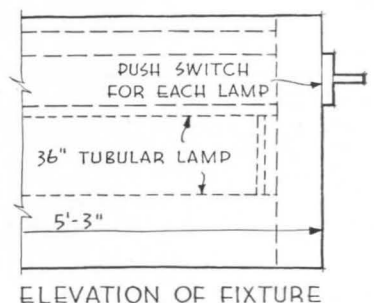
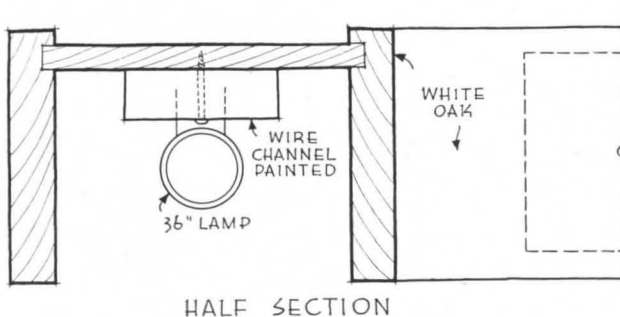
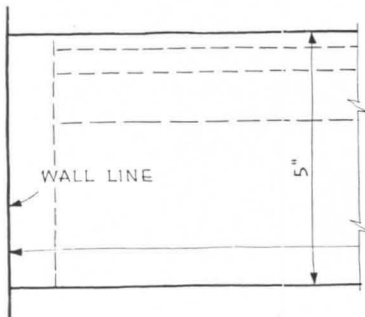
G. McStay Jackson, Designer; W. H. Buderus, Associate

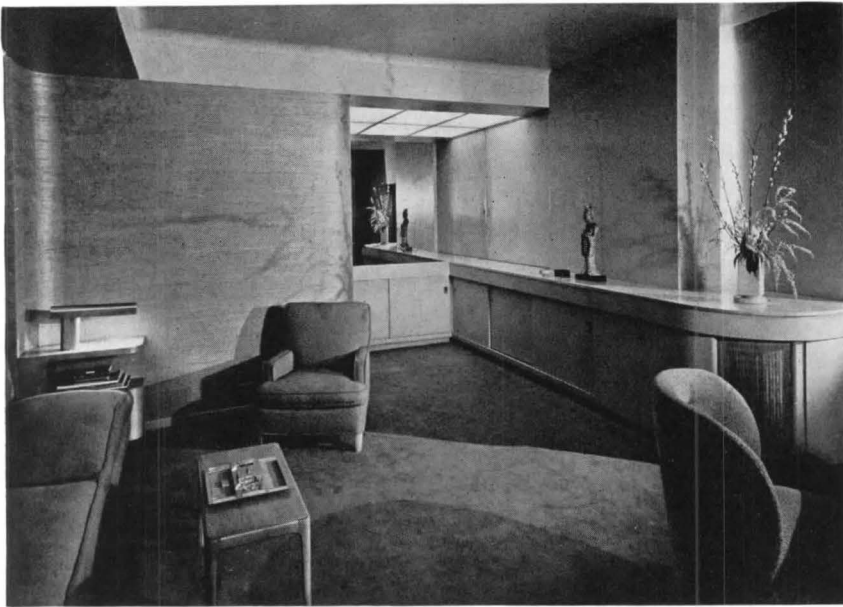


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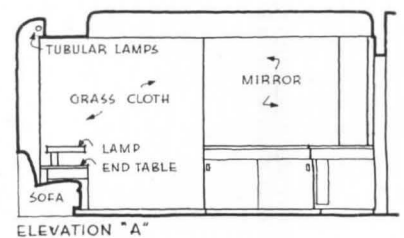
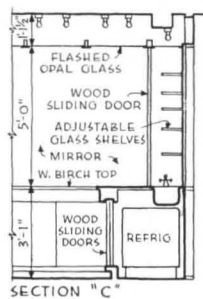
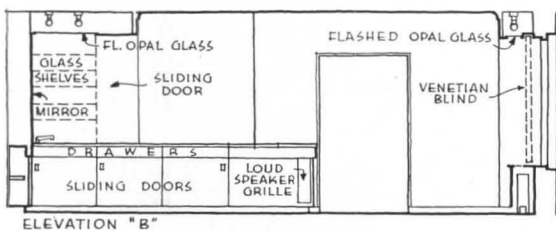
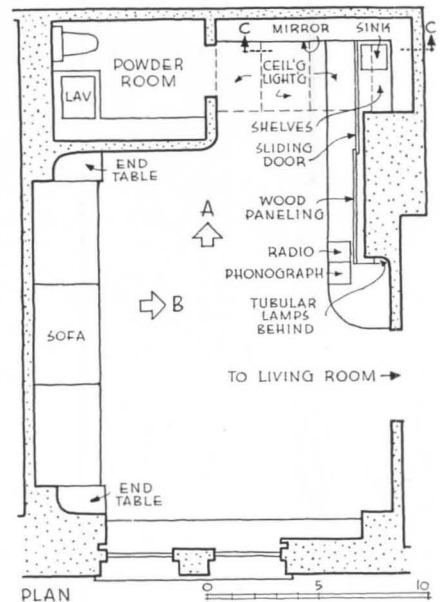
1. DUAL DESK. Actually a business office shared by two persons, this room contains ideas that might be readily incorporated into a house study. The desk is the feature of the design. Four low steel file cabinets, painted a strong yellow-green, support an oak-edged desk top that is surfaced in sand-colored leather. Centrally located along one wall of the room, the desk is lighted by a suspended, overhead fixture consisting of a wood frame in which two fluorescent lamps are mounted. The fixture is hung at a height that allows an unobstructed view of each person seated at the desk. The chairs, framed in oak, are upholstered in yellow-green leather.





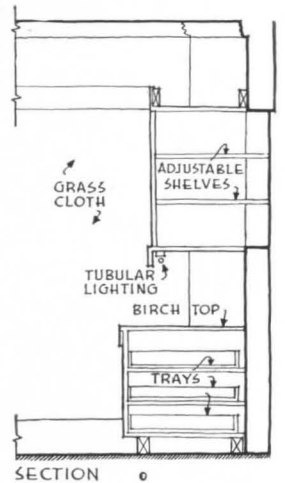
2. BAR. This bar and recreation room was originally a bedroom; in converting it, skillful use was made of an awkward corner to house the bar, the radio and a phonograph in a continuous built-in that terminates in a mirror wall. Lighting of the otherwise dark alcove area is handled with a flush-mounted soffit light, shielded with opal glass. A concealed tube illumines the area above the radio and phonograph units.

All woodwork is bleached curly maple in a very light finish; walls and rug are turquoise. The ceiling is painted sand color.



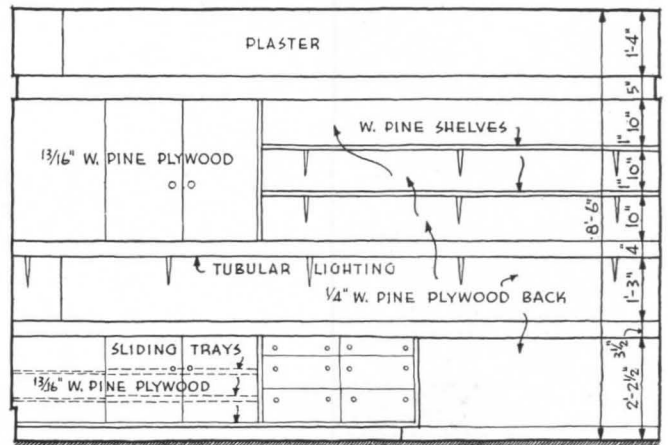


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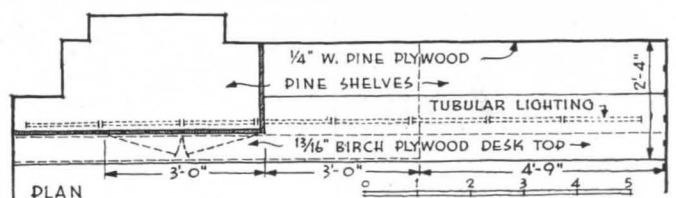


SECTION 0

3. STUDY UNIT. This multi-purpose built-in is a successful solution on two counts: it corrects the proportions of a room that was too long for its width; it is an unusually well equipped study and storage unit. At the left (not visible in the photograph) is a cabinet for a phonograph, and a portion of the counter above is used for storing albums of recordings. A generous supply of cupboards and drawers provides storage space for desk equipment and for various items, logically assigned to living room use, which are desirably out of sight when not needed. The desk top is of white birch; all other woodwork is white pine. The whole work-top area is lighted by tube lighting installed beneath the shelves and cupboards above. Note the shelf for handy filing of unbound magazines. Walls of the room are surfaced with natural grasscloth; the carpet is a strong yellow-green, and the ceiling is sand color.



ELEVATION



PLAN



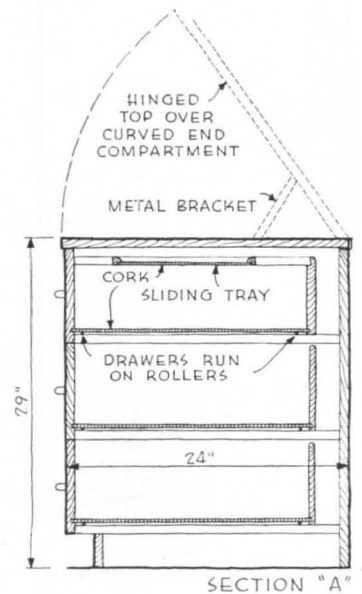
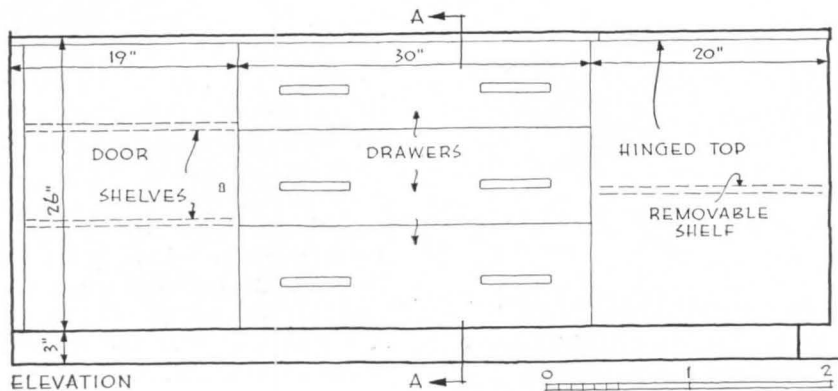
4. DINING UNIT. For cramped quarters such as are frequently encountered in the small city apartment, this fold-away table and built-in storage unit form an ingenious space-saving device. The oak sideboard unit, mounted on the wall, has cork-lined trays under the top ledge, and the drawers are used for silver and linen. Addition of a single leaf forms the dining table shown. All woodwork is natural striped oak; both walls and ceiling are in tones of sand; the carpet is soft brown, and furniture is upholstered in blue-green rough-textured material.





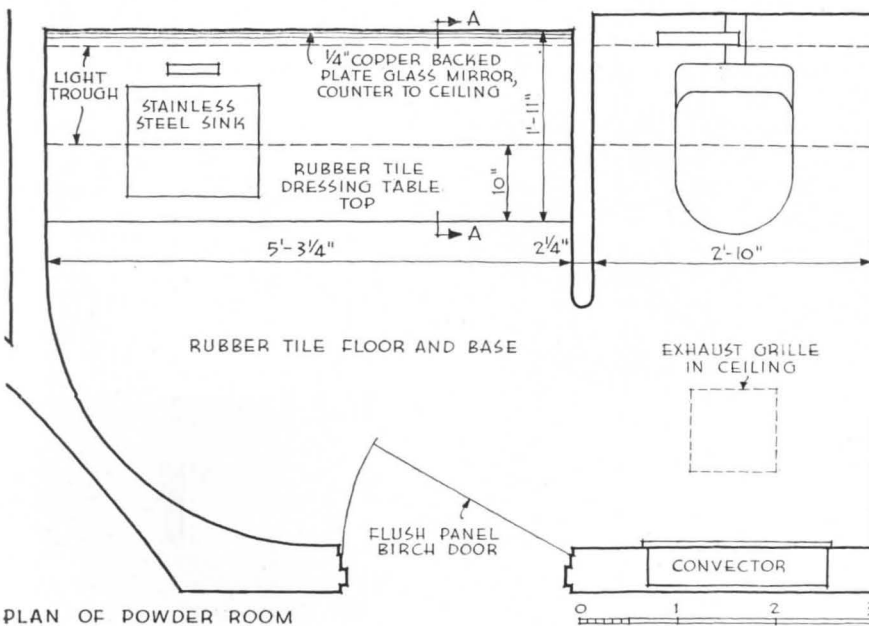
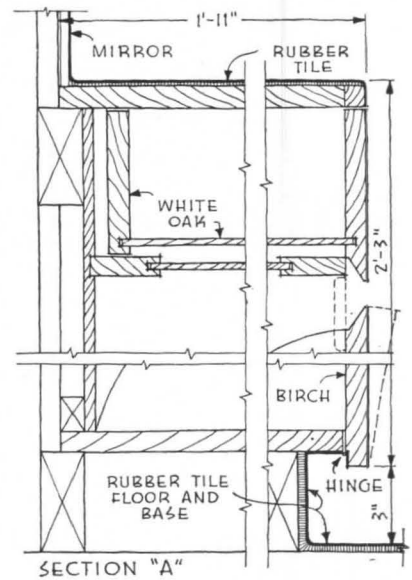
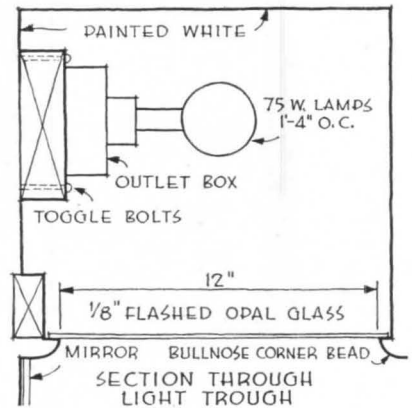
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5. STORAGE. In this dual-purpose room, the low built-in separates the living and dining areas. On the living room side, wall space is gained for furniture placement; a bar and dining room storage drawers open toward the dining area. The unit at left contains cork-surfaced trays for glassware; the central drawers are for linen; at right is the liquor-storage compartment, with a lift-out tray, beneath which is additional storage space. The cabinet-work is of natural-finish oak; walls and ceiling are light sand-color and the carpet is light brown; upholstery is tomato and yellow-green.



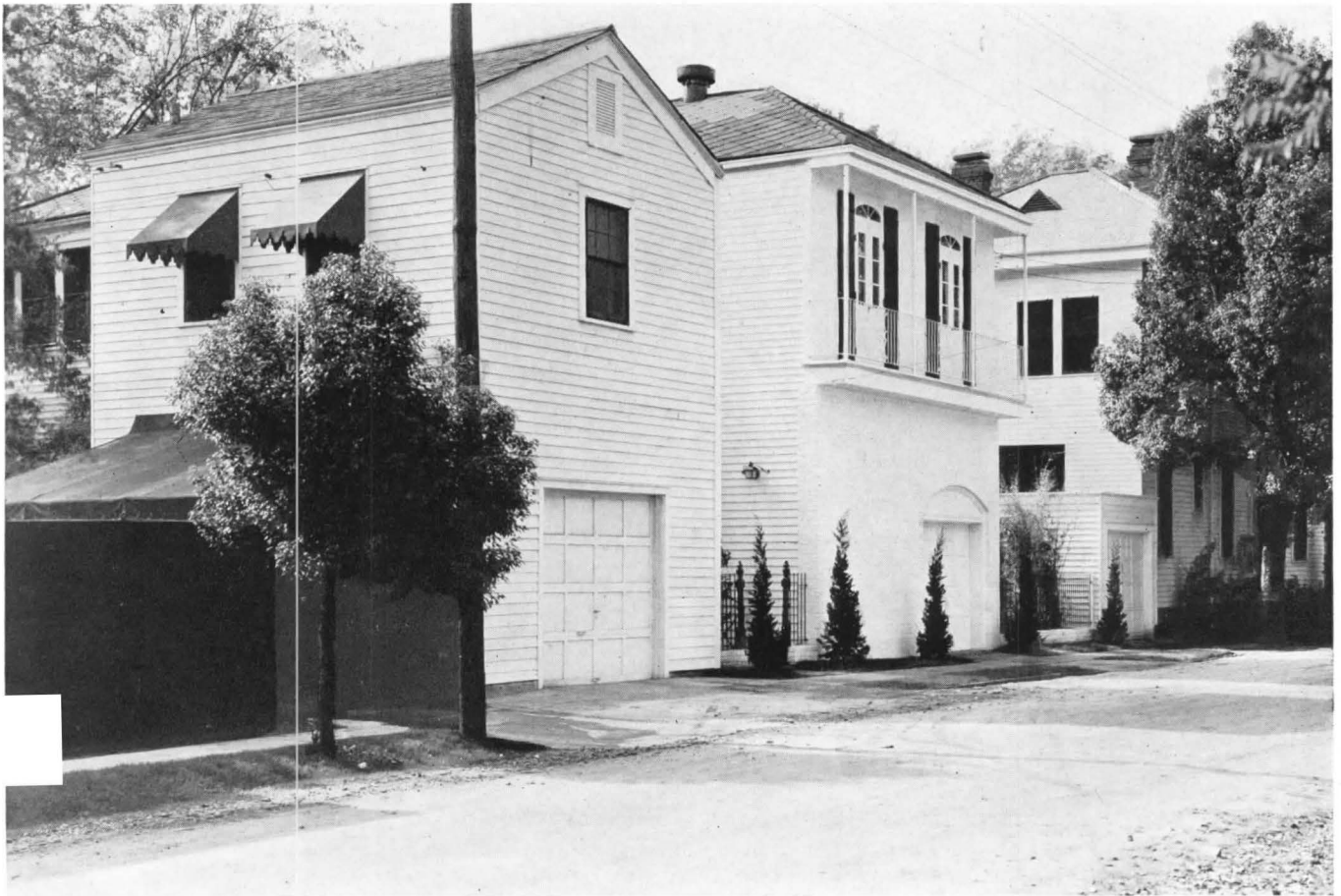


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PLAN OF POWDER ROOM

6. LAVATORY. This recessed lavatory unit is in a powder room; the casing is of stainless steel, with the horizontal surface finished in linoleum. At right is a drawer for towel storage, with a swing-down hamper beneath for used towels. A full wall mirror is brightly lighted by a flush fixture mounted at the top. The enameled walls are soft turquoise; the floor is turquoise rubber tile; the ceiling, white.



REMODELED FOR RENTAL

WHILE this New Orleans remodeling job was completed before the \$500 limit was placed on residential improvement, it is a type of project which the government encourages in war production areas, and it is a good illustration of the remodeling opportunity that even the most unpromising of structures may offer. The unsightly store building was in a Class A residential district, but a zoning ordinance permitted non-conforming commercial use for a period, if the building was not vacated; hence an adjoining property owner purchased it and had it converted. The "before" and "after" plans on the following page give the details of the project. The entire front of the building was redesigned and resurfaced, and the roof and projecting line at the second-floor level were retained. Objectionable, shanty-like garage structures at either side were eliminated, and entrance and private gardens substituted. Exterior styling was worked out to harmonize with the general architectural aspect of the neighborhood.

Moise H. Goldstein and Associates, Architects



Leon Trice

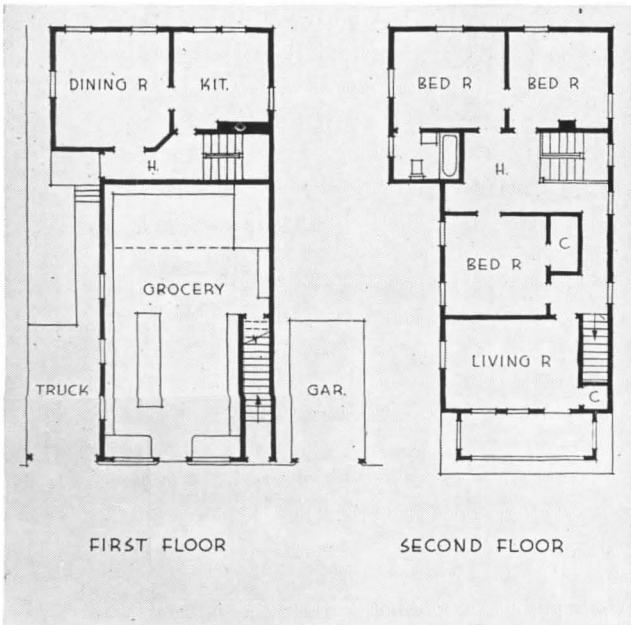


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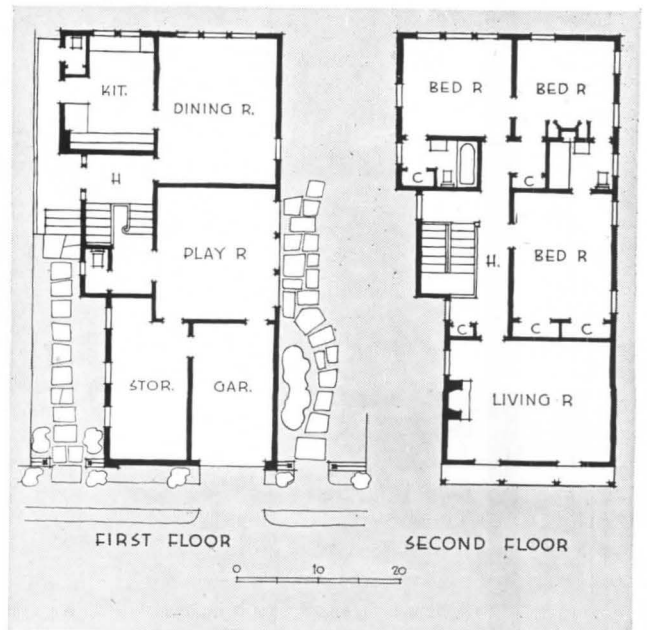


REARRANGEMENT of certain elements produced a living room that is both wider and longer than the original; relocation of the stairway made room for the addition of a second bathroom. On the ground floor of the "after" plan, the area labeled "Storage" is used for storing caps, gowns and hoods that are worn in academic processions at Tulane University, near by. At Commencement times, the playroom and garage space are used for fitting and equipping the marchers. Total remodeling cost was \$5,000.

BEFORE



AFTER





THE LIGHTING OF INDUSTRIAL PLANTS

THE accelerated tempo of war production calls for the revision of machines and methods in most existing plants, the building of new ones, and the adoption of the most advanced lighting methods in all plants.

Ten years ago it was fairly standard practice to allow one watt per square foot for lighting factory space. In terms of percentage cost—including wiring, fixtures and lamps—the usual allowance was approximately one-half of one per cent. This permitted an average lighting intensity of less than 10 foot-candles.

Today with new light sources and with growing demands for higher levels of lighting, estimates allowing $2\frac{1}{4}$ to 3 watts per square foot of factory space with fluorescent lamps and 6 to 8 watts per square foot with filament lamps are not out of line. This permits average lighting intensities of 50 foot-candles and better.

The following factors have made it possible to provide higher levels of light at lower and lower costs.

A. The efficiency of incandescent lamps has been increased and their prices have been progressively reduced.

B. New kinds of lighting fixtures made of new materials and designed to provide more light have been produced.

C. Electric current rates have gone steadily down.

D. New light sources—fluorescent lamps and rectified fluorescent lamps. (The latter will not be available due to savings in critical material.)

... BUILDING TYPES STUDY NO. 69

PREPARED FOR ARCHITECTURAL RECORD BY MAURICE GAUTHIER, ARCHITECT

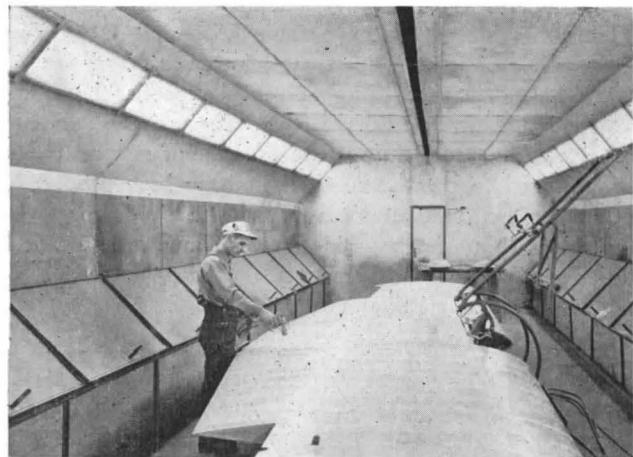
LIGHT AS A PRODUCTION TOOL



Older or defective eyes are enabled to function more efficiently and with less fatigue when assisted by good illumination properly located with respect to the work



The maximum utilization of floor space is accomplished by well distributed lighting. The system employs 2-lamp fluorescent units on 10 ft. by 10 ft. spacing, 12 ft. and 13 ft. high



Diffused lighting reduces reflected glare in this spray tunnel for plane wings. Lighting consists of parallel rows of diffusing panels equipped with fluorescent lamps

AS FAR BACK as 1923 tests showed that an increase in illumination of 2.6 foot-candles resulted in 18.5 per cent increased production.*

1. FEWER REJECTS

Better visibility of the object being worked upon means greater accuracy. With proper lighting no harsh, dark shadows exist which might confuse the object with its shadow or obscure detail in the shadowed area.

2. REDUCTION OF FATIGUE

The act of seeing involves thousands of small eye muscles as well as nervous and physical energy. The greater the effort of the eye to see, the greater the drain on the body's physical energy. Physical fatigue slows down the rate of production and affects its quality. Good lighting reduces strain.

3. REDUCTION OF ACCIDENTS

It is estimated by the National Safety Council, Inc. that 15 per cent to 25 per cent of all industrial accidents are due to poor lighting. In most cases where accidents are attributed to poor illumination they occur because there is improper quality of illumination or totally inadequate illumination. Many factors associated with poor illumination such as glare, light reflected from the work, and dark shadows hamper seeing and cause after-images and excessive visual fatigue which are important contributing causes of industrial accidents. Many accidents are also caused by delayed eye adaptation when coming from bright surroundings into dark interiors. Frequently accidents which are attributed to the individual's carelessness can actually be traced to difficulty of seeing, due to bad lighting.

4. MAXIMUM UTILIZATION OF FLOOR SPACE

Manufacturers have found that more work can be achieved with less floor space when proper artificial lighting is employed. It facilitates the arrangement of machines and eliminates crowding and dependence upon natural outdoor light. Particularly in factories does effective artificial light free us from the limitations of construction involved in the utilization of daylight. The width and length of structures with good artificial light are practically unlimited. It permits erection of windowless factories,

* Tests reported by James E. Ives, physicist, United States Public Health Service. (Reprint No. 973 from Public Health Reports, November 14, 1924.)

uninterrupted production in blackouts, ease of camouflage.

5. TWENTY-FOUR HOUR PRODUCTION

With working shifts boosted from 8 to 9 and 10 hours night and day it is absolutely necessary to provide the workers with the kind of working conditions that build their morale and heighten their efficiency. Proper lighting will help overcome the natural handicaps and reluctance of employees in working nights.

6. COMPENSATING POOR VISION

War has increased the proportion of employees over 50 years of age and those of all ages with deficient vision. Such eyes require more and better light for the visual task than do normal young eyes. It is therefore important that

lighting levels be established which are sufficiently high not only to provide good seeing for normal eyes but also to meet the requirements for more light for the older and visually deficient employees.

7. EFFECTIVENESS OF SUPERVISION AND MINIMIZING OF ESPIONAGE OR SABOTAGE

Foremen can see their machines and men more readily.

8. PLANT CLEANLINESS

Poor illumination makes it difficult to see into corners or under machinery. These dark areas inevitably collect dirt and waste which would otherwise be cleaned out. In the well-lighted plant such dingy areas do not exist and much more sanitary conditions prevail.

AMOUNT OF LIGHT AND CHOICE OF LIGHT SOURCES

THE designing of industrial lighting installations is a matter of engineering calling for careful and experienced study of the specific problems and for their solution with a knowledge of the latest advances in the development of light sources and lighting equipment. The determination of the amount of light and the choice of light sources are governed by several factors. These factors very definitely establish the order of magnitude of illumination necessary for more efficient seeing in industrial operation.

Under good illumination it is possible to see an object much smaller in size and finer in detail than is discernible under poor illumination. Thus a determining factor in the amount of light to be provided is the *size or detail* of the object.

A relation exists between the *contrast* of an object or detail with its background and the amount of light required for easy seeing. Where a variety of materials is handled, the best contrast is achieved through the use of a background color that is the average color of the materials. Even when work is all one color contrast should not be too great.

Excessive contrast between object and background tends to strain the eye by producing after-images and blurred edges. The ideal condition is that in which the background is slightly lower in brightness than the object.

While more light is generally desirable in most working environments, sometimes the mere painting of a machine from black to gray, or the arrangement of a small, properly colored field back of the working area will do the job.

Another factor which determines the amount of light and the choice of light sources is the *brightness of the object*. The brightness of an object, with a surface that diffuses light falling upon it, is measured by the reflectivity of the object and the amount of light falling upon it.

The brightness of an object, with a shiny surface which produces specular reflections, is determined by the brightness of the light source in the direction in which the images of the light source are more or less perfectly reflected by the object.

Etched or sandblasted metals exhibit spread reflections

while polished metals exhibit perfect specular reflections.

As it is not always possible to control the brightness of the work or to reduce its reflection factor, comfortable lighting may be provided by: 1. Increasing the size and correspondingly decreasing the brightness of the light source. 2. Increasing the general level of illumination without, however, increasing the brightness of each unit of the lighting equipment itself. This is done by increasing the number of units. This has a tendency to reduce the specular reflection from polished or spread surfaces because such reflections are not much brighter than the general brightness levels of the general surroundings.

Still another factor is the *speed of seeing*. The time required for seeing becomes less as the amount of light is increased. An increase in illumination from 1 foot-candle to a moderate level of 20 foot-candles increases the speed of seeing approximately 3 times. This enormous improvement in perception and recognition of surroundings affects practically everything the worker does.

It reduces the *time required for seeing* and some of this time, at least, becomes available for production. Another determining factor is the *duration of the visual task*. Prolonged work and sustained effort tire the eyes more than intermittent work. For continuous and prolonged visual tasks, levels of light in excess of those required for merely good seeing are necessary to prevent undue eye strain or fatigue.

QUALITY OF LIGHTING—COLOR

General lighting in order to be of acceptable quality must be: 1. Free from objectionable glare. 2. Free from excessive contrasts of brightness within visual field. 3. Distributed in a suitable manner. Diffused lighting is generally desirable.

So far as color quality is concerned, the approximately white light furnished by any of the commonly used light sources is suitable for most work since there seems to be no important difference in the speed, accuracy and ease of seeing under the light from these various sources.

Where fairly close color discrimination is a factor, light approaching the color of daylight is best. Incandescent and fluorescent bulbs are available for such purpose.

COLOR OF REFLECTING SURFACES — WALLS, FLOORS, CEILINGS



White floor acts as huge reflector and permits work to be performed under wings of planes without having to resort to auxiliary lighting on the assembly line of this great aircraft plant

A BALANCE is needed between light and color of reflecting surfaces. The most desirable is the condition in which the working area is slightly brighter than the surrounding areas. While the functional use of color concerns brightness more than hue, the matter of color choice—red, green, blue—offers an opportunity to control and influence human moods. People like color. Yet in industry it is necessary to use it with some discretion. Color may be just as distracting as it is pleasing. The color of walls, machines, backgrounds should obviously never be too pure or saturated. Light tones, pale in hue, are always best. However, brightness is the chief thing to be watched. There must not only be enough illumination to see clearly, but the object seen must be visible in its surroundings. It must have moderate rather than intense color contrast.

Walls brighter than the details of the task cause eye strain. They lower manual skill and prevent mental concentration. The room, on the outer boundaries of vision, should be fairly light in color, but slightly lower in intensity than the working areas. This will limit the eye to a comfortable light adaptation and prevent annoying pupillary changes. The eye accommodates itself more quickly and easily to brightness than darkness. In looking from a dark machine to a light wall, the wall has the advantage. But when the contrast is reversed (the wall

toned down and the machine brightened) the eye can readily get down to work.

In certain kinds of manufacturing, such as airplane plants, white floors have been found to increase the general illumination 20.6 per cent by their action as giant reflectors. The reflection from the floor lights up the underside of wings, speeds up work and reduces mistakes.

Tests have been conducted in one of the largest airplane plants in the nation. These tests show that before production started, with a clean floor and reflectors, the average reflection factor of the white concrete floor in the main assembly was 44 per cent as compared with 27.4 per cent for the regular grey concrete floors in receiving areas. Sixty-one per cent more light was reflected by the white floors than by the grey.

At the end of the lamps' useful life and with floors as soiled as they could be under normal use, tests show a loss of 18 per cent in foot-candles over the white floors and a loss of 22 per cent over the grey floors. Thus the reflecting factor of the white floor was still more than 61 per cent higher than that of the grey.

These tests and studies further showed that without white concrete floors, proper lighting would have required 20 per cent more fluorescent fixtures, plus more and heavier copper in the distribution system, larger transformers and switchgear equipment, more steel and aluminum for reflectors, magnesium for cutouts, lead for cables, more zinc, rubber, and resins in insulation, more electric current.

When all added up it was found that the white concrete floor at 5c per sq. ft. extra cost paid for itself in seven months and will hereafter yield a return of about 90 per cent annually on the investment.



Fluorescent lamps in rows of individual fixtures give uniform lighting for the manufacture of fighter planes, with high intensity light and a minimum of shadows at the level of the work

LIGHT SOURCES

THREE types of light sources are in current use for the general lighting of industrial plants—incandescent filament, fluorescent, and mercury. Each has certain advantages that make it suitable for certain applications in lighting for war production.

1. INCANDESCENT FILAMENT LAMPS

Being practically point light sources of highly concentrated brightness, incandescent filament lamps lend themselves well to the control of their light by means of suitable reflectors and lenses, which have been made available in great quantities and varieties. Simplicity is one of the advantages of incandescent filament lighting. It requires no auxiliary equipment for the operation of the lamps. Incandescent lamps are compact and their initial cost is relatively small. Those of the higher wattages furnish great quantities of light which can be distributed effectively. Lamps are available in 15 to 1500 watt sizes and with inside frosted, clear or white bowl bulbs.

Incandescent filament lamps will operate in any position. The light output maintenance, especially with higher wattage lamps, is best when used vertically with the base up.

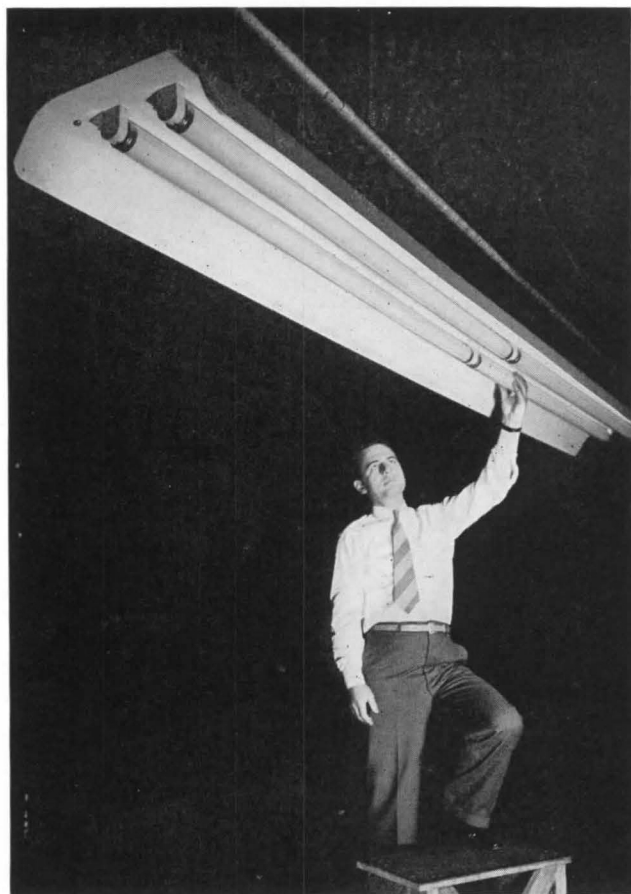
The clear bulb is best when used in adequately shielded reflectors such as high-bay units and diffusing equipment which protect the eyes from glare.

White bowl lamps are used in open type fixtures such as dome reflectors. They improve the quality of illumination by reducing direct glare, reflected glare and deep shadows. They operate base up only.

Silvered bowl lamps are standard lamps with a coating of "mirror" silver on the bowl. They range from 60 to 500 watts and provide soft indirect lighting.



While many modern installations use fluorescent lamps in continuous rows, with this type of lamp it is possible to achieve good even lighting with fewer fixtures placed at fairly low height



Because of the shortages of critical materials manufacturers have developed non-metallic fluorescent reflectors, providing efficient illumination with a minimum of priorities trouble

2. FLUORESCENT LAMPS

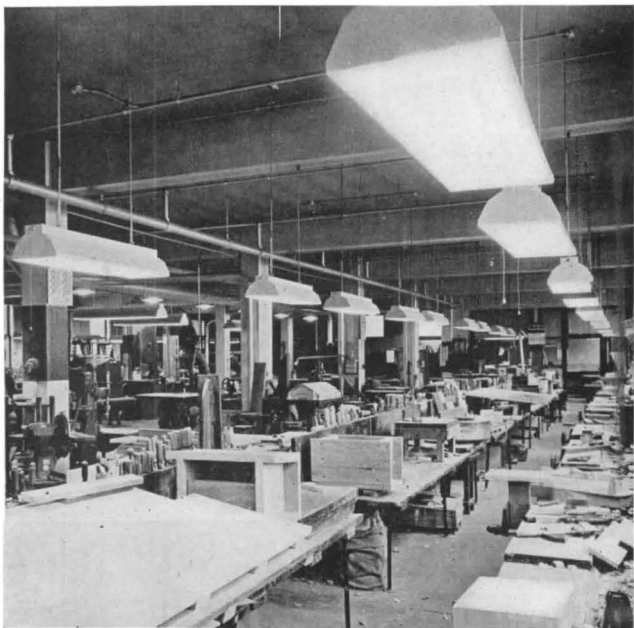
The fluorescent lamp is an "electric discharge lamp." The light from this lamp is given off by a coating of fluorescent powders on the inside of the glass tube. These substances are activated by ultra-violet radiations produced by the passage of an electric current through the mercury vapor enclosed in the tube. With these lamps, more light is made available for the current consumed than with incandescent lamps. They furnish light of white or daylight color at high efficiency, and are made to furnish a variety of other colors for special uses. The lamp gives off much less radiant heat for the amount of illumination than incandescent filament lamps.

Fluorescent lamps do not lend themselves to the direction and control of their light in the same ways as filament lamps, although special methods and equipment have now been developed for the effective control and distribution of the light of these lamps. Because of their tubular form and low surface brightness they lend themselves naturally to the form of large area, low brightness units and to their use in continuous rows or as individual units which furnish a quality of illumination highly desirable in industrial lighting. They are adaptable to low mounting or high bay installations up to 40 feet.

The continuous row system running crosswise of the normal direction minimizes installation and wiring costs



In this continuous row installation, one 40-watt fluorescent lamp in each troffer section provides an illumination of 50 foot-candles for this combined drafting room and office of a defense plant



To deliver 75 foot-candles at the bench level of this pattern department of a large Eastern concern, fluorescent fixtures were placed just 7 ft. above the floor, on 6 ft. by 9 ft. spacings

because the channel for each row is installed and wired as a unit. Although closed end reflectors* are preferable in continuous row mounting (the closed ends acting as baffles in breaking up the brightness effect of a long row of lamps) many successful continuous row installations, using the open-end reflector, have been made.

For satisfactory starting and operation, fluorescent lamps, like other electric discharge lamps, require standard auxiliary equipment: ballast, starters, lamp holders, and starter sockets.

Proper performance of this auxiliary equipment depends upon voltage being within a certain acceptable range. This range is clearly indicated on the ballast name plate. Decreased light output and uncertain starting and operation may result at excessive undervoltages and danger of overheating the ballast may accompany excessive overvoltage operation. In either case, the lamp life is likely to be shortened. Although satisfactory performance and operation of fluorescent lamps can be expected through a range of line voltages (such as 110-125 volts for normal-voltage ballast), care must be taken to operate within the recommended range.

* Due to the restrictions in the use of critical materials, the installation of closed-end reflectors is not permitted.

The ballast delivers the proper voltage and lamp current, one value for starting, another for normal operation. The ballast limits current to the value normally required by the lamp. The automatic starter switch must close and open with reliable timing and pass enough current through the filament electrodes for the time needed to preheat these sufficiently for quick and positive starting.

Although fluorescent lamps are designed for alternating current operation they may be used on direct current circuits if an approved direct current auxiliary or inductance unit and a series resistance of the correct value are employed. Direct current operation usually results in decreased useful lamp life and inferior lumen maintenance and starting liability. On the other hand, color quality and total light output of the lamp compare favorably with alternating current operation, and the stroboscopic effect is of course completely eliminated.

Stroboscopic Effect

High frequency stroboscopic effect (which is noticeable when observing a fast moving object, and which makes high speed rotating machinery appear to revolve slowly or stand still) results from normal variations of light output on alternating current.

Every lamp, when burned in the usual manner on alternating current, has a nonuniform light output caused by the cyclic variations in current. This effect is, of course, increased at lower frequencies. In electric discharge lamps where practically no energy is stored (as it is stored in the hot tungsten of a filament lamp), the light drops almost to zero along with the current between each half cycle. However, all the fluorescent powders but the one producing the blue color have a persistence of glow, or phosphorescence, which helps to reduce flicker in various colors of fluorescent lamps when operated from a 60-cycle circuit. Operation on two or more phases or with

two-lamp ballasts brings the lamps out of phase, and the fluctuation in light output is further reduced and becomes comparable to the variation in low-wattage filament lamps.

3. MERCURY VAPOR LAMPS

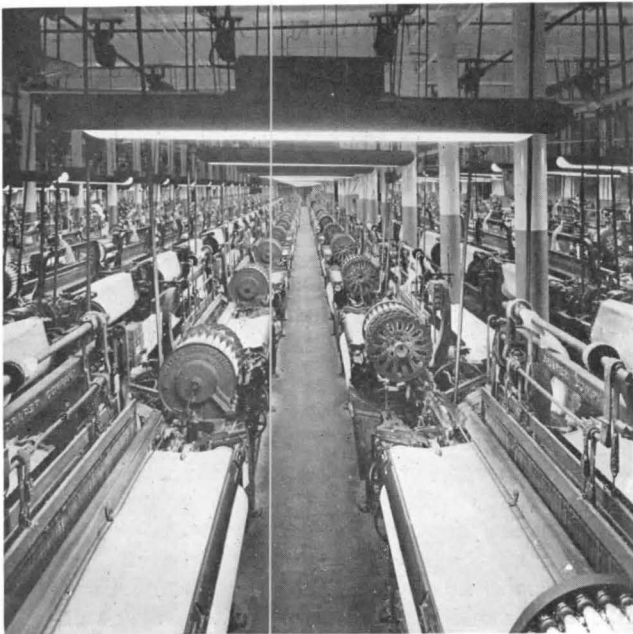
The high efficiency of mercury vapor lamps gives them a place of importance in industrial lighting, particularly with reference to high bay installations. There are two Mazda H (mercury) lamps receiving much consideration—the 400 watt H-1 lamp and the 3000 watt A-H9 lamp. Others available: AH-2, 250 watts, AH-4, 100 watts.

400 Watt H-1 Lamp

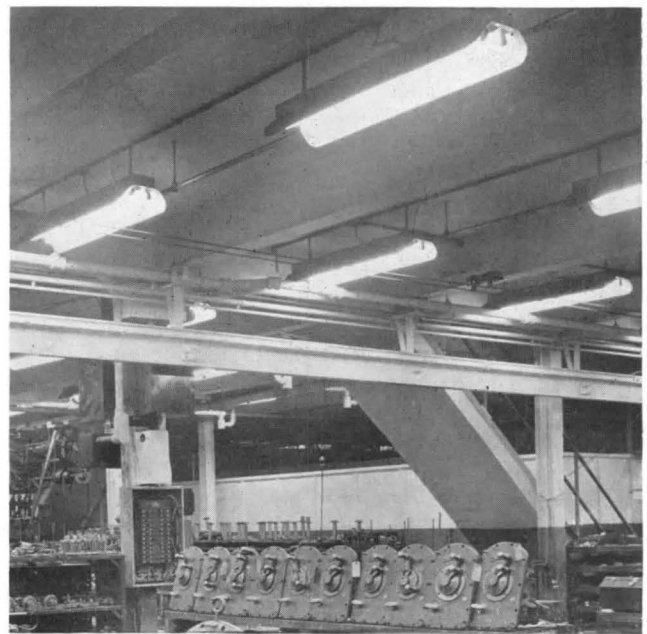
The 400 watt H-1 lamp is 13 inches long and a tubular bulb 2 inches in diameter. A standard mogul base is used and it is available for base up or base down burning, but in neither case can it be tilted more than 10 degrees from the vertical. Its light can be directed by reflector units like those used for incandescent filament lamps.

The 400 watt mercury lamp has a rated average life of 3000 hours and its initial output (after 100 hours) is 16,000 lumens or 40 lamp lumens per watt. At 70 per cent of its rated life, the rated output is 35 lumens per watt. Thus the lumen maintenance characteristics compare favorably with filament and fluorescent lamps. One of the advantages of this lamp is its high rated average life. Thus the normal replacement would be only one every 4-5 months when burned 24 hours a day, 7 days a week.

Under average conditions, the H-1 lamp requires about 7 minutes to reach full light output, and at full brilliance the arc is concentrated into a pencil-like stream of high intensity. A bluish argon glow is noticed for the first two minutes and the remaining time is required to complete the vaporization of the mercury. If the current is interrupted while the lamp is in operation, the lamp will not be relighted until it has cooled, after which



These single lamp fluorescent units are mounted 8 ft. above the floor, give 40 foot-candles of illumination. The box above the reflector contains the auxiliary equipment



Two-lamp 40-watt fluorescent units with open end porcelain enamel reflectors provide excellent lighting for this industrial interior. Minute detail is clearly visible on the various objects



3000-watt mercury lamps in porcelain enamel reflectors located on nominal 35 ft. by 40 ft. centers. The illumination in service is about 35 foot-candles. Fixtures may be lowered for cleaning or relamping

the arc will strike again automatically if the current is on. This characteristic precludes the use of this lamp for protective lighting service where the time element is all-important.

Because of the time required for relighting, and the blue-green color of mercury light, it is advisable to combine mercury lamps with incandescent lamps. This combination provides a more reliable lighting system, reduces stroboscopic effect, and provides appreciable color-correction. The two light sources can be used in the same luminaire or in separate units so installed that their light mingles. This is known as mercury tungsten or mercury incandescent lighting.

3000 Watt Mercury Lamp A-H9

This lamp is of long tubular form which favors the reduction of shadows when units are properly spaced. It is $54\frac{7}{8}$ in. long and $1\frac{1}{4}$ in. in diameter and the actual light source length or distance between electrodes is about 48 in. It has a rated life of 2000 hours and is used in high bay lighting because of its rating of approximately 120,000 lumens initially (after 100 hours).

The high lumen output of this lamp gives it a place of special importance in high bay (minimum 40 ft.) industrial installations, such as steel plants, dry docks, foundries, heavy duty erection shops, wherever high-level illumination is desired at high mounting heights with a minimum of fixtures.

Comparisons of the over-all cost of light (lamps, energy and owning charges) for various systems show that the 3000 watt A-H9 lamp produces light more inexpensively than any other light source now on the market. Maintenance costs (not included in comparison just mentioned) will be low because of the relatively small number of lamp replacements per year in a given area.

Both mercury lamps require auxiliary equipment for their proper operation. The H-1 lamp requires a regulating device in the form of a high-reactance transformer. This transformer may be located at any point in the circuit as long as no other current than that of the respective lamp is drawn from it and provided that the voltage drop between lamp and transformer does not exceed two volts. However, in most cases the auxiliary is located directly above the reflector on the supporting stem or else it is



An area of 22,000 sq. ft. is lighted by 220-400 watt mercury lamps mounted at a height of 32 ft. They provide about 60 foot-candles of illumination for the critical visual task performed

mounted on beams somewhere near the lighting unit.

Autotransformers for the A-H9 lamp have been made available and include a built-in capacitor for power factor

correction. The autotransformer and connection leads are carried into a wiring compartment for direct conduit connection of line and lamp.

MAINTENANCE OF ILLUMINATION

SYSTEMS which are adequate when first installed will soon deteriorate unless properly maintained.

A regular definite system of maintenance must be established so as to insure that all lamps and accessories are kept clean, in proper adjustment and in good repair.

It is recommended that an illumination check be made with a foot-candle meter periodically, say once every month, and when illumination has decreased to 75 per cent of its initial value, the lighting equipment should be cleaned. In addition to cleaning of the lighting units, the frequent painting and maintenance of the surroundings—side walls, ceiling, machinery, etc., will help keep the lighting efficiency near the original value.

Group replacement plan of relamping can be established to coincide with the cleaning period with a resultant saving in maintenance costs. Easy access to all lighting units should be provided.

While general lighting conforming to present day standards serves for most uses in industry, there are some tasks in which the seeing is of a highly critical nature.

Supplementary local lighting affords the most practicable means of furnishing the necessary high level of illumination. This lighting is furnished by lighting units suspended over the work stations attached to the machines or by projector lamps so mounted that their light is directed upon the work.

OTHER TYPES OF LAMPS FOR INDUSTRIAL USE



Combination mercury installation. Each unit uses one 250-watt high-intensity mercury lamp and three 100-watt incandescent lamps. It provides 20 foot-candles upon working surfaces

1. DAYLIGHT FILAMENT LAMPS

Daylight filament lamps have a light blue bulb and produce a light comparable to daylight. They are available in 60 to 500 watt sizes.

Because the bulbs of these lamps absorb about $\frac{1}{3}$ of the light emitted by the filament the next larger size of lamp is required to produce approximately same illumination level as a clear lamp of given size.

These lamps are used in supplementary lighting units and for special assembling and inspection processes where whiter light than that provided by standard lamps is desirable.

2. FLOODLIGHT LAMPS

Made with filament concentrated into a small space for use in floodlighting equipment designed to give a narrow beam of light which can be projected a long distance. Available in 250, 500, 1000 watt sizes. Where it is not necessary to have a closely controlled beam, it is usually more desirable to use general service lamps in equipment designed to accommodate them.

3. VIBRATION LAMPS

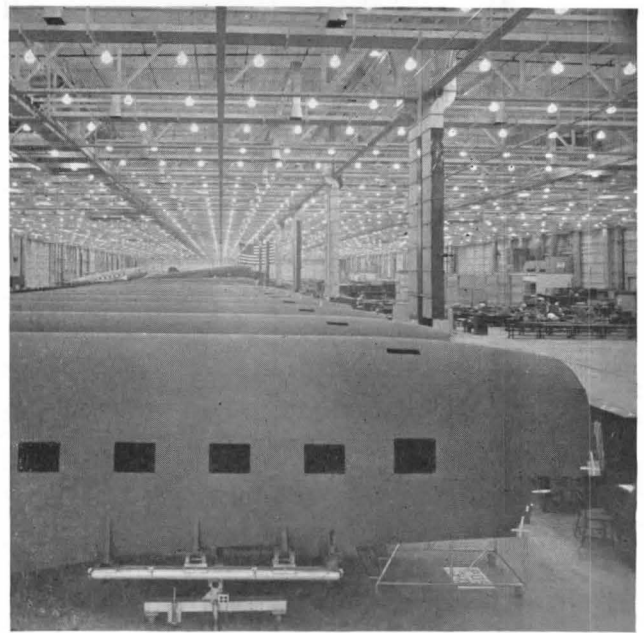
Available only in 50 watt size. They are designed to withstand high frequency vibration produced by high speed machinery.

4. ROUGH SERVICE LAMPS

These are made in 50 and 100 watt sizes for use where severe shocks and bumps occur.

5. WATER-COOLED MERCURY LAMP

(Midget sun.) This lamp is made of special quartz glass. Although no bigger than a cigarette, it is $\frac{1}{5}$ as



Mercury lamps in prismatic reflector units provide 55 foot-candles of illumination for this great bomber plant. The mounting height is 35 ft.; the spacing 8 ft. 3 in. and 15 ft.

bright as the sun's surface. It is used in photo-enlarging, engraving and blueprinting plants.

6. PROJECTOR LAMP

This lamp combines a reflector, lens, and 150 watt or 300 watt filament in one sealed-in unit. It is used to supplement lighting installations where a high level of accurately controlled lighting is required over a restricted area from a small unit.

It comes in spotlight and floodlight types and is made of heat-resisting glass which permits outdoor use. Mounted 5 ft. above work area the 150 watt spotlight lamp produces about 400 foot-candles and the beam covers an area 20 in. in diameter.

7. NEON GLOW LAMP

Used for pilot lights and indicators. Its light is produced through agency of electrically excited rare gases.

It operates directly from commercial lighting circuits and has no filament. Therefore it produces very little heat, withstands shock and vibrations and voltage variations without affecting its life or light output. The orange-red color of the neon lamp causes it to stand out from other surrounding light sources.

8. DRYING LAMP

The drying lamp produces a wealth of effective infrared (heat) rays instead of light. The most powerful is the 1000 watt unit. There are also the 500 watt lamp and two types of 250 watt lamps. These lamps speed process drying and surface heating processes; facilitate straight-line continuous flow production, and are used to dry photo prints, synthetic enamels and lacquers, industrial finishes of many kinds.

LIGHTING OF INDUSTRIAL PLANTS

1--RECOMMENDED LEVELS OF ILLUMINATION

ARCHITECTURAL RECORD
**TIME-SEVER
 STANDARDS**
 SEPTEMBER, 1942

	Foot-candles		Foot-candles
Aircraft:		Textile Mills (Cotton) continued	
Sub-Assembly	30	Inspection:	
Final Assembly (high bay areas)	40	Grey Goods (Hand Turning)	50
Machine Shop	50	Denims (Rapidly Moving)	200A*
Assembly:		Automatic Tying-in, Weaving	50B*
Rough	10	Drawing-in by Hand	100A*
Medium	20	Woolen:	
Medium Fine	50	Carding, Picking, Washing, Combing, Twisting, Dyeing	15
Fine	100B*	Drawing-in, Warping:	
Extra Fine	200A*	Light Goods	20
Chemical Works:		Medium Goods	50
Hand Furnaces, Boiling Tanks, Stationary Driers, Stationary and Gravity Crystallizers	5	Dark Goods	100A*
Mechanical Furnaces, Generators and Stills, Mechanical Driers, Evaporators, Filtration, Mechanical Crystallizers, Bleaching	10	Weaving:	
Tanks for Cooking, Extractors, Percolators, Nitrators, Electrolytic Cells	20	Light Goods	20
Cloth Products:		Medium Goods	50
Cutting, Inspecting, Sewing		Dark Goods	100B*
Light Goods	30	Knitting Machines	20
Medium Goods	100	Toilets and Wash Rooms	10
Dark Goods	200A*	Warehouse	5
Pressing, Cloth Treating (Oil Cloth, etc.)		Welding	30
Light Goods	20	Woodworking:	
Medium Goods	50	Rough Sawing and Bench Work	15
Dark Goods	100B*	Sizing, Planing, Rough Sanding, Medium Machine and Bench Work, Gluing, Veneering, Cooperage	20
Foundries:		Fine Bench and Machine Work, Fine Sanding, Finishing	50
Changing Floor, Tumbling, Cleaning, Pouring and Shaking Out	10		
Rough Molding and Core Making	10		
Fine Molding and Core Making	20		
Inspection:			
Rough	20		
Medium	30		
Medium Fine	50		
Fine	100B*		
Extra Fine	200A*		
Locker Rooms	10		
Machine Shops:			
Rough Bench and Machine Work	20		
Medium Bench and Machine Work, Ordinary Automatic Machines, Rough Grinding, Medium Buffing and Polishing	30		
Fine Bench and Machine Work, Fine Automatic Machines, Medium Grinding, Fine Buffing and Polishing	100B*		
Extra Fine Bench and Machine Work, Grinding and Fine Work	200A*		
Plating	10		
Polishing and Burnishing	20		
Receiving and Shipping	10		
Sheet Metal Works:			
Miscellaneous Machines, Medium Bench Work, Punches, Presses, Shears, Stamps, Welders, Spinning, Medium Bench Work	20C*		
Tin Plate and Similar Inspection	B* C*		
Stairways, Corridors and Passageways	5		
Steel and Iron Manufacturing:			
Billet, Blooming, Sheet Bar, Skelp and Slabbing Mills	10		
Boiler Room, Power House, Foundry, Furnace Rooms	10		
Hot Sheet and Hot Strip Mills	10		
Cold Strip, Pipe, Rail, Rod, Tube, Universal Plate and Wire Drawing	10		
Merchant and Sheared Plate Mills	20		
Store and Stock Rooms:			
Rough Bulky Materials	5		
Medium or Fine Material Requiring Care	10		
Testing:			
Rough	20		
Fine	30		
Extra Fine Instruments, Scales, etc.	100A*		
Textile Mills (Cotton):			
Opening, Mixing, Picking, Carding, and Drawing	10		
Slubbing, Roving, Spinning, Spooling	20		
Grading	100B*		
Warping on Comb	30		
Beaming and Slashing on Comb:			
Grey Goods	20		
Denims	100B*		

OFFICES AND DRAFTING ROOMS

	Foot-candles
Offices:	
Bookkeeping, Typing and Accounting	50
Business Machines—Power Driven (Transcribing and Tabulating)—Calculators, Key Punch, Bookkeeping	100A*
Conference Room:	
General Meetings	30
Office Activities (See Desk Work)	
Corridor and Stairways	5
Desk Work:	
Intermittent Reading and Writing	30
Prolonged Close Work, Computing, Studying, Designing, Reading Blueprints and Plans	50
Drafting:	
Prolonged Close Work—Art, Drafting and Designing in Detail	50
Filing and Index References	30
Lobby	20
Mail Sorting	30
Reception Rooms	20
Stenographic Work:	
Prolonged Reading Shorthand Notes	50
Vault	20

* The foot-candle values in this table are, in general, those given in the Recommended Levels of Illumination sponsored by the Better Light-Better Sight Bureau. The lighting levels for the aircraft industry were supplied by the engineering department of a typical large plane factory. The footnotes A*, B*, and C*, describing methods of obtaining the recommended lighting levels for the more difficult seeing tasks, are based on the notes published in connection with Table I. Minimum Foot-candles in Service, in the American Recommended Practice of Industrial Lighting, 1942. In that manual, sponsored by the Illuminating Engineering Society and approved by the American Standards Association, minimum foot-candle levels of illumination are given for a comprehensive list of industries.

A*—100 foot-candles of illumination or more required. To be furnished by at least 20 foot-candles of general illumination plus specialized supplementary lighting to the required level. Installation must not only provide a sufficient amount of light, but also provide the proper direction of light, diffusion, eye protection and, insofar as possible, must eliminate direct and reflected glare as well as objectionable shadows. This lighting is recommended for seeing tasks involving (a) the discrimination of extremely fine detail under conditions of (b) extremely poor contrast (c) for long periods of time.

B*—50 to 100 foot-candles of illumination required. For the quality of the lighting and usual manner of providing it see A* above. Localized general lighting may sometimes be employed, lighting units over the work stations furnishing the required illumination on the work and, as well, sufficient general illumination in the intervening areas. This lighting is recommended for seeing tasks involving (a) the discrimination of fine detail under conditions of (b) a fair degree of contrast (c) for long periods of time.

C*—The essential requirements are that the luminous area shall be large enough to cover the surface which is being inspected and (2) that the brightness be within the limits necessary to obtain comfortable contrast conditions. This involves the use of light sources of large area and relatively low brightness in which the source brightness is the principal factor, rather than the foot-candles produced at a given point.

The seeing tasks of this group require the discrimination of fine detail by utilizing (a) the reflected image of a luminous area or (b) the transmitted light from a luminous area.

LIGHTING OF INDUSTRIAL PLANTS

2—FIXTURES FOR FILAMENT AND MERCURY LAMPS

The tables and much of the data incorporated in these Time-Saver Standards, on this and the following pages, are adapted from those issued by the General Electric Company, and are used with permission.

CHOICE OF REFLECTORS

Although filament lamps and mercury lamps type H operate on entirely different principles, the general types of fixtures available may be used with either type of lamp.

Several fundamentals of performance are considered by engineers and architects in the choice of types of units.

1. Desirable distribution of light and suitability for the particular interior involved.
2. Efficiency of light output.
3. Inherent maintenance of initial efficiency and ease of periodic cleaning and lamp replacement.
4. Adaptability to use of larger lamp should more light be required.
5. Sturdiness of construction.
6. Cost of installation, operation and maintenance.

The relative importance of each of these factors varies with different applications. The elimination of bad shadows in certain rooms might be of first importance, whereas in others the efficiency of producing illumination on the floor and ease of maintenance would rank ahead. In choosing between two or more units, the industrial architect should be governed by such considerations rather than by first cost alone.

RLM Standard Dome Reflector

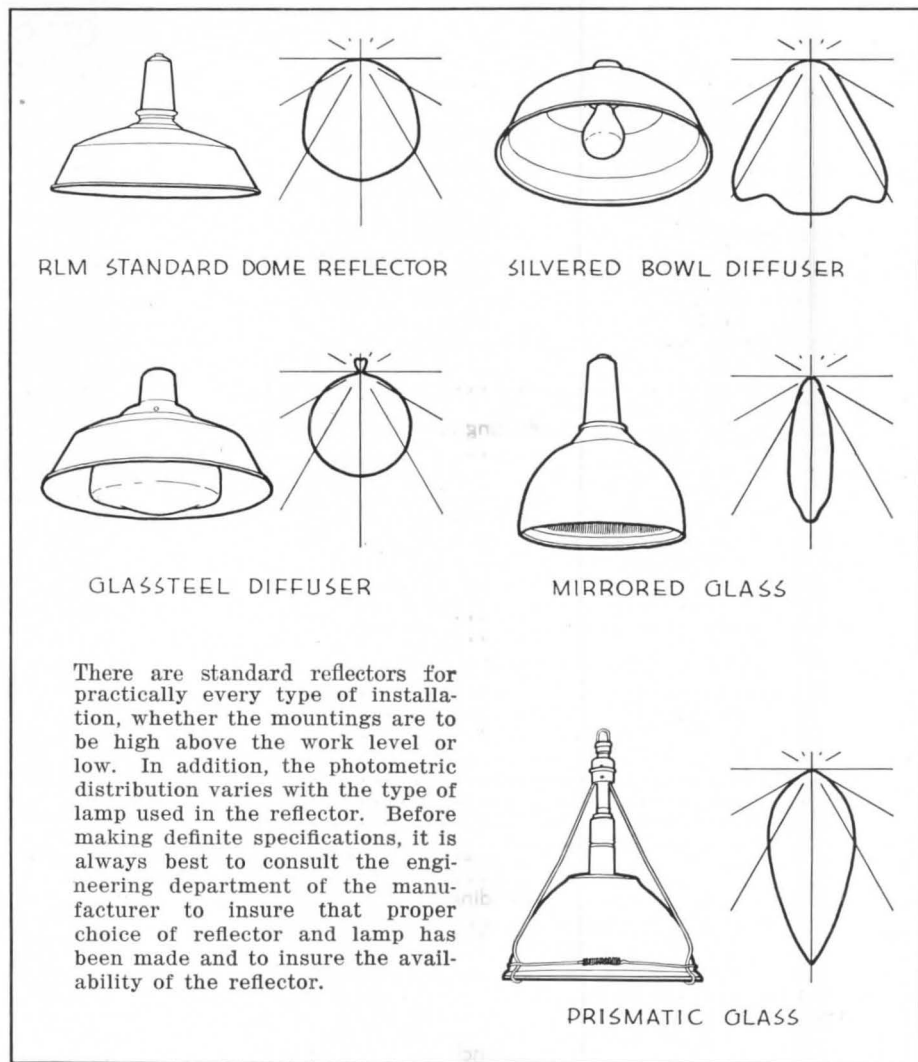
This standard porcelain-enameled steel reflector meets many of the general lighting requirements of industry. It is the standardized product of a large number of manufacturers and must meet rigid specifications which insure its mechanical excellence and lighting efficiency. For general lighting purposes the recommendation is to use white bowl lamps with these reflectors. Practical for the use of inside frosted lamps or mercury H lamps in locations where mounting height is above 20 feet. A glass cover plate should be employed to keep the reflecting surface clean when used in dusty or smoky locations.

Silvered Bowl Diffuser (for use with silvered bowl filament lamps)—

Because this type of fixture is equipped with semi-diffusing aluminum insert, its use has been discontinued and prohibited.

Glassteel Diffuser

This porcelain-enameled steel reflector is fitted with an opal glass diffusing globe which completely encloses the lamp. Thus, a much softer, more diffused light is obtained.



RLM STANDARD DOME REFLECTOR

SILVERED BOWL DIFFUSER

GLASSTEEL DIFFUSER

MIRRORED GLASS

There are standard reflectors for practically every type of installation, whether the mountings are to be high above the work level or low. In addition, the photometric distribution varies with the type of lamp used in the reflector. Before making definite specifications, it is always best to consult the engineering department of the manufacturer to insure that proper choice of reflector and lamp has been made and to insure the availability of the reflector.

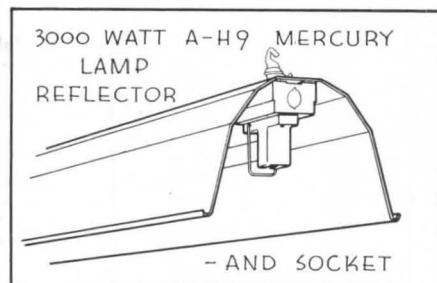
PRISMATIC GLASS

Either clear, inside-frosted or mercury lamps may be used. Color correcting globes are also available where a whiter light is desired. An installation of glassteel diffusers provides a high quality of illumination without excessive brightness, harsh shadows, direct or reflected glare.

High-Bay Reflectors

These luminaires provide a relatively concentrated distribution of light and are generally used for lighting high-bay areas. They come in prismatic glass, mirrored glass and aluminum.* The more highly concentrating types should be used in bays which are narrow in comparison to their height. With such units the sharper shadows, greater reflected glare and low illumination on vertical surfaces must be balanced against the increased efficiency of light directed to the working plane.

*Unobtainable because of priorities.



Porcelain-enameled reflector for the 3,000 watt A-H9 mercury lamp is available.

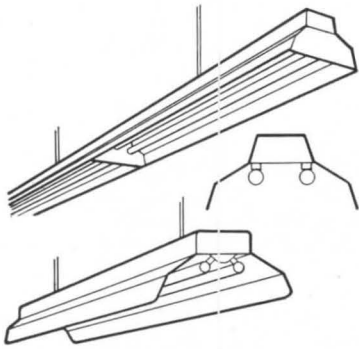
The unit measures 6¾ by 12¾ by 60 inches. Equipment for this lamp is expected to be announced by various manufacturers in the near future.

Porcelain socket for the A-H9 lamp is equipped with a wire loop which helps prevent the lamp from falling during handling of the fixture.

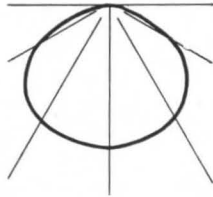
LIGHTING OF INDUSTRIAL PLANTS

3—LUMINAIRES FOR FLUORESCENT LAMPS

ARCHITECTURAL RECORD
**TIME-SAVER
 STANDARDS**
 SEPTEMBER, 1942



TWO LAMP PORCELAIN ENAMELED REFLECTOR

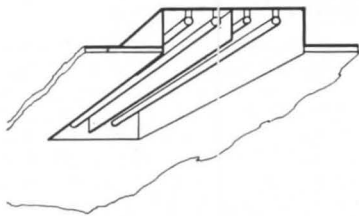


OUTPUT - 75 - 80%

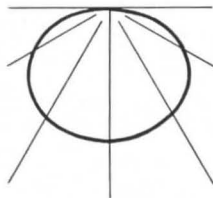
FOR ROOM INDEX J - 0.30
 FOR ROOM INDEX A - 0.70

**IMPORTANT FACTORS
 TO BE CONSIDERED
 AND RATING**

Direct Glare	A-B
Reflected Glare	A-B
Maintenance	A
Illumination on Horizontal	A
Illumination on Vertical	A
Appearance of Lighted Room	A



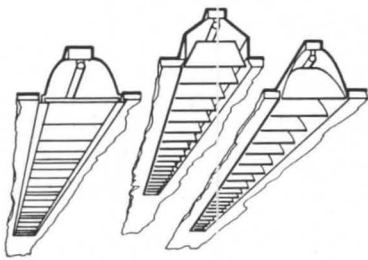
OPEN COFFER OR SUSPENDED TROUGH



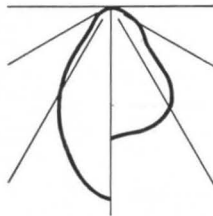
OUTPUT - 70-75%

ROOM INDEX J - 0.30
 ROOM INDEX A - 0.65

Direct Glare	A-B
Reflected Glare	A-B
Maintenance	A
Illumination on Horizontal	A
Illumination on Vertical	A-B
Appearance of Lighted Room	A



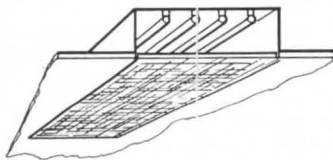
TROFFERS



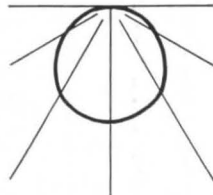
OUTPUT - 60-65%

ROOM INDEX J - 0.30
 ROOM INDEX A - 0.60

Direct Glare	A
Reflected Glare	A-B
Maintenance	B
Illumination on Horizontal	A
Illumination on Vertical	C
Appearance of Lighted Room	A



FLUSH OR
 SUSPENDED UNIT WITH GLASS PANEL



OUTPUT - 50-60%

FOR ROOM INDEX J - 0.25
 FOR ROOM INDEX A - 0.50

Direct Glare	A
Reflected Glare	A
Maintenance	B-C
Illumination on Horizontal	B-C
Illumination on Vertical	B
Appearance of Lighted Room	A

Two-lamp Porcelain Enameled Reflector

Sides of reflector shield lamps from direct view crosswise to angle of 15° or more below the horizontal. Closed ends provide some shielding in lengthwise direction.

Due to the restriction in the use of critical materials, no closed end reflectors are available.

New non-metal reflectors will shortly be available. These are made of hardboard with baked enameled surfaces. Applications—Industrial interiors, warehouses, stockrooms, etc.

Open Coffers or Suspended Trough

Crosswise shielding is dependent upon depth of coffer. If more than two rows of lamps are used, it is generally desirable to use a lengthwise baffle similar to that shown.

Applications—Certain types of factory offices, industrial interiors, warehouses.

Maintenance—Ease of maintenance because of closed top and absence of dust retaining surfaces.

Troffers

Spread or diffuse reflectors with louvers and specular reflector with lens plates.

Sides of louvered troffers provide shielding in crosswise direction (usually 45° below horizontal); louvers provide shielding in lengthwise direction (30° below horizontal) which is satisfactory for most critical seeing tasks. Louvers if opaque should have a surface with diffuse or spread reflection characteristics. Protection with lens plates depends upon several factors. In some cases it may be desirable to add a supplementary system to light the ceiling and reduce harsh contrasts of brightness.

Applications — Particular inspection problems and factory offices.

Maintenance—The vertical surfaces tend to collect little dust. May be easily cleaned and relamped if provision is made for removing louvers. For troffers with lens plates the discussion under next type applies.

Flush or Suspended Unit with Glass Panel

Brightness at higher angles (direct glare) is reduced considerably and with some glasses those at the lower angles (reflected glare) are also diminished appreciably. More diffusing glasses provide very good brightness control but reduce output.

Lamp centers should be a minimum of 2" above glass and luminous sides, or a supplementary system directing

LIGHTING OF INDUSTRIAL PLANTS 4—DATA FOR LIGHTING DESIGN

LUMINAIRE SPACING*		Diffused						Semi-Concentrating	Concentrating
Light Distribution		Indirect		Semi-Indirect	Semi-Direct	Direct	Direct	Direct	
Mounting Height of Luminaire									
[Ceiling Height for Indirect and Semi-Indirect Luminaires]									
All Dimensions in Feet	Spacing Between Units	Spacing* From Walls	Length of Suspension	Usual Spacing Between Units	Maximum Spacing Between Units	Spacing* From Walls	Maximum Spacing Between Units	Maximum Spacing Between Units	
8	9	3	1-3	7	7½	3	5½	2½	
9	9½	3	1½-3	8	8	3	6	3	
10	10½	3½		9	9	3½	7	4	
11	12	3½	2-3	10	10½	3½	8	4½	
12	14	4	2½-4	10-12	12	4	9	5	
13	15	4		10-12	13	4	10	5½	
14	17	5	3-4	10-13	15	5	11	6	
15	19	5		10-13	17	5	12	6½	
16	21	6		10-13	19	6	13	7	
18	23	6	4-5	10-20	21	6	15½	8	
20 or More	26	7	4-6	18-24	24	7	17½	9	

ROOM INDEX**		CEILING HEIGHT—FEET										
For Semi-Indirect and Indirect Lighting		9 and 9½	10 to 11½	12 to 13½	14 to 16½	17 to 20	21 to 24	25 to 30	31 to 36	37 to 50		
For Direct and Semi-Direct Lighting		7 and 7½	8 and 8½	9 and 9½	10 to 11½	12 to 13½	14 to 16½	17 to 20	21 to 24	25 to 30	31 to 36	37 to 50
Room Width (Feet)	Room Length (Feet)	ROOM INDEX										
8 (8½-9)	8-10 10-14 14-20 20-30 30-42 42-up	H G F E	I H G F	J I H G	J I H G	J I H G	J I H G	J I H G	J I H G	J I H G	J I H G	J I H G
10 (9½-10½)	10-14 14-20 20-30 30-42 42-60 60-up	G F E	H G F	I H G	J I H	J I H	J I H	J I H	J I H	J I H	J I H	J I H
12 (11-12½)	10-14 14-20 20-30 30-42 42-60 60-up	G F E	H G F	I H G	J I H	J I H	J I H	J I H	J I H	J I H	J I H	J I H
14 (13-15½)	14-20 20-30 30-42 42-60 60-90 90-up	F E D	G F E	H G F	I H G	J I H	J I H	J I H	J I H	J I H	J I H	J I H
17 (16-18½)	14-20 20-30 30-42 42-60 60-110 110-up	E D D D C	F E E E D	G F F F E	H G G G F	I H H H G	J I I I H	J I I I G	J I I I F	J I I I E	J I I I D	J I I I C
20 (19-21½)	20-30 30-42 42-60 60-90 90-140 140-up	D D C	E D D	F E D	G F E	H G F	I H G	J I H	J I H	J I H	J I H	J I H
24 (22-26)	20-30 30-42 42-60 60-90 90-140 140-up	D C C C C	E D D D D	F E E E E	G F F F F	H G G G G	I H H H H	J I I I I	J I I I I	J I I I I	J I I I I	J I I I I
30 (27-33)	30-42 42-60 60-90 90-140 140-180 180-up	C B B B B	D C C C C	E D D D D	F E E E E	G F F F F	H G G G G	I H H H H	J I I I I	J I I I I	J I I I I	J I I I I
36 (34-39)	30-42 42-60 60-90 90-140 140-200 200-up	B A A A A	C C C C C	D D D D D	E E E E E	F F F F F	G G G G G	H H H H H	I I I I I	J I I I I	J I I I I	J I I I I
42 (40-45)	42-60 60-90 90-140 140-200 200-up	A A A A A	B B B B B	C C C C C	D D D D D	E E E E E	F F F F F	G G G G G	H H H H H	I I I I I	J I I I I	J I I I I
50 (46-55)	42-60 60-90 90-140 140-200 200-up	A A A A A	B B B B B	C C C C C	D D D D D	E E E E E	F F F F F	G G G G G	H H H H H	I I I I I	J I I I I	J I I I I
60 (56-67)	60-90 90-140 140-200 200-up	A A A A	B B B B	C C C C	D D D D	E E E E	F F F F	G G G G	H H H H	I I I I	J I I I	J I I I
75 (68-90)	60-90 90-140 140-200 200-up	A A A A	B B B B	C C C C	D D D D	E E E E	F F F F	G G G G	H H H H	I I I I	J I I I	J I I I

some light to the ceiling and walls is desirable, so as to relieve possible harsh brightness contrasts. Applications — For inspection problems requiring a uniform brightness source. Maintenance—The horizontal surface of the glass is naturally dust collecting: the depreciation, however, depends upon tightness of joints. The glass bottom should be hinged or otherwise easily removable to permit easy cleaning and lamp replacement.

GENERAL CONSIDERATIONS
 General lighting design is a procedure which allows us to predetermine the lumens per sq. ft. (foot-candles) delivered to a horizontal work plane corresponding to the floor area. Conversely, knowing the foot-candles desired (lumens per sq. ft.) the problem is to account for losses due to room proportions, color of walls and ceiling, and fixture efficiency and light distribution, so that we can specify the total lumens that must be generated by the lamps. The procedure is the same regardless of the type of lamp used. The accompanying tables take these factors into account.

Foot-candle Standards
 The chart (Recommended Levels of Illumination) on page 73 indicates the general foot-candle levels being employed in practical installations.

Equipment Spacing and Layout
 In order to get fairly uniform illumination over an area, the maximum spacing between units as shown in the table should not be exceeded. Closer spacing to conform to bays and other building construction features is quite often necessary. Downlight and similar concentrating reflectors require close spacing, depending on the degree of light concentration. The actual spacing for different types can best be worked out by the point-by-point method using the candle power distribution curve for the specific unit under consideration.
 Where continuous rows of units such as fluorescent troffers are used, the figures apply to the spacing between rows. However with individual fluorescent equipment (where the

*Where desks and benches are next to wall. Otherwise one-half the spacing between units is satisfactory.
 **Room Index is the classification of a room according to its proportions; large and small rooms of the same proportion have the same index. Hence, for large rooms of dimensions greater than those shown, divide each dimension by the same number and use the Index determined for the smaller room.

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lumen output is limited) conventional spacing distances cannot be used. The problem then becomes one of first figuring out the number of fixtures required to deliver the necessary lumens, and then planning the layout to accommodate this number of units.

Room Proportions

This table classifies rooms according to width, length and height of light source. For indirect and semi-indirect luminaires use the ceiling height. Determine the room index and apply it in the Coefficients of Utilization Table.

Coefficient of Utilization

This table brings together all of the factors that affect the utilization of light. The figure obtained by reference to this table (for the type of fixtures used, the size and finish of the room in which these are to be installed) is the percentage of the lumens given out by the lamps that reaches the working plane. For example, a utilization factor of 40 per cent means that 40 per cent of the light is useful in producing foot-candles and that 60 per cent is absorbed by the walls, ceiling and fixture itself. Luminaire efficiency and light distribution—coefficients of utilization—are calculated for the output and distribution shown and the sketches of fixture types merely help identify units which may fall into each class. Several luminaires may look about the same but differ considerably in efficiency and light distribution.

Space does not permit publishing data on all the specific luminaires on the market, but if actual performance data on a specific luminaire are available, the range of data published is sufficient to the designer to make acceptable allowances for any departures.

Initial Foot-candles vs. Foot-candles Maintained in Service

Initial foot-candles measured when lamps are new and when the equipment is clean will be higher than the average maintained in service. To allow for this, a maintenance factor (M.F.) is given to indicate about the percentage of initial foot-candles to be expected under reasonable maintenance schedules of cleaning and repainting.

The lamp lumens required to light a room are computed from the formulas at the right.

COEFFICIENTS OF UTILIZATION

FILAMENT AND MERCURY LUMINAIRES	Candlepower Distribution	Ceiling								
		Walls	75%		50%		30%			
		Room Index	50%	30%	10%	50%	30%	10%	30%	
HIGH BAY UNIT M.F. = .70		J	.40	.38	.36	.39	.38	.36	.38	.36
		I	.48	.46	.46	.47	.46	.46	.45	.43
		H	.51	.51	.50	.50	.50	.49	.50	.48
		G	.55	.54	.54	.54	.52	.52	.52	.51
		F	.58	.56	.55	.55	.55	.54	.55	.53
		E	.60	.59	.58	.59	.58	.57	.57	.56
D	.64	.61	.60	.62	.60	.60	.60	.59		
C	.65	.63	.61	.63	.62	.60	.60	.60		
B	.65	.64	.63	.64	.62	.62	.62	.61		
A	.66	.65	.64	.64	.63	.62	.62	.62		
R.L.M. DOME REFLECTOR M.F. = .75		J	.37	.32	.28	.37	.32	.28	.31	.28
		I	.46	.41	.38	.45	.40	.37	.40	.37
		H	.50	.46	.43	.49	.46	.43	.45	.43
		G	.54	.50	.47	.58	.50	.47	.48	.47
		F	.58	.54	.50	.56	.52	.50	.52	.50
		E	.62	.59	.56	.61	.58	.56	.57	.56
D	.67	.64	.60	.65	.63	.60	.60	.60		
C	.69	.66	.63	.67	.64	.63	.64	.63		
B	.72	.69	.67	.70	.68	.66	.67	.65		
A	.74	.71	.69	.72	.69	.68	.68	.67		
SILVERED BOWL LAMP TROUGH AND COFFER M.F. = .75		J	.35	.30	.26	.34	.30	.26	.29	.26
		I	.44	.39	.36	.43	.38	.35	.38	.35
		H	.48	.44	.41	.46	.44	.40	.43	.40
		G	.51	.48	.45	.50	.47	.44	.46	.44
		F	.54	.51	.48	.52	.50	.47	.49	.47
		E	.59	.56	.53	.58	.55	.52	.54	.52
D	.63	.60	.57	.62	.59	.57	.58	.57		
C	.65	.62	.59	.63	.61	.59	.60	.59		
B	.68	.65	.63	.66	.64	.62	.63	.63		
A	.69	.67	.65	.68	.65	.64	.64	.63		
SILVERED BOWL LAMP AND GLASSTEEL DIFFUSERS M.F. = .75		J	.34	.31	.29	.34	.31	.29	.31	.29
		I	.42	.39	.38	.41	.38	.37	.38	.38
		H	.45	.43	.42	.44	.42	.41	.42	.41
		G	.48	.46	.45	.47	.46	.44	.45	.44
		F	.51	.49	.46	.49	.47	.46	.47	.46
		E	.54	.52	.50	.53	.51	.49	.51	.49
D	.57	.55	.53	.56	.54	.53	.53	.53		
C	.59	.57	.54	.57	.55	.54	.55	.55		
B	.60	.58	.57	.58	.57	.56	.56	.55		
A	.61	.59	.58	.60	.58	.57	.57	.56		
GLASS ENCLOSING UNIT M.F. = .70		J	.23	.19	.16	.21	.17	.15	.16	.14
		I	.29	.24	.22	.26	.22	.19	.21	.18
		H	.33	.28	.25	.29	.26	.23	.23	.21
		G	.37	.32	.28	.33	.28	.26	.26	.22
		F	.40	.35	.32	.35	.31	.28	.28	.25
		E	.44	.40	.36	.39	.35	.32	.32	.29
D	.48	.43	.39	.42	.38	.35	.36	.32		
C	.51	.46	.43	.44	.40	.37	.37	.34		
B	.55	.50	.46	.48	.44	.41	.41	.39		
A	.57	.53	.49	.50	.46	.43	.41	.39		
TRANSLUCENT GLASS OR PLASTIC BOWLS M.F. = .65		J	.18	.14	.13	.13	.11	.09	.08	.07
		I	.23	.19	.17	.17	.14	.12	.09	.07
		H	.26	.22	.20	.19	.16	.14	.13	.10
		G	.30	.26	.23	.21	.19	.17	.13	.13
		F	.32	.28	.25	.24	.21	.19	.14	.13
		E	.36	.32	.29	.27	.23	.21	.16	.15
D	.40	.35	.32	.29	.26	.24	.18	.17		
C	.42	.38	.35	.33	.28	.26	.19	.18		
B	.46	.42	.40	.33	.31	.29	.21	.20		
A	.48	.44	.42	.35	.32	.31	.24	.21		
GLASS OR METAL INDIRECT UNIT M.F. = .60		J	.15	.12	.10	.10	.08	.07	.04	.04
		I	.19	.15	.14	.12	.10	.09	.06	.05
		H	.22	.18	.16	.14	.12	.10	.08	.06
		G	.25	.21	.18	.17	.14	.13	.08	.08
		F	.27	.24	.21	.19	.16	.14	.09	.08
		E	.31	.27	.25	.21	.18	.16	.10	.10
D	.34	.30	.28	.22	.20	.19	.12	.11		
C	.36	.33	.30	.24	.22	.20	.13	.12		
B	.40	.37	.34	.26	.25	.23	.14	.14		
A	.42	.39	.37	.28	.26	.25	.16	.14		
SILVERED BOWL LAMP AND SHALLOW SHIELD M.F. = .75		J	.17	.13	.11	.11	.09	.08	.05	.04
		I	.21	.17	.15	.14	.12	.10	.07	.06
		H	.25	.21	.18	.16	.14	.12	.08	.07
		G	.28	.24	.21	.20	.16	.14	.09	.08
		F	.31	.27	.23	.21	.18	.16	.10	.09
		E	.35	.31	.28	.24	.20	.19	.12	.11
D	.39	.34	.31	.26	.23	.21	.14	.13		
C	.41	.37	.34	.27	.25	.23	.14	.14		
B	.46	.42	.39	.30	.28	.26	.16	.15		
A	.48	.44	.42	.32	.30	.28	.18	.16		

$$\text{Lamp Lumens Required} = \frac{\text{Foot-candles} \times \text{Area of Room}}{\text{Coefficient of Utilization} \times \text{Maintenance Factor}}$$

$$\text{Lamp Lumens pr. Luminaire} = \frac{\text{Total Lumens Required}}{\text{Number of Luminaires to be installed}}$$

LIGHTING OF INDUSTRIAL PLANTS

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COEFFICIENTS OF UTILIZATION

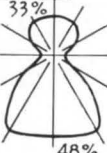
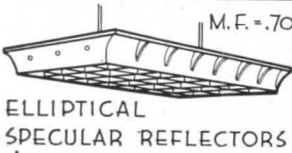
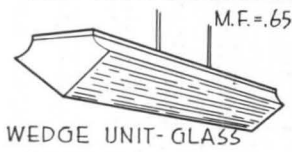
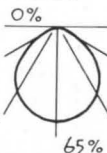
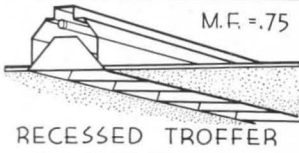
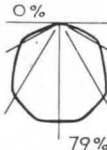
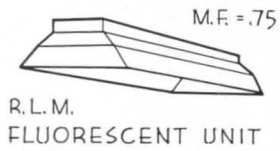
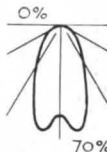
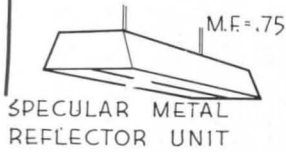
FLUORESCENT LUMINAIRES

Candlepower Distribution

Ceiling 75% 50% 30%
Walls 50% 30% 10% 50% 30% 10% 30% 10%

Room Index COEFFICIENTS OF UTILIZATION

Room Index	COEFFICIENTS OF UTILIZATION								
J	.40	.38	.36	.39	.38	.36	.38	.36	.36
I	.48	.46	.46	.47	.46	.46	.45	.45	.43
H	.51	.51	.50	.50	.50	.49	.50	.48	.48
G	.55	.54	.54	.54	.52	.52	.52	.51	.51
F	.58	.56	.55	.55	.55	.54	.55	.53	.53
E	.60	.59	.58	.59	.58	.57	.57	.56	.56
D	.64	.61	.60	.62	.60	.60	.60	.59	.59
C	.65	.63	.61	.63	.62	.60	.60	.60	.60
B	.65	.64	.63	.64	.62	.62	.62	.61	.61
A	.66	.65	.64	.64	.63	.62	.62	.62	.62



LAYOUT SUGGESTIONS

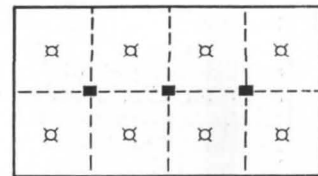
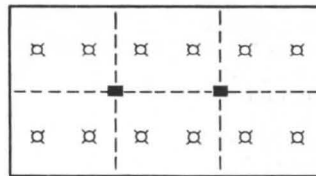
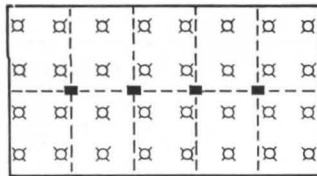
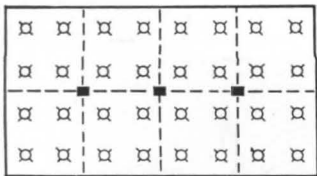
The conventional arrangements of lighting outlets to get uniform illumination with filament lamps have been adequate for an extreme range of foot-candles because of the availability of lamp sizes from 15 to 1500 watts with lumen outputs from 150 to 33,000 lumens.

With fluorescent lamps, the wattage range at present is 15 to 100 watts, and lumen outputs from 495 to 4400 lumens. High lumen output per fixture means adding more lamps.

Whereas filament lamps offered greatest flexibility in wattage sizes, the fluorescent lamp, by virtue of its

tubular form, suggests new layout and installation methods. Lacking interchangeability of wattage sizes, provision for future increases in illumination must be provided for in a flexible layout to accommodate added luminaires or rows of units to coordinate with the original installation.

CONFORMING WITH STRUCTURAL DESIGN



The common arrangement for the typical rectangular bay is the use of four fixtures per bay

With narrower bays, the four-bay system may be used, the equivalent of three units per bay

Sometimes two units per bay are permissible, usually where the bays are extraordinarily shallow

Where bay size does not exceed maximum allowable lamp spacing, one lamp per bay may do

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COMPUTED VALUES OF ILLUMINATION USING M.F. = 0.70

FOOT-CANDLES PER 1000 LAMP LUMENS

Area in Square Feet per Lamp	COEFFICIENT OF UTILIZATION																	
	.14	.15	.17	.19	.21	.23	.25	.27	.30	.33	.36	.40	.44	.48	.53	.58	.64	.70
5	20	21	24	27	29	32	35	38	42	46	50	56	62	67	74	82	90	98
6	16	18	20	21	24	27	29	32	35	38	42	47	51	57	62	68	75	82
7	14	15	17	19	21	23	25	27	30	33	36	40	44	48	53	58	64	70
8	12	13	15	17	18	20	22	24	26	29	32	35	38	42	46	51	56	61
9	11	12	13	15	16	18	20	21	23	26	28	31	34	37	41	45	50	54
10	10	10	12	13	15	16	18	20	21	23	25	28	31	34	37	41	45	49
12	8	9	10	11	12	13	15	16	18	19	21	23	26	28	31	34	37	41
14	7	8	8	10	10	12	12	14	15	16	18	20	22	24	26	29	32	35
16	6	7	7	8	9	10	11	12	13	15	16	18	19	21	23	25	28	31
20	5	5	5	6	7	8	9	10	12	13	14	15	17	19	20	22	24	27
24	4	4	4	5	6	7	8	9	10	11	12	13	14	15	17	19	20	22
28	4	4	4	5	5	6	7	8	9	10	11	12	13	14	16	17	19	20
32	3	3	4	4	5	5	6	7	7	8	9	10	10	12	13	14	15	15
36	3	3	3	4	4	5	5	6	6	7	8	9	9	10	11	12	14	14
40	2	3	3	3	4	4	5	5	6	6	7	8	8	9	10	11	12	14
50	2	2	2	3	3	3	4	4	5	5	6	6	7	8	9	10	11	12

COMPUTED ILLUMINATION VALUES (using M.F. of 0.70)

For convenience, a Table of Values is computed from the formulas on page 77. The first part of the Table is based on 1000 lamp lumens for different areas per lamp. For example, if eight luminaires containing six 48" Mazda F white lamps in each were used in an area 20' x 48' (960 sq. ft.) the area per lamp would be 960 ÷ 48 = 20 sq. ft. per lamp; with a coefficient of utilization of .44, 1000 lumens per lamp would produce 15 foot-candles. But from the lumen output table we find this lamp (40 watts) produces 2100 lumens so the actual foot-candle result would be 2.1 x 15 or 31.5 foot-candles. This table can be used for any type of lamp; and by multiplying the area per lamp by 10 and dividing the foot-candle values by 10 the range of the table is extended from 50 to 500 sq. ft. per lamp. The second part of the table is calculated specifically for the lumen outputs of various wattages of Mazda Filament Lamps.

FOOT-CANDLES FOR SPECIFIC FILAMENT LAMP WATTAGES (Calculated for 120-Volt Lamps)

Area Watts per Lamp	COEFFICIENT OF UTILIZATION																			
	.14	.15	.17	.19	.21	.23	.25	.27	.30	.33	.36	.40	.44	.48	.53	.58	.64	.70		
50	100	3	3	4	4	5	5	6	6	7	7	8	9	10	11	12	13	14	16	
200	6	6	7	8	9	10	11	12	13	14	16	17	19	21	23	25	28	30	33	36
300	11	12	14	15	17	18	20	22	24	27	29	32	35	39	43	47	52	56	61	
500	20	21	24	27	29	32	35	38	42	46	50	56	62	67	74	82	90	98	107	
60	100	3	3	3	4	4	5	5	6	6	7	8	8	9	10	11	12	13	13	
200	6	6	7	8	9	10	11	12	13	14	16	17	19	21	23	25	28	30	33	36
300	9	10	11	13	14	15	17	18	20	22	24	27	29	32	35	39	43	47	52	56
500	16	18	20	22	25	27	29	32	35	38	42	47	51	56	62	68	75	82	90	98
70	100	2	3	3	3	4	4	5	5	6	6	7	8	8	9	10	11	12	13	13
200	5	5	6	7	8	8	9	10	11	12	13	14	16	17	19	21	23	25	28	30
300	8	9	10	11	12	13	14	16	17	19	21	23	25	28	30	33	37	40	44	47
500	14	15	17	19	21	23	25	27	30	33	36	40	44	48	53	58	64	70	77	84
80	100	2	2	2	3	3	3	4	4	5	5	6	6	7	7	8	9	9	10	11
200	4	4	5	6	7	7	8	9	10	11	12	13	14	16	17	19	21	23	25	28
300	7	8	9	10	11	12	13	14	15	17	18	20	22	24	27	29	32	35	37	40
500	12	13	15	17	18	20	22	24	26	29	32	35	38	42	46	51	56	61	66	71
90	100	2	2	2	3	3	3	3	4	4	4	5	5	6	6	7	7	8	8	9
200	4	4	5	6	6	7	7	8	9	10	10	12	13	14	15	17	18	20	21	23
300	6	7	8	9	10	11	12	13	14	15	17	18	20	22	24	27	29	31	34	37
500	11	12	13	15	16	18	19	21	23	25	28	31	34	37	41	45	50	54	60	64
100	200	4	4	4	5	5	6	6	7	8	8	9	10	11	12	14	15	17	18	18
300	6	6	7	8	8	9	10	11	12	13	14	16	18	19	21	23	26	28	31	33
500	10	10	12	13	15	16	18	19	21	23	25	28	31	34	37	41	45	49	54	58
750	14	15	17	19	21	23	25	27	30	34	36	40	44	48	53	58	64	70	77	84
110	200	3	4	4	4	5	5	6	6	7	8	8	9	10	11	12	14	15	16	16
300	5	6	6	7	8	8	9	10	11	12	13	15	16	18	19	21	23	25	28	30
500	9	10	11	12	13	15	16	17	19	21	23	26	28	30	34	37	41	44	48	51
750	13	14	16	18	19	21	23	25	28	30	33	37	41	44	49	54	59	65	71	77
130	200	3	3	3	4	4	5	5	6	6	7	7	8	9	10	11	12	13	14	14
300	4	5	5	6	6	7	7	8	8	9	10	11	12	14	15	16	18	20	22	22
500	8	9	10	11	12	14	15	16	18	19	22	24	26	28	31	34	38	41	45	48
750	11	12	13	15	16	18	20	21	23	26	28	31	34	38	41	45	50	55	60	65
150	200	2	3	3	3	4	4	4	5	5	6	6	7	8	8	9	10	11	12	12
300	4	4	5	6	6	7	7	8	8	9	10	11	12	13	14	16	17	19	20	20
500	6	7	8	9	10	11	12	13	14	15	17	19	20	22	25	27	30	33	36	38
750	10	10	12	13	14	16	17	18	20	22	24	27	30	32	36	39	43	47	52	56
1000	14	15	17	19	21	22	24	26	29	32	35	39	43	47	52	57	63	69	75	81
170	200	2	2	3	3	3	4	4	4	5	5	6	6	7	7	8	9	10	11	11
300	3	4	4	4	5	5	6	6	7	8	8	10	11	12	14	15	17	18	20	20
500	6	6	7	8	9	10	10	11	12	14	15	16	18	20	22	24	26	29	32	32
750	8	9	10	11	12	14	15	16	18	20	22	24	26	29	32	35	38	42	46	46
1000	12	13	15	16	18	20	22	23	26	28	31	35	38	42	46	50	55	60	65	70
190	200	2	2	2	3	3	3	4	4	4	5	5	6	6	7	8	9	10	11	11
300	3	3	4	4	4	5	5	6	6	7	8	8	9	10	11	12	14	15	16	16
500	5	6	6	7	8	8	9	10	11	12	13	15	16	18	20	21	24	26	29	29
750	8	8	9	10	11	12	13	14	15	16	18	19	21	22	24	27	30	34	37	37
1000	11	12	13	15	16	18	19	21	23	25	28	31	34	37	41	45	50	54	60	64
210	300	3	3	3	4	4	4	5	5	6	6	7	8	8	9	10	11	12	13	13
500	5	5	6	6	7	8	8	9	10	11	12	13	15	16	18	19	21	23	25	25
750	7	7	8	9	10	11	12	13	14	16	17	19	21	23	26	28	31	34	37	37
1000	10	10	12	13	15	16	18	19	21	23	25	28	31	34	37	41	45	49	54	58
1500	15	16	19	21	23	25	28	30	33	36	40	44	48	53	58	64	70	77	84	90
230	300	2	3	3	3	4	4	4	5	5	6	6	7	8	8	9	10	11	12	12
500	4	5	5	6	6	7	8	8	9	10	11	12	13	15	16	18	20	21	23	23
750	6	7	8	9	10	11	12	13	15	16	18	19	21	23	26	28	31	34	37	37
1000	9	10	11	12	13	15	16	18	19	21	23	26	28	31	34	37	41	45	49	53
1500	14	15	17	19	21	23	25	28	30	33	36	40	44	48	53	58	64	70	77	84
250	500	4	4	5	5	6	6	7	8	8	9	10	11	12	13	15	16	18	20	20
750	6	6	7	8	8	9	10	11	12	13	15	16	18	20	22	24	26	29	32	32
1000	8	9	10	11	12	14	15	16	18	19	21	23	24	26	28	31	34	37	41	41
1500	13	14	16	18	19	21	23	25	28	30	33	37	41	44	49	54	59	65	71	77
300	500	3	4	4	4	5	5	6	6	7	8	8	9	10	11	12	14	15	16	16
750</																				



FIGURE 1

ALLOY WATER SERVICE PIPE

A WATER-SERVICE pipe extruded from an alloy of lead, magnesium, calcium and tin is being stressed as available now for prompt delivery. This pipe is not an emergency product but was widely utilized, according to the manufacturer, prior to current shortages in other water service pipes. It retains the ability of lead to withstand corrosion and is recommended where steady working pressures do not exceed 125 lbs. per sq. in. Flared tube fittings of malleable iron have been developed for use with the pipe. These products are recommended solely for conveying water from main to meter. American Smelting and Refining Company, New York City. (See figure 1.)

ALUMINUM HEATING SECTIONS

A UNIT HEATER, made since 1929 with aluminum heating sections, is now being made with cast iron sections. The manufacturer states that the new unit is free from electrolysis, that causes corrosion, leaks and breakdowns, as only one type of metal comes in contact with steam or hot water, and that for stability and service the product will be entirely dependable in operation. 8 sizes. D. J. Murray Manufacturing Company, Wausau, Wis.

MALLEABLE IRON FITTINGS

FITTINGS of galvanized malleable iron have been developed for use with an alloy water service pipe, and are said not only to be suitable for permanent use but to improve the design of connections already made. These fittings are now being manufactured and are available for use. Grinnell Company, Providence, R. I.

OVERHEAD AIR DIFFUSER

FOR AIR CONDITIONED spaces with high ceilings there is a new thermostatically controlled overhead air diffuser. It is recommended for combined heating and cooling installations which require that the outlet be mounted 25 ft. or more from the floor. Directional air flow is automatically controlled and the diffuser can handle supply air with a wide range of temperature. Barber-Colman Company, Rockford, Ill.

PLASTICS FOR PLUMBING

A LINE of plumbing fixtures and showers, for defense housing, in line with the Defense Housing Critical List, offers plastic handles and escutcheons, with exposed metal parts unplated emery finish. Speakman Company, Wilmington, Del.

SLOTTED WOOD MOLDINGS

A NEW slotted wood molding, designed in various styles for use wherever ceiling or curtain traverses are specified, is now being offered. The molding comes with a patented slide curtain-hanging feature which eliminates the need for metal curtain rods and fixtures. This device is a woven cotton tape set at intervals with sliders. After the tape is sewed to the top of a curtain the sliders are inserted into the slot, one after the other, through a small aperture near the end of the molding. With double slot moldings glass curtains or blackout curtains can be hung under draperies. The moldings are made of kiln-dried and processed medium-hard woods and come in 4-, 6-, 8-in. and other standard lengths. Jiffy Join, Inc., 203 E. 18th St., New York City. (Fig. 2.)



FIGURE 2

PROJECTED WOOD SASH

A PROJECTED wood sash, engineered by an architectural firm under supervision of a technical committee of the National Door Manufacturers Association of Chicago, has been announced. The sash are offered in 18 standard basic units, each unit an opening in itself. The units may be installed individually, or may be combined in height and width, it is claimed, to meet almost every installation requirement in industrial and commercial buildings, schools, hospitals, etc., and in any type of wall construction. The standardized frame is designed to accommodate either bottom-pivoted in-projecting vents or top-pivoted out-projecting vents. Necessary hardware for one complete unit weighs about 3 lbs. Frames are factory-fitted and sash-prefitted. Parts are treated with a toxic preservative. National Door Manufacturers Association Inc., 322 S. Michigan Ave., Chicago.



FIGURE 3

CONDUCTIVE ASPHALT TILE

A NEW conductive asphalt tile is said to be the first conductive flooring specified by the government which contains no critical materials. This low-cost tile, it is claimed, provides a surface condition which results in less than .1 megohm resistance to static electricity under certain specific conditions. The tile is recommended as a resilient flooring in arsenals, shell and bomb loading plants, powder plants, temporary field hospitals and industries in which static electricity presents a hazard. Armstrong Cork Company, Lancaster, Pa. (See figure 3.)

(continued on page 82)



"OUR WINDOWLESS BUILDING IS SCIENTIFICALLY DESIGNED FOR BETTER WORKING CONDITIONS"

...says WM. F. R. MURRIE, *President, Hershey Chocolate Corp.*



"ONE of our major objects in designing our windowless building was to provide the best possible working conditions for our employees. Our experience in this building since

1936 has proved to us that we have been successful in that attempt.

"The construction of this modern building was not expensive. It cost considerably less to build than if it had been of the conventional type. Long walls, unbroken by many windows with their resultant hanging of awnings, inside shades and installation of screens, reduced the initial cost considerably. Maintenance costs are kept correspondingly low by elimination of windows to be cleaned."

Windowless buildings are receiving particular attention today because of their

specific advantages in the war economy. Among those advantages are: Production need not be interrupted during black-outs; military secrets are readily con-

Facts about "FREON"*

"Freon" refrigerants have been used almost exclusively for new air conditioning installations because of their *unique safety*. They meet the safety specifications of the Underwriters' Laboratories. By specifying a "Freon" system you avoid any possibility of penalty to your client in insurance rates, and promote safety of life and property. Kinetic Chemicals, Inc., Tenth & Market Sts., Wilmington, Del.



*"Freon" is Kinetic's registered trade mark for its fluorine refrigerants.

cealed from outsiders; and scrupulous cleanliness is easily maintained, a requirement in the manufacture of airplane engines. In the Hershey building, and in today's controlled-conditions plants for war production, the safety and efficiency of "Freon" refrigerants make possible air conditioning at its best.

HERSHEY'S ATTRACTIVE RECEPTIONIST, Mrs. Alitha R. De Hart, has probably



asked more people how they like windowless buildings than any other person in the world. During the last ten years, she has chatted with thousands of visitors to Chocolate Land, as well as the office employees themselves. As a result, she knows that people are invariably enthusiastic about windowless buildings after they've actually been inside!

Mrs. De Hart says, "Most visitors can't believe there are no windows—it's so pleasant inside. They always say they'd rather work here than in their own offices. Before this building was built, I never dreamed what a difference working in a windowless building could make. Now, I'm certain I'd never enjoy working in an ordinary building again!"

(continued from page 80)

PLASTIC PREVENTS GLARE

A GLARE-ELIMINATING plastic sheeting for industrial application is said to lower the surface brightness of fluorescent lamps while transmitting high-intensity, comfortable illumination. A shield of this sheeting may be attached to fluorescent reflectors. It is said to be nonfragile, lightweight, pli-

able and shatterproof. Ivan T. Johnson Company, Inc., 95 Madison Ave., New York City.

PLASTIC FLUSH ELBOW

PLASTIC is used to make a new flush elbow for connecting tank to water closet. According to the manufacturer, the elbow does not crack or dent

in packing or handling with tools, is leakproof, impervious to all water content, noncorrosive and invincible to electrolysis. 4 in. by 6 in., 2 in. outside diameter. American Molded Products Company, 1753 N. Honore St., Chicago, Ill.

LOW-COST SIDING

A LOW-COST siding material, with weather-resistant mineral granule finish that eliminates painting, has been put on the market. It can be used over any kind of sheathing, and for temporary construction may be applied directly to framing provided the studs are on 16-in. centers. The product consists of two sheets of heavy roofing felt saturated with an asphaltic compound and bound together with a high melting point asphalt adhesive. The outer surface of the sheets receives an extra coating of asphalt, into which are embedded mineral granules. The material is recommended for army barracks and other military buildings, factory structures, low-cost housing. 3/16 in. thick; 3 and 4 ft. wide; 6, 7, 8, 9, 10 ft. long. Celotex Corporation, 919 N. Michigan Ave., Chicago, Ill.

WOOD COMPARTMENTS

A MANUFACTURER of toilet compartments has converted its four types of steel compartments to all-wood construction as a temporary substitute, using plywood for partition panels and doors. They are said to compare favorably in appearance with longer lasting steel toilet compartments. Sanymetal Products Company, Inc., Cleveland, Ohio. (See figure 4.)

(continued on page 84)



WHEREVER WHEELS TURN
There's need for **SPENCER VACUUM**

The wheels of industry are producing mountains of waste and acres of dust these days, with less idle time for cleaning and fewer men to do the work.

HERE'S HOW SPENCER VACUUM CLEANING SAVES MEN . . . SAVES TIME . . . SAVES MATERIALS

Removes debris during working hours with smaller cleaning force.

Removes dust—underfoot or from walls, pipes and overhead.

Cleans machinery—inside and out, without scattering dust.

Reclaims valuable metals, powders, chemicals.

Improves working conditions—health, safety, fire, explosions.

Cleans finished goods, cartons, trucks and freight cars.

Ask for Bulletin 102R on Portables or 125R on Spencer Stationary Vacuum Cleaning Systems.

THE SPENCER TURBINE COMPANY, HARTFORD, CONN.
PORTABLE CLEANERS 3/4 TO 7 1/2 H.P.; STATIONARY SYSTEMS UP TO 100 H.P.

SPENCER VACUUM

S-228A

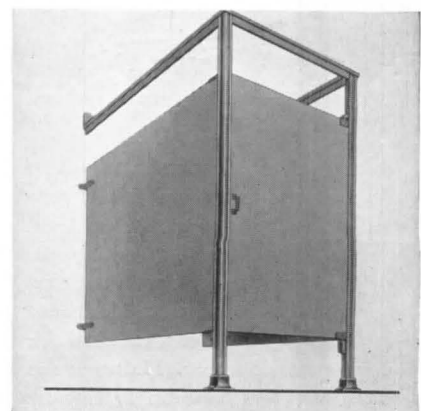


FIGURE 4

PHOTOMURAL VISTAS

now dramatized in glass



The Cottonwood Room, Blackstone Hotel, Omaha. Photomural by Kaufmann and Fabry. Design by Johns H. Hopkins.

Here's another new and interesting use of polished plate glass in modern interior design. Dramatized with lights of plate glass, this arresting vista in The Cottonwood Room of Omaha's Blackstone Hotel is what is believed to be the first full wall size, full color, illuminated transparency to be installed. It extends over the entire curved wall, seven and one-half feet by fifty-four feet, and is lighted from behind. In addition to its novel decorative effect it provides the illumination for the entire room.

The use of clear Libbey-Owens-Ford glass on both sides of the photomural contributes to the vista effect, provides clear vision, and protects the mural.

Here's a novel technique that offers a fine medium of dramatizing locale . . . scenes, historical points of interest, etc. . . . in reception rooms, foyers, dining rooms, lobbies, corridors and other places in public buildings, such as post offices, libraries, municipal and federal buildings, and in hotels and restaurants.

Here also is an ideal application for Libbey-Owens-Ford Polished Plate Glass. Its smooth, clear surfaces and greater freedom from imperfections and distortion fit it perfectly for installations where clear vision is an essential. Libbey-Owens-Ford Glass Company, 1329-A Nicholas Building, Toledo, Ohio.



LIBBEY·OWENS·FORD

QUALITY *Flat Glass* PRODUCTS

(continued from page 82)

PACKAGED FURNACES

THREE gas-fired models and one oil-fired model constitute a line of winter air conditioners which have been placed in production. Factory-wired and assembled, the units are said to minimize time, labor and expense of installation. They have been approved

for close-quarter installations. Gas-fired model has output ratings of 48,000, 72,000 and 96,000 Btu per hr. Oil-fired, 100,000 Btu per hr. General Electric Co., Bloomfield, N. J.

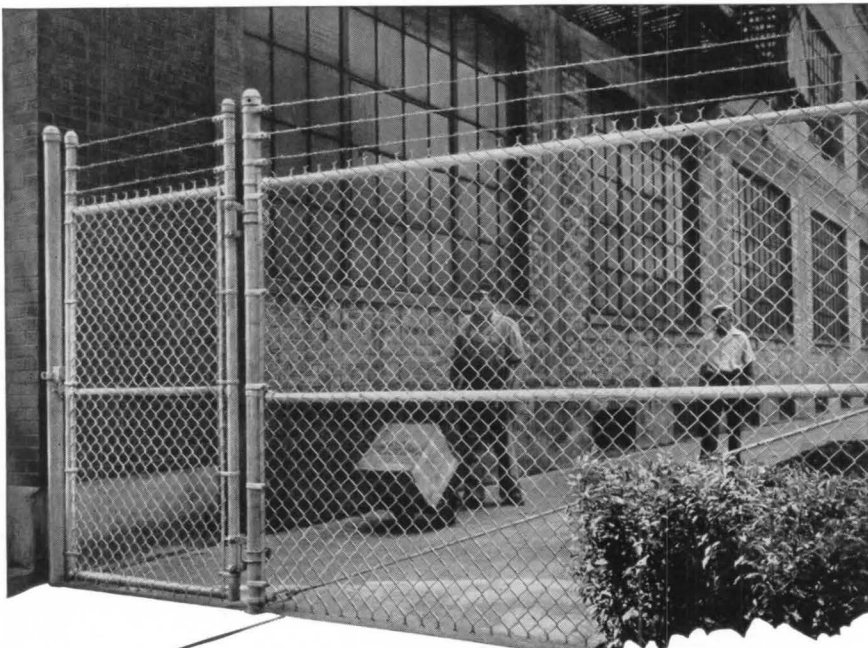
SHOWER CABINET— NON-CRITICAL

A LOW-PRICED shower cabinet, using

non-critical materials, has walls of hard-pressed, treated fiberboard; receptors of reinforced non-slip precast cement composition, galvanized steel frame. One standard size with cast iron drain and soap dish; also shower head, valves, curtain and curtain rod as optional equipment. The product should meet the need in war housing, camps, naval bases, plants, schools, hospitals. Installation speed is another feature. Milwaukee Stamping Company, South 72nd St., Milwaukee.

PAGE FENCE

America's First Wire Fence — Since 1883



BARRIER AGAINST INTERFERENCE WITH AMERICA'S ALL-OUT PRODUCTION

• No one can predict where treachery may attempt to strike, but industry can and will set up protections. Logically the first barrier should be at all property lines. Two important factors favor Page Industrial Fence. The first woven wire fence was Page Fence, and for 59 years its makers have held a forefront position in major developments. Page also originated localized experience and responsibility in fence engineering and erecting. When you specify Page Fence you deal with a nearby business man — one of 102 technically-trained, long-experienced firms which own their own plants and comprise the PAGE FENCE ASSOCIATION, Headquarters: Monessen, Pennsylvania.

VICTORY FIRST
At the Page mills, men, machines and materials are on an all-out schedule for production of fence to protect plants working on Government orders

PRODUCT OF PAGE STEEL & WIRE DIVISION—AMERICAN CHAIN & CABLE COMPANY, INC., BRIDGEPORT, CONN.

TO SHATTERPROOF WINDOWS

TO "SHATTERPROOF" windows and lighting fixtures and prevent broken glass from flying in factories, office buildings, public buildings, etc., a liquid can be brushed or sprayed on to form a film said to have tensile strength of 3,000-5,000 lbs. per sq. in. Elongation over 20 per cent permits considerable movement of glass without rupture of film. The coating, which, it is stated, is lightproof, will not pinhole and has been flame-proofed. CLOPAY, 1207 Clipay Square, Cincinnati, Ohio.

WAR PLANT VENTILATORS

DESIGNED to prevent transmission and reflection of illumination from the building interior or reflection of light from the night sky is a new series of war plant ventilators for blackout and other factory buildings. They are available in three types. 1. Exhaust ventilators to remove air from the plant. 2. Supply ventilators to draw in and circulate outdoor air. 3. Tempering ventilators to deliver and circulate warmed air. Three capacities—10,000, 15,000, 20,000 Cfm. Single or in multiple. Carrier Corporation, Syracuse, N. Y.

SUBSTITUTE FOR RUBBER RUNNER

AN ASPHALT composition material, now available for delivery, has been found highly satisfactory, according to the manufacturer, as substitute for rubber runners and mats on floors subject to heavy traffic. Corrugations or ribs form a non-skid surface. In rolls 36 in. wide, 30 ft. long. Philip Carey Manufacturing Company, Lockland, Cincinnati, Ohio.

DEPENDABILITY

Proof that a Carrier Centrifugal Refrigeration Machine will give you dependable operation at Low Cost year after year

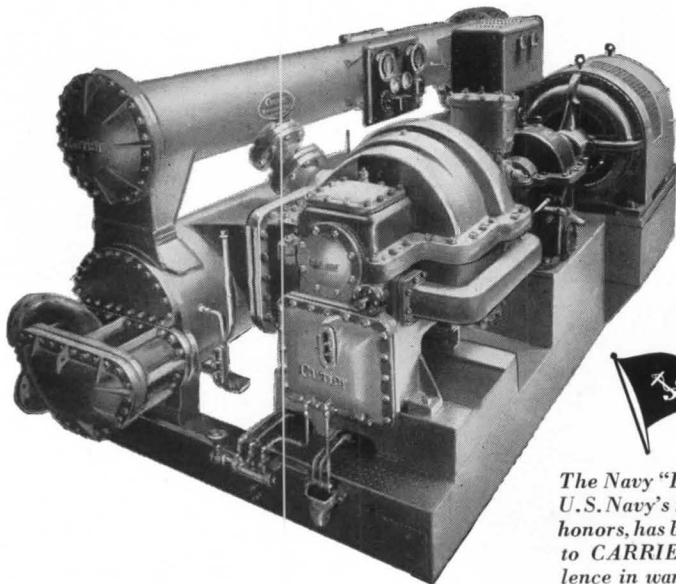
365 Days Around the Clock is the operating schedule of the Carrier Centrifugal Refrigeration Machine installed in the blast furnace of the Woodward Iron Company, Birmingham, Ala.

20 Years Service is the record of the first Carrier Centrifugal installed at the Onondaga Pottery Company, Syracuse, N. Y.—still operating as efficiently as ever.

7200 Hours A Year. The Carrier Centrifugal at the Narragansett (R. I.) Brewery operates on an average of 7200 hours a year—and brings the owner large annual savings.

24 Hours A Day. Operating 24 hours a day every day, the Carrier Centrifugal Refrigeration Machine at the Skenandoa Rayon Corp., Utica, N. Y. has drastically cut processing and refrigeration costs.

More Than 1000 In Use. Dr. Willis H. Carrier invented the Centrifugal Refrigeration Machine which represents the greatest improvement ever developed in mechanical cooling. Whether the requirement is for a minus 100° F. or for 1200 tons of water chilling capacity, the new range of Carrier Centrifugals takes care of every need — will meet refrigeration requirements more efficiently, dependably and at low operating costs. The operating records of the Carrier Centrifugal Refrigeration Machines cover two decades. Carrier brings to architects and consulting engineers experience gained in both peacetime and wartime industries.



The Navy "E", one of the U. S. Navy's most coveted honors, has been awarded to CARRIER for excellence in war production.

Just a Few Operating Records

WHERE INSTALLED	YEAR INSTALLED	AVERAGE HOURS PER YEAR
Convention Hall	1929	3,000
Printing Plant	1929	6,000
Textile Mill	1929	4,254
Rayon Manufacturer	1930	7,200
Drug Manufacturer	1938	3,946
Cosmetic Manufacturer	1936	6,612
Brewery	1935	7,200
Chemical Manufacturer	1933	5,000
Hospital	1934	7,200
Fruit Storage	1933	2,400
Hotel	1934	7,200
Broadcasting Studio	1930	3,100

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REQUIRED READING

(continued from page 20)

plan, the substantial low-cost housing, economical to maintain and comparing well in appearance with the neighboring mill supervisor's great house and with those of the town bourgeoisie.

Readers will wish that the arrangement of an otherwise readable work had been simpler: that, e.g., the chapter on the "Background of Lowell" and the appendix on the "Economic

Background" had been merged, similarly "A Decade of Growth" and "The Growth of the City."

WARTIME BUILDING CONSTRUCTION. New York, Chemical Pub. Co., 1942. 151 pp., 5½ by 8½ in., illus., \$4.00

A COLLECTION of 12 useful papers recording British wartime experience in the handling of materials—con-

crete, steel, brick, etc.; in special building types—the small hut, the single story factory; in construction types—the centerless arch, fire protection of structural steelwork.

An index is needed. A preface might have explained the references to "previous Building Editions," to "Wartime Building Editions," and to "Wartime Bulletin Chapter 3," which form the content of most of the astonishing faint patches in these unusually black pages. Statement of the fact that this "First American Edition" is a slightly abridged offset reproduction, on pages half the size of the original, of "Wartime Building Bulletins" 2-3, 5-7, 9, 11-16 of Great Britain's Department of Scientific and Industrial Research would not only have given authority to this anonymous collection of papers but would also prevent duplicate buying by libraries, firms and individual architects having purchased the Bulletins when they were published in 1940 and 1941.

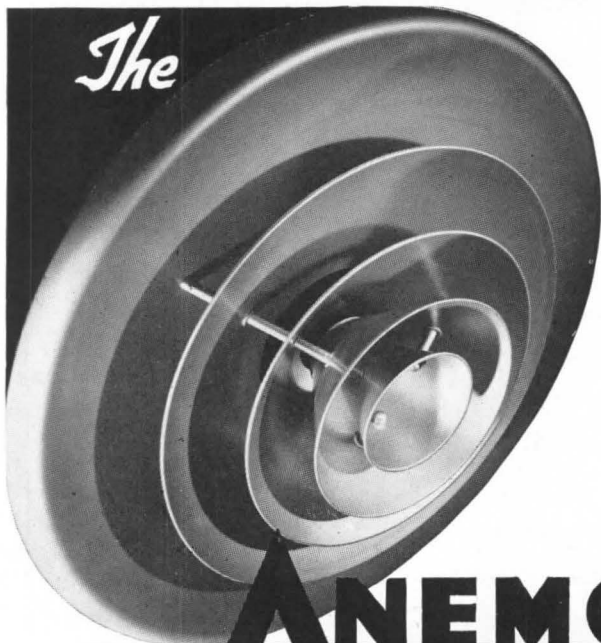
NEWPORT TOWER. By Philip Ainsworth Means. New York, Holt, 1942. 344 pp., 6 by 9¼ in., illus., \$5.00

IN architecture lies the best hope of solution of the 100-year controversy about the origin and purpose of "the most enigmatic and puzzling building in the U. S." After examination of over three hundred documents, from 1823 to 1939, witnesses in the case of what Vilhjalmur Stefansson calls the "non-fictional detective story," a former associate in anthropology at Harvard's Peabody Museum, identified also with Yale-National Geographic, Smithsonian, Haye Foundation and other researches, urges that space around the tower be excavated. He devotes half of his well considered guess as to results to their being nothing found, about a third to Norse evidence of 1211-1400, a twentieth to 1492-1580 European evidence, about a tenth to 17th century American.

HOW TO LIVE IN THE TROPICS. By Virginia Lloyd Hunt. New York, Harcourt Brace, 1942. 178 pp., 5½ by 8¼ in., tables, \$2.00

WRITTEN for the traveller and packed with observations on equipment and techniques for successful living in the tropics, this handbook includes many observations useful to those

(continued on page 88)



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Draftless Air Distribution

Permitting

High Velocities . . . Large Temperature Differentials

Resulting in

Minimum size Ducts and Equipment—
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Competent Service by Competent Engineers located throughout the country
To render service before and after installation.

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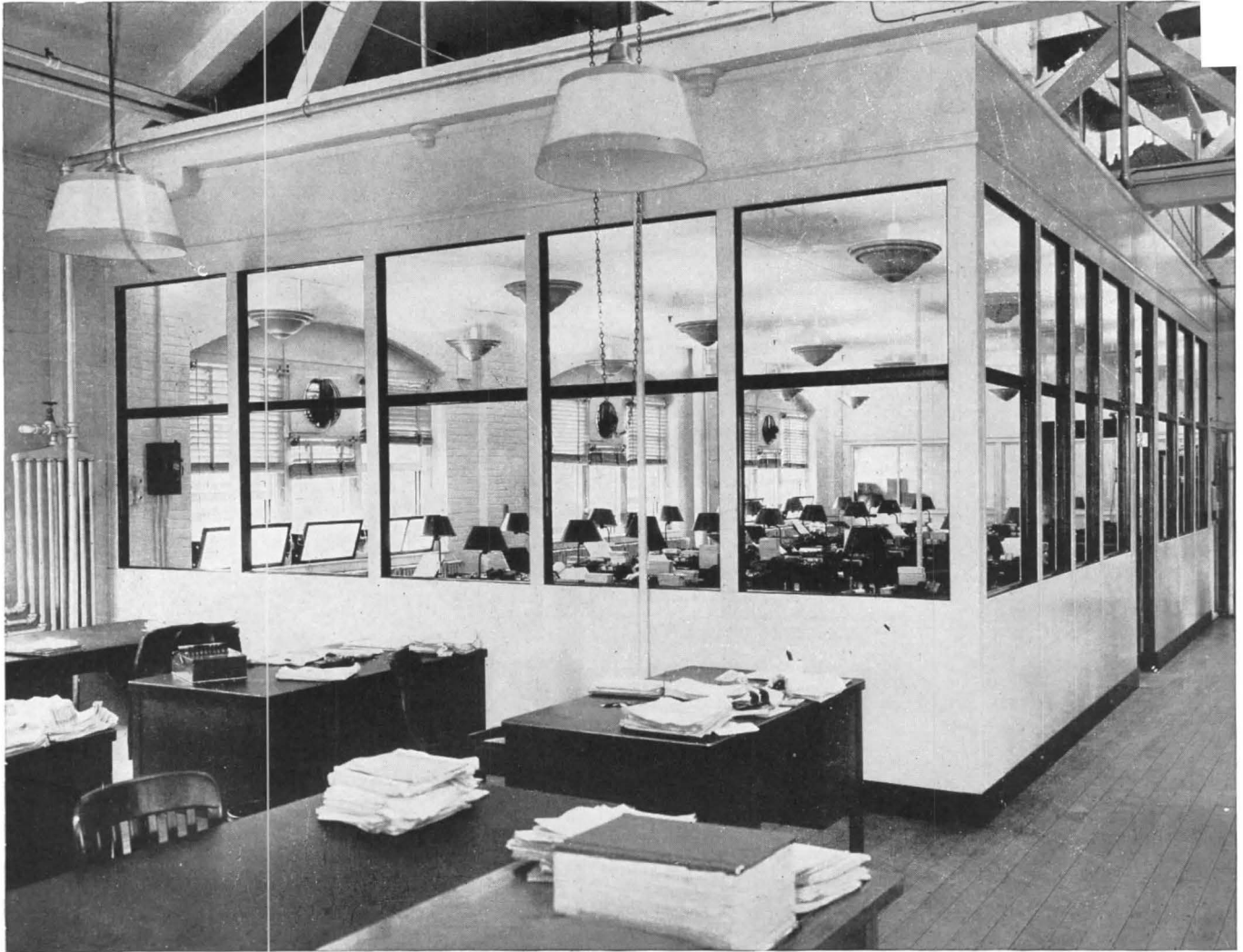
No air conditioning system is better than its air distribution

Anemostat Corporation of America

everywhere, and

10 East 39th Street

New York, N. Y.



Write SPEED into your Plant Office Specifications

WITH THESE MODERN MOVABLE WALLS

FEW, if any partitioning materials can be installed as rapidly as Transite Walls. In many cases these modern, movable partitions permit *complete new offices to be erected overnight*. And their asbestos-cement composition assures unusual durability, maximum fire-safety, continued low maintenance. Check these advantages—

QUICKLY INSTALLED—because of a patented construction method. Routine work need not be interrupted. Relocation is accomplished with 100% salvage.

STRONG, DURABLE, FIRE-RESISTANT—Transite

Walls provide all the solidity and privacy of fixed masonry walls. They are highly resistant to shock, impact and abuse.

FORM ANY TYPE PARTITION—free-standing, ceiling-high, solid, or in combination with glass. Ideal for any type of plant or office partition.

ATTRACTIVE APPEARANCE—The natural gray color of Transite Walls is ideal for plant or general office use. While this finish is permanent in itself, walls may be painted or treated with practically any other decorative finish.

RELEASE CRITICAL MATERIALS FOR WAR USE—because Transite Walls are composed principally of asbestos-cement sheets.

For details on J-M Transite Walls, see our Catalog in Sweet's, or write for brochure TR-22A. Johns-Manville, 22 E. 40th St., New York, N. Y.



Johns-Manville TRANSITE Movable Asbestos WALLS

REQUIRED READING

(continued from page 86)

knowing only temperate zones who may be called upon to design housing in our new bases in tropical and subtropical countries. The effect of a hot climate on the newcomer, tropical aspects of everyday functions and habits—perspiration, work, eating, drinking, dress, etc.—as well as sanitation and hygiene are handled in a thoroughly practical way, supported by

citations from leading authorities.

CITY-WIDE STUDIES, WPA of the City of New York under sponsorship of the Mayor's Committee on City Planning New York, Regional Plann. Assoc., 400 Madison Ave., [1942]. 3 vol., 137, 122, 176 pp., 128 maps, illus., tables. \$1.50 a set

AVAILABLE on Sept. 10 at a nominal price will be a limited edition of three volumes condensed from studies made

by WPA workers under expert direction in 1934-38.

These basic factual studies were made possible by the availability over a four-year period of an average of 250 workers to carry out detailed investigation. Not a little of the information acquired by this low-cost million dollar project has been available to specialists of many kinds during and since the years of its making; the distribution of this limited edition on a non-profit basis will be a boon to students of city planning, especially if libraries avail themselves of this offer.

TECHNIQUE OF PLYWOOD. By Charles B. Norris. Seattle, I. F. Laucks, Inc., 1942. 249 pp., 4½ by 7½ in., diags., tables. \$2.50

TOGETHER the works "Wood Technology" by Harry D. Tieman and "Modern Plywood" by Thomas D. Perry published last spring (ARCH. RECORD, Mar., 42, p. 26) and the present handbook cover plywood for manufacturer, engineer, architect, wood worker and the general reader. The present work, reprinted from a well tested series in the *Hardwood Record*, contains in convenient and relatively inexpensive form what the technician needs to know. Any reader will enjoy the chapter by Mr. Laucks on principles and practices of gluing.

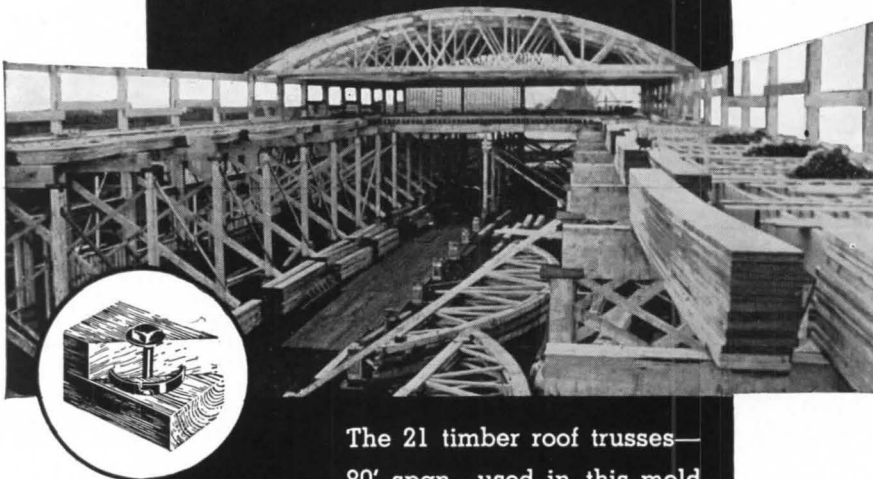
FIELD INSPECTORS' CHECK LIST FOR BUILDING CONSTRUCTION. Washington, D. C., Govt. Printing Office, 1942. 68 pp., 5 by 7½ in., \$0.20. (BMS81).

A USEFUL handbook compiled by the CHC's Subcommittee on Structure for use of the clerk-of-works. The arrangement is by order of procedure, and the enumeration of items under each stage of the work is detailed. A chapter on Final Records—guaranties, reports, contractors' affidavits, utility approvals, etc.—is well calculated to avoid many a painful afterthought; and there are useful appendices on points to watch.

STANDARD FILING SYSTEM. Washington, D. C., Amer. Inst. of Architects, 1942. 63 pp., 8½ by 11 in., \$1.00 (AIA Doc. 172).

TO MEET changes in one of the least stable of all industries, the field of building materials, appliances and equipment, comes this thorough revision of the 1937 edition with a greatly expanded index.

DELIVERED IN 6 DAYS



The 21 timber roof trusses—80' span—used in this mold loft at a modern shipyard, were framed, assembled, and delivered ready-to-erect in 6 working days after final lumber delivery.

The TECO Ring Connector spreads the load on a timber joint over practically the entire cross-section of the wood and brings the full structural strength of lumber into play.

Speedy and efficient construction of buildings ranging from small storage sheds to giant mold lofts, like this, is assured through use of the TECO Connector System of Timber Construction and a new engineering service offered to users of wood.

Timber

ENGINEERING COMPANY

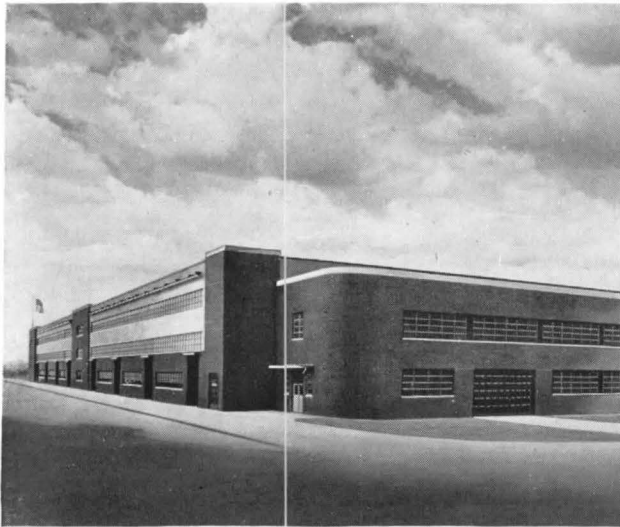
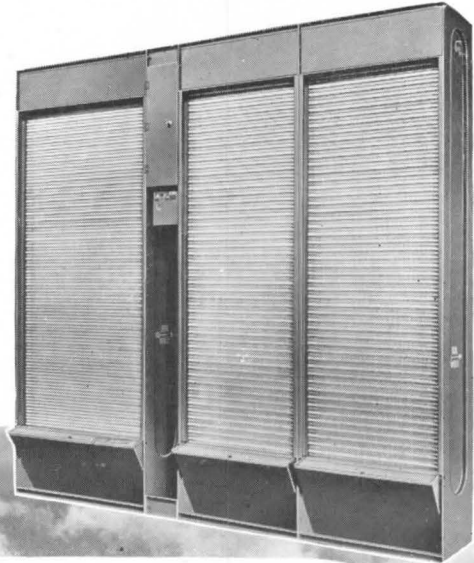
WASHINGTON, D. C.

PORTLAND, ORE.



Automatics

Keep the Air clean in the huge Ford Bomber Plant



The Importance of "Clean Air"

The fact that 100% of our output of dust control equipment is being delivered to war materials manufacturers attests the importance of *clean air* in the war effort. Vastly accelerated production schedules demand the protection of materials in process as well as the workers themselves—against the ravages of airborne dust.

MILLIONS of cubic feet of air per minute pass through the big batteries of American Automatic Filters installed in the Ford bomber plant to protect manufacturing operations and personnel from atmospheric dust.

American manufacturers have found AAF Automatic Filters a most economical and satisfactory means of cleaning air. The self-cleaning feature insures a constant, uniform air supply. No time out for cleaning is necessary—they clean themselves as they clean the air.

The collected dust is deposited in the Viscosine reservoirs at the bottom of the filters where it may be removed without disrupting continuous operation.

Send for "AAF in Industry" which completely describes the entire line of American Air Filtering and Dust Control equipment.



Two views of the Ford Bomber Plant.
ALBERT KAHN ASSOCIATED ARCHITECTS &
ENGINEERS, DETROIT.



AMERICAN AIR FILTER COMPANY, INC., 389 CENTRAL AVE, LOUISVILLE, KY.

INCORPORATED
IN CANADA, DARLING BROTHERS, LIMITED, MONTREAL, P. Q.

POSTWAR POTENTIALS FOR BUILDING

(continued from page 50)

If no emergency arises, that will mean that industry, individuals and local communities will be able to carry on with a minimum of Federal aid. If there is an unemployment emergency, the Federal government will step in. In either case the volume of public works projects will be very large.

Even if the Public Works Reserve program should never be implemented by Federal financial aid, it will have taught many local government bodies to program their improvement needs far ahead on a long-range basis; the six-year capital budget is usually the central feature of such a program. Such long-range programs are, of course, subject to revision, curtailment or expansion as they progress toward execution.

Since increased community facilities are an essential supplement to increased private construction, since community improvement needs are paramount in developing civilized living, and since very substantial progress is being made in advance planning of improvement programs, public works will contribute a vast amount of activity during the postwar period of catching up with deferred construction and well beyond the period. Industrial and transportation developments, improved community planning and urban redevelopment will all augment public improvement needs.

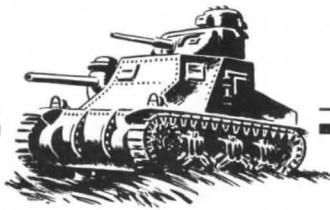
4. Prospects of Economic Expansion:

Assuming victory, the potentialities of great economic expansion and prosperity for the United States, with its great resources, technological development, enlarged productive facilities, high level of income and outstanding position in world affairs, are enormous. With sound policies and good management, with reference to our domestic affairs and to international relationships, this country should enjoy hereafter a greater prosperity than it or any other country has ever had.

Such prosperity cannot be achieved without enormous construction activity. Careful appraisal of long-range prospects indicates that the decade following the war should have a larger volume of construction than any previous decade in our history—assuming victory.

Help them

GET IN THE SCRAP



You know materials. This training can be invaluable to your local Salvage Committee *and to your country.*

You see idle equipment on your trips—old water heaters and tanks, bathtubs, abandoned industrial machinery, and much else. Urge the owners to turn in all scrap and useless equipment to a scrap dealer or the local Salvage Committee. (All scrap collected will be purchased by the steel industry at prices set by the Government.)

America desperately needs this scrap to *shorten* the war. For scrap must be mixed with pig iron *half and half* to make new steel for tanks, trucks, ships and guns . . . weapons your country must have *ahead of any metal building materials for civilian construction.*

The quicker America wins the war, the sooner all of us can return to constructive work and peaceful living. Help get this vital job done. *Get in the scrap!* The American Rolling Mill Company, 2621 Curtis Street, Middletown, Ohio.

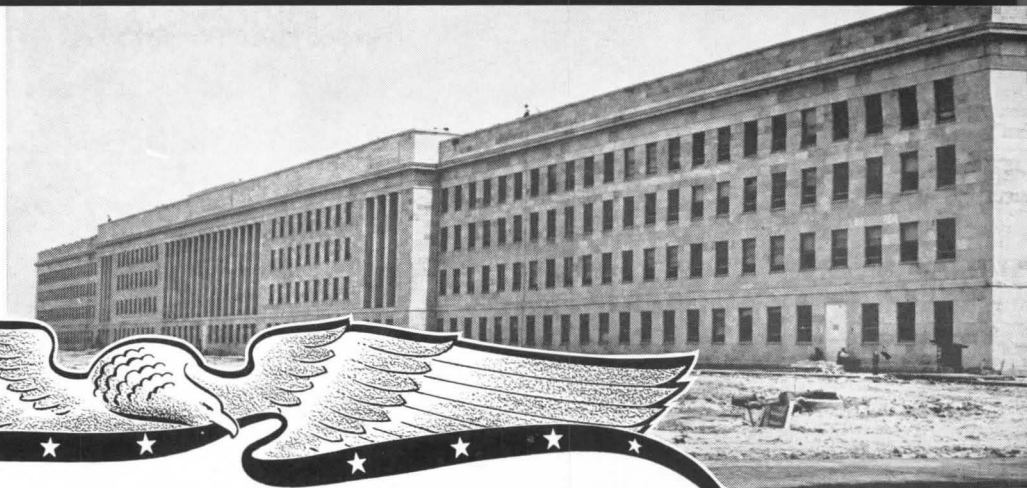
★ ★ ★ ★ ★ ★ ★ ★ ★ ★

This advertisement is in support of the Salvage Program of the Bureau of Industrial Conservation, the War Production Board.

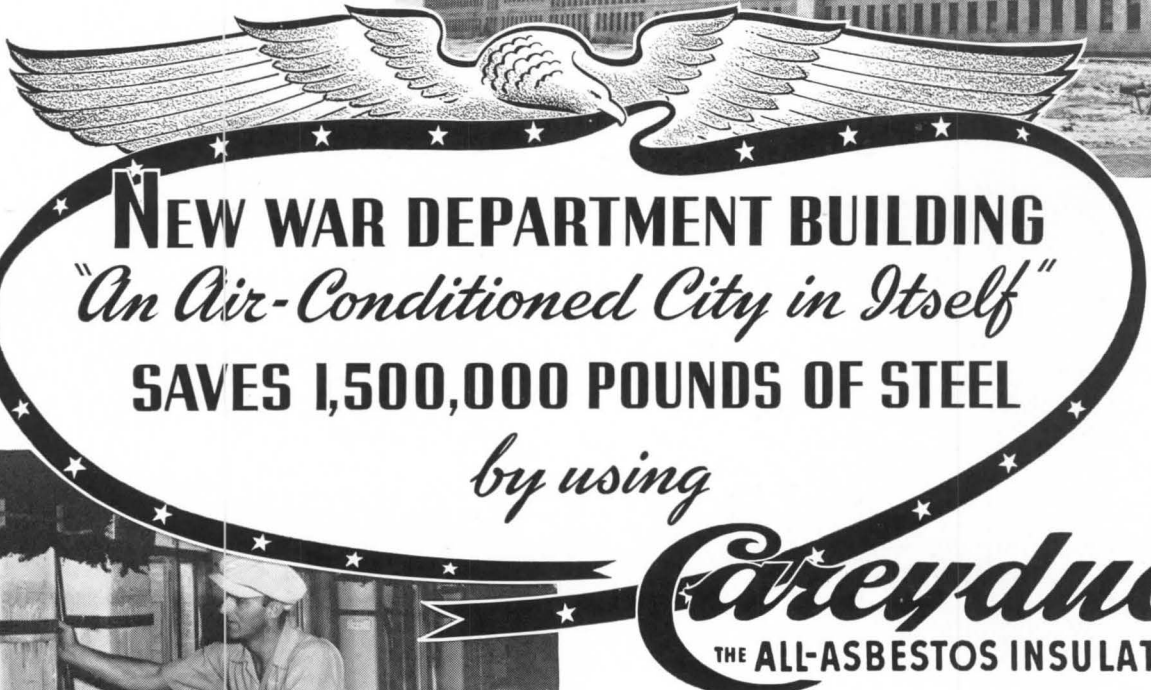


Big facts

New War Department Building believed to be the largest office building in world . . . Will house 30,000 workers . . . Air Conditioning System required approximately 25 miles of Careyduct . . . 10,000 Careyduct Elbows and fittings . . . 80,000 pounds of Carey Adhesive Cement . . . A total of 65 carloads of material . . . Careyduct saved over 1,500,000 pounds of steel in the air conditioning system of this building.



Photographs in this advertisement released by Materiel Div., U. S. Army Procurement Div.



NEW WAR DEPARTMENT BUILDING

"An Air-Conditioned City in Itself"

SAVES 1,500,000 POUNDS OF STEEL

by using

Careyduct

THE ALL-ASBESTOS INSULATED DUCT

**Meets Rigid Standards of Government Engineers
—Advantages Over Metal Demonstrated in
Important Jobs All Over Nation.**

Millions of pounds of steel have been saved by using Careyduct in air-conditioning the new War Department Building at Arlington, Va., and hundreds of other important public and private structures throughout the country. Yet saving vital steel is but one of the many advantages of using Careyduct. Made entirely of asbestos, it is a natural sound absorber; hushes equipment noises and metallic "cracking" due to pressure changes or expansion strain. By reducing noise, higher velocities with smaller sizes may be used, solving difficult problems where space is limited.

Factory fabrication eliminates costly shop work; saves time, man-power. Silent erection permits installation in occupied buildings such as hospitals, radio stations, banks, etc. With all its advantages, Careyduct costs no more, frequently less, than insulated metal duct.

To conserve steel—insure better air-conditioning—specify CAREYDUCT. Write for full information, address Dept. 21.

THE PHILIP CAREY MFG. COMPANY

Dependable Products Since 1873

Lockland, CINCINNATI, OHIO

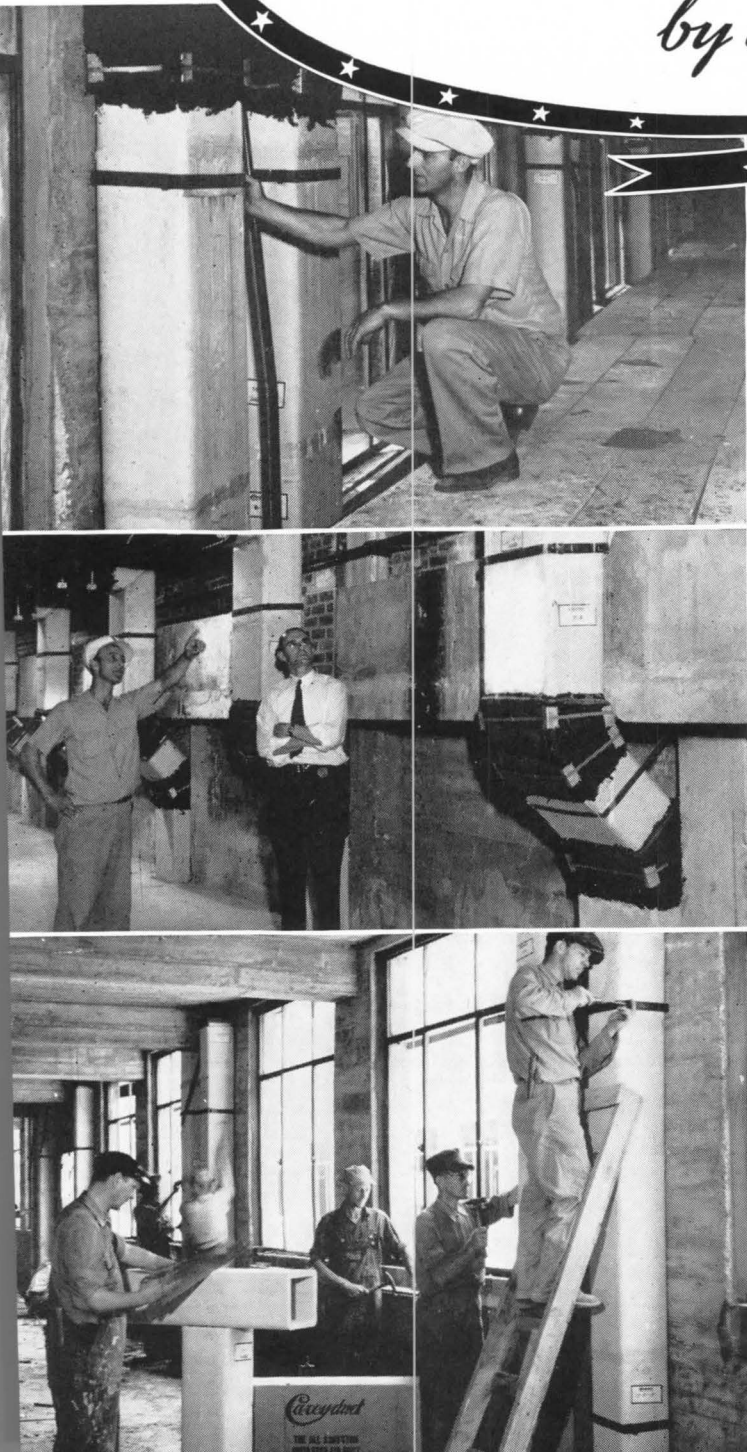
In Canada: The Philip Carey Co., Ltd. Office and Factory: Lennoxville, P. Q.

Architect: George Edwin Bergstrom

General Contractors: John McShain, Inc.

Heating and Air Conditioning: Baker Smith & Co., Inc.
Mehring & Hanson Co.

Consulting Engineer: Chas. S. Leopold



Careyduct
THE ALL-ASBESTOS
INSULATED AIR DUCT

AT
PIEDMONT SHIRT CO., TOO
 —**NORTHERN HARD** **Maple**



New plant of the Piedmont Shirt Co., Greenville, S. C.—floored with MFMA Northern Hard Maple.

*"Takes on a Smoother
 Appearance with use"*

says

H. S. ABRAMS, Supt.

"Since flooring our building (the home of nationally-advertised Wings Shirts) we wish to express our deepest satisfaction with the Northern Maple stock which we used," says Mr. H. S. Abrams. . . . "We have noticed from month to month that the flooring takes on a better and smoother appearance with use. We are particularly pleased with the hardness of the floor and the fact that there is no possible chance of it splintering. This was a constant source of trouble to us in our old building."

In mills everywhere, Hard Maple's daily satisfaction and eventual economy have been proved through the years. When you build, remodel, or re-floor, don't fail to investigate MFMA (trade-marked, guaranteed) Northern Hard Maple.

MAPLE FLOORING MANUFACTURERS ASSOCIATION
 1782 McCormick Building, Chicago, Illinois

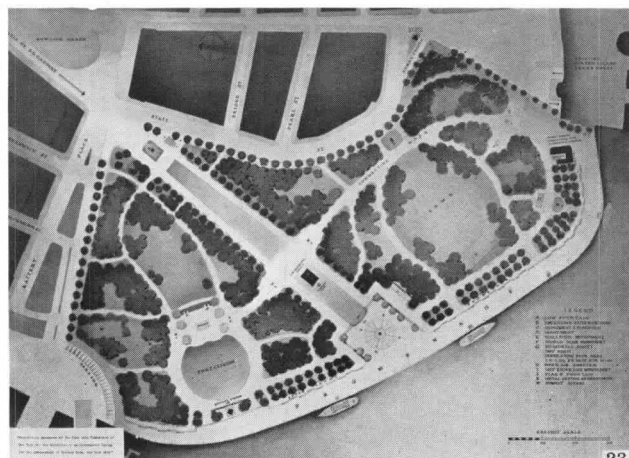
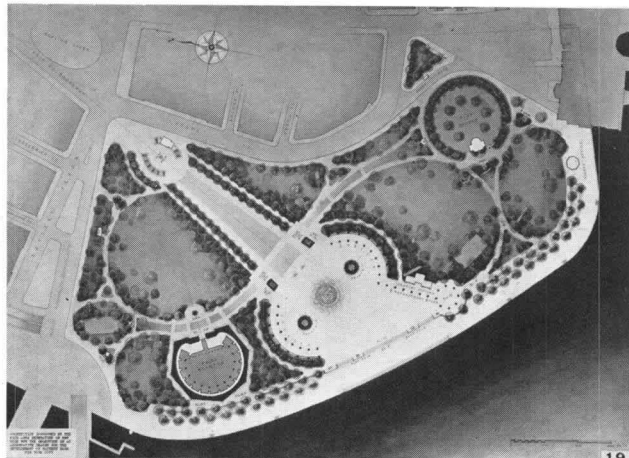
Write for folder on heavy-duty finishes for old or new Maple floors,
 which further reduce cleaning costs. See Sweet's, Sec. 11/82.

Floor with
MFMA Maple
REG. U. S. PAT. OFF.
 (NORTHERN HARD)

THE RECORD REPORTS

(continued from page 16)

Winning Designs for New York's Battery Park

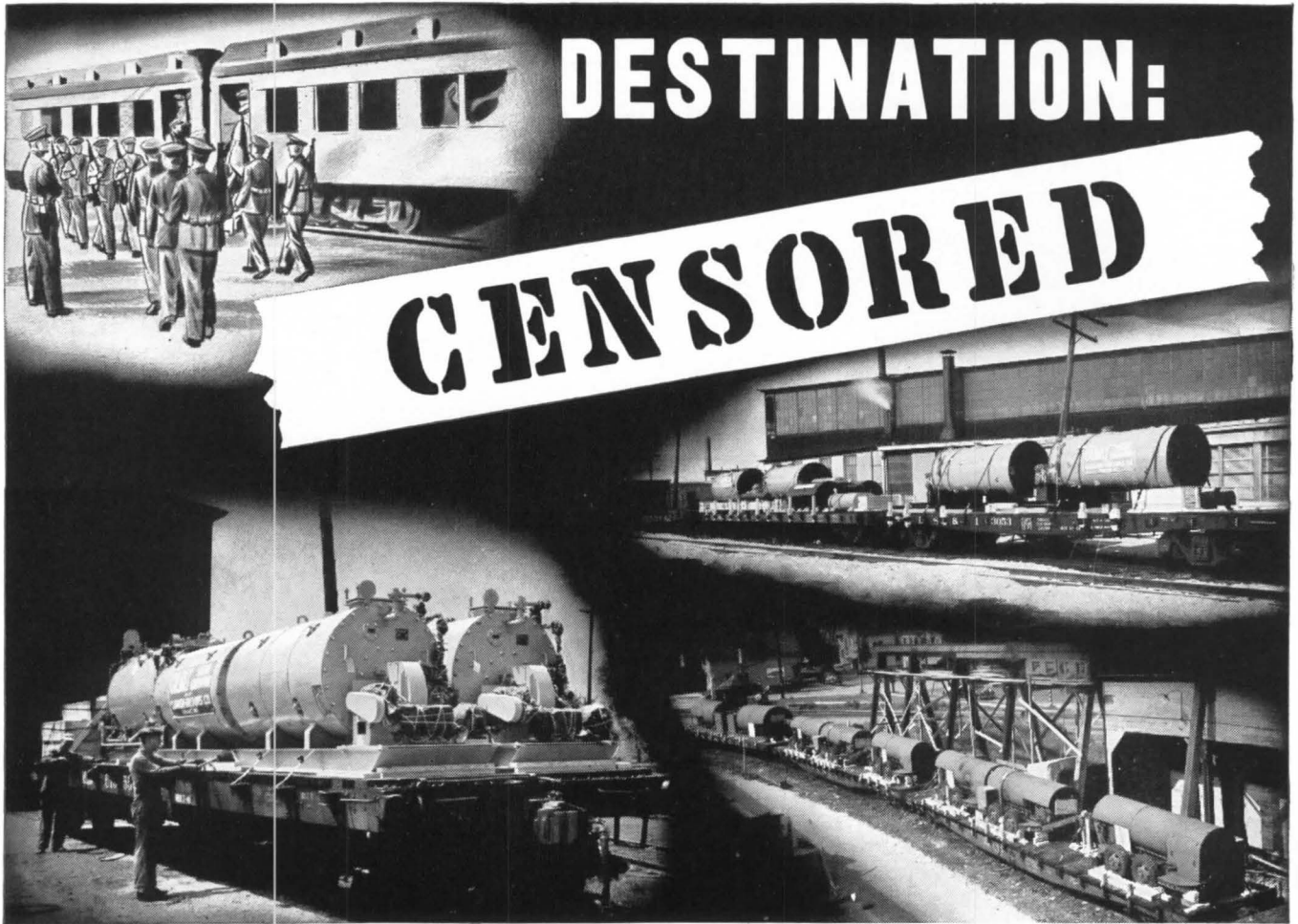


First prize winning design (above) was that of Walter W. W. Jones, Brooklyn architect. Below is design by Philip Sanfilippo and Vito P. Battista, Brooklyn architects, and David Davis, Manhattan landscape architect, which took the second award

A VOLUNTARY EFFORT on the part of a group of citizens and by the Fine Arts Federation of New York, the competition for redesigning Battery Park was conducted as "a contribution to the furtherance of civic development and the preservation of historic structures." The program specifically stated that the competition was conducted solely as a public-spirited gesture, that it had no authorization from City authorities, nor did it contain any implication that the design or services of the winner would be utilized. In effect, the competition served as a counter-argument to the contention of Park Commissioner Robert Moses that in reconstructing the park, the old Aquarium, a favorite "sight" of the city, should be demolished; in all competition drawings, the Aquarium is not only maintained but restored to its original form as Fort Clinton—a basic requirement of the competition.

The first prize of \$500 (the competition was restricted to registered architects and landscape architects of Greater New York) went to Walter W. W. Jones, Brooklyn architect; second prize was awarded to a collaborative group: Philip Sanfilippo and Vito P. Battista, both Brooklyn architects, and David Davis, Manhattan landscape architect. Honorable mentions were given to the designs submitted by Delano and Aldrich, Manhattan architects; Harry Leslie Walker, architect, also of Manhattan; and Maud Sargent, Manhattan landscape architect.

Thirty-seven plans were entered, and the following judges constituted the jury: James C. Mackenzie, FAIA; Edward Shepard Hewitt, FAIA; Adolph A. Weinman, sculptor, former president of the National Sculpture Society; Ralph Griswold and Armand Tibbets, landscape architects; and Thomas S. Holden, president of F. W. Dodge Corporation.



Scenes of carload shipments like those above are almost a daily occurrence at the Cleaver-Brooks Company plants.

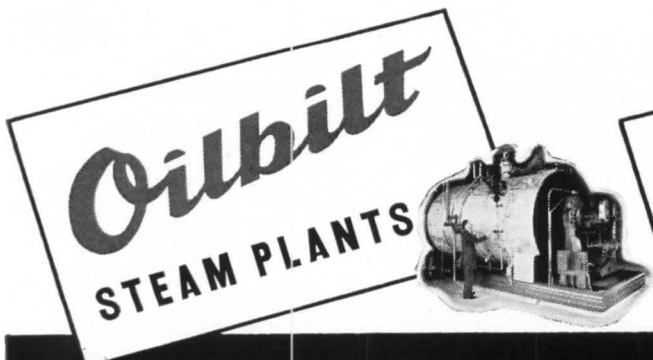
Oilbilt steam generators and Cleaver mobile heating equipment are being started on their way to "unknown" destinations on the far flung fronts of global war as well as bases at home.

The construction of special steam generating plants — hot water heating equipment — distilling, sterilizing, disinfecting units, employing the use of the proven Oilbilt and Cleaver multi-pass, down-draft, fuel oil heating principle, has long been our contribution to the war effort.

Cleaver bituminous boosters and tank car heaters, too, have played an important part in the swift construction of military roads, airports and runways . . . providing fast, efficient heating of bituminous material in tank cars and storage tanks at lowest cost.

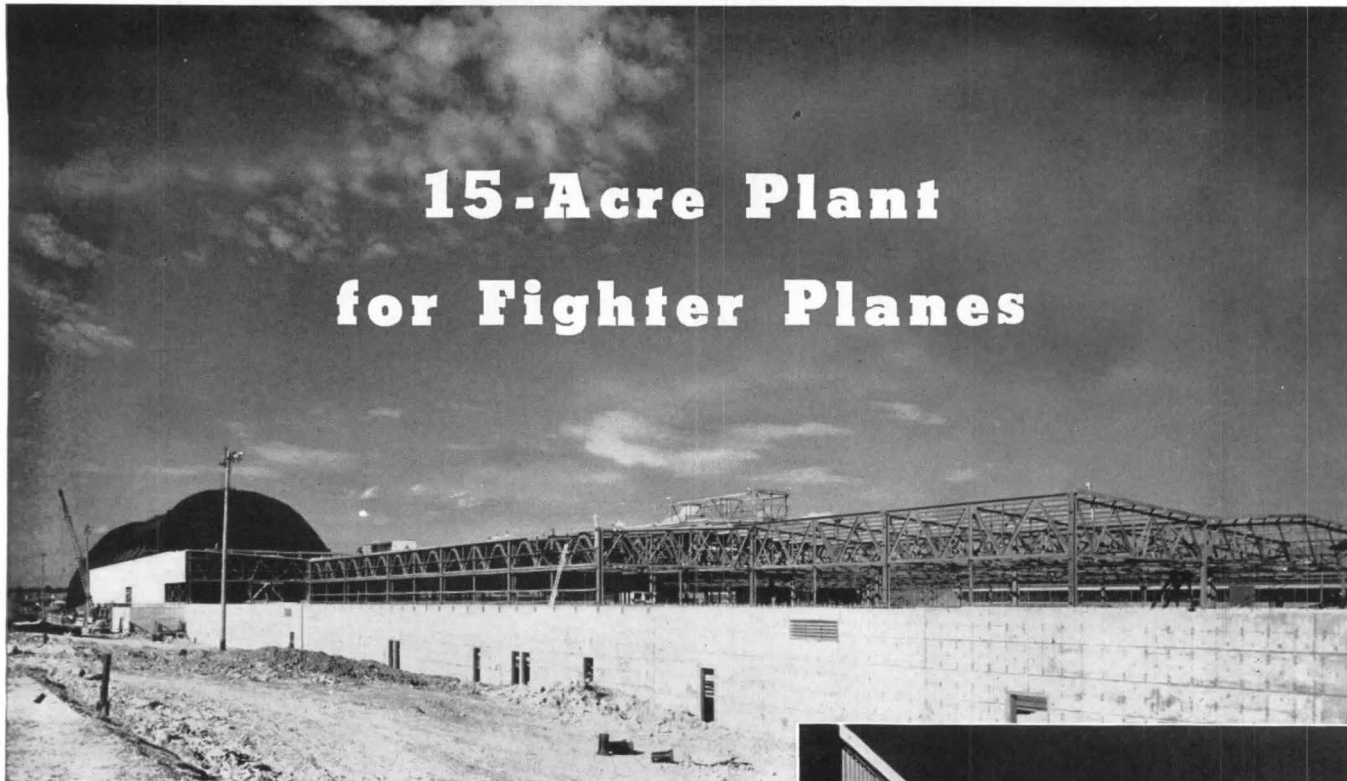
Even though the major part of our production now is allocated to the needs of the military services — such "Victory" effort naturally comes first — we welcome your inquiry concerning the value and advantages of Oilbilt steam plants and Cleaver bituminous boosters and tank car heaters for your future needs.

CLEAVER-BROOKS COMPANY
5119 N. 33rd STREET • MILWAUKEE, WISCONSIN



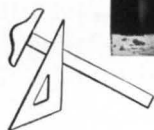
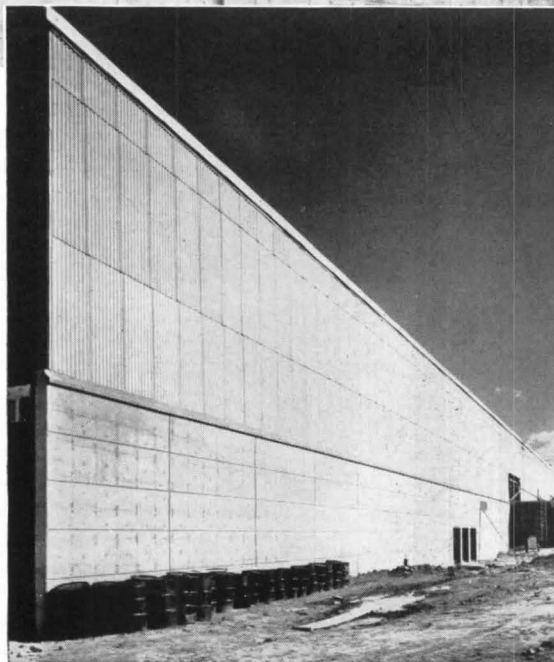
CLEAVER-BROOKS COMPANY • MILWAUKEE, WISCONSIN

15-Acre Plant for Fighter Planes



Somewhere in America the Sikorsky Plant, shown here, is fast nearing completion. Covering an area of 652,500 sq. ft., this completely windowless, 100 per cent fireproof plant, will soon be turning out large numbers of the new 400 m.p.h., long-range Vought-Sikorsky Corsair fighters for the Navy.

An unusual feature of the Sikorsky Plant is the walls. On the west side of the building, shown above and right, is a bomb-fragment-proof wall, of 10-in. reinforced concrete, 15 ft., 4 in. high. This is designed to provide air-raid protection for employees, as well as protection for emergency hospital, vault, general offices, and other key elements. The other walls of the structure are of corrugated asbestos composition, $\frac{5}{8}$ in. thick, backed up by $1\frac{1}{2}$ in. of insulation. These walls rest on steel girders so that, should a bomb hit, only bays actually demolished need be replaced. Fire curtains are included to prevent the spread of fire to any other section of the plant.



Architects and Engineers: J. Gordon Turnbull, Inc.

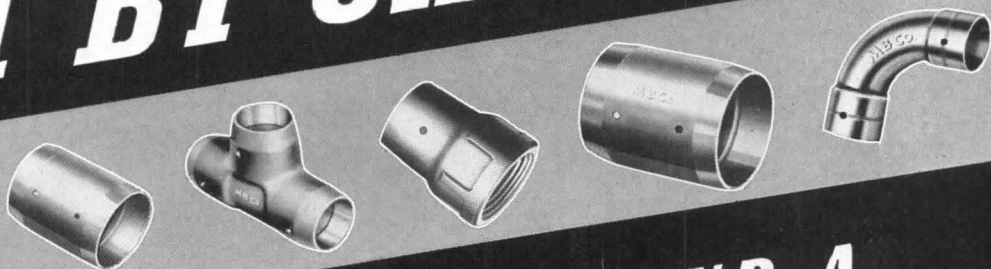
Contractors: Clemmer Construction Co.

Construction has provided a 40-ft. ceiling throughout. There are four aisles 1050 ft. long, with 100-ft. spans, and one 450-ft. aisle with a 200-ft. span and two aisles with 100-ft. spans. A cafeteria on the main floor accommodates 600. General offices and storage space are located on a mezzanine which runs along one side of the rectangular structure for a distance of 1000 ft. Fabrication and erection of the 8000 tons of structural steel were carried out by the Bethlehem Steel Company.

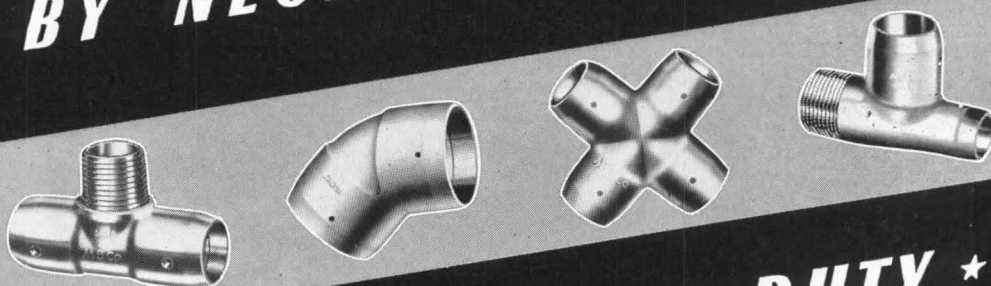
BETHLEHEM STEEL COMPANY



NOT BY CHOICE ★



BUT BY NECESSITY AND A



PATRIOTIC PRIVILEGE OF DUTY ★

BRASS CO.—PORT
MICH.—STREAMLIN
ARD—GOVT.—TYPE M—



WINNERS OF NAVY "E" AWARD

**MUELLER
BRASS CO.
PORT HURON, MICH.**

● Up until a few months ago, we still thought, here in America, that we might keep out of this second World War. We wanted to mind our own affairs and go on with the business of building up rather than tearing down—of pursuing peace and prosperity.

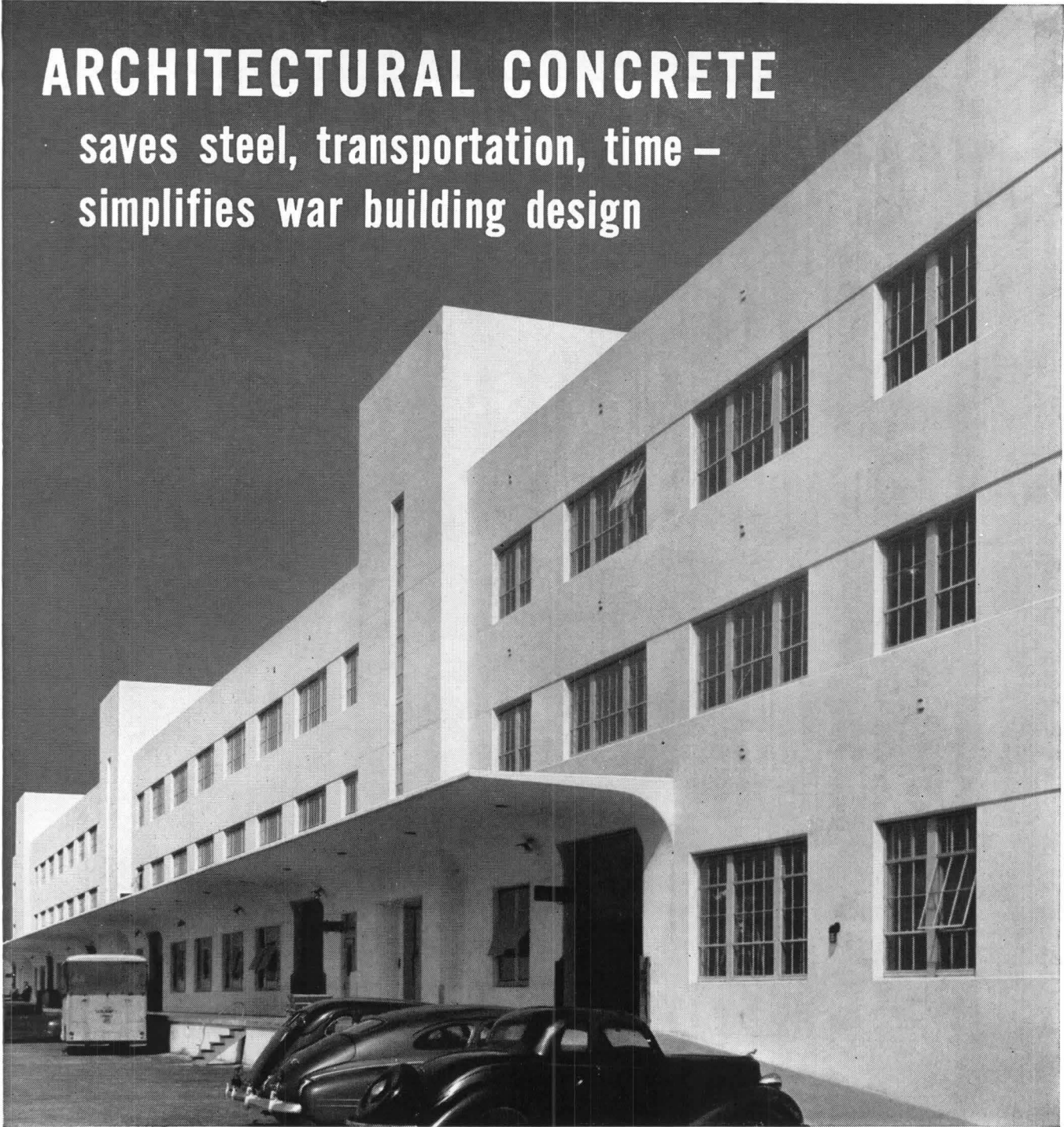
We at the Mueller Brass Co. wanted to go on making, among other good products of copper and brass, STREAMLINE copper pipe and fittings for the finest plumbing and heating conducting systems in the world. We didn't want war business . . . we wanted to keep our peace-time business with the plumbers and steamfitters of America.

But now our plant is engaged 100% in the production of war materials. Brass and bronze are safeguarding the life of the nation, but after peace is won, we will again manufacture and supply an even better STREAMLINE copper pipe and fittings.

So we are producing those things which Uncle Sam requires of us, with every ounce of skill and energy which we possess, not by choice, but by necessity and a patriotic privilege of duty, to the end that freedom, peace and prosperity be ours once more—and that those very businesses of which we are temporarily deprived be regained in the shortest possible time.

ARCHITECTURAL CONCRETE

saves steel, transportation, time —
simplifies war building design



IT IS often an aid in the war program to design building walls in concrete as a unit with frame, floors and roofs, for these reasons:

1. Maximum fire resistance and structural integrity—vital protective factors—are obtained with minimum steel.
2. Transportation facilities are conserved, since the bulk of concrete material is usually found locally.
3. The job is speeded by simple, quick concrete methods, accessible materials, local labor.
4. Architectural distinction is easily given to war buildings of straight forward or even severe design, by interesting textures and simple decorative effects inexpensively produced in the forms.

This huge, heavy-duty, firesafe supply depot for a naval air station was planned by Robert & Co., of Atlanta, and built by Hillyer & Lovan, Jacksonville, contractors.

• • •

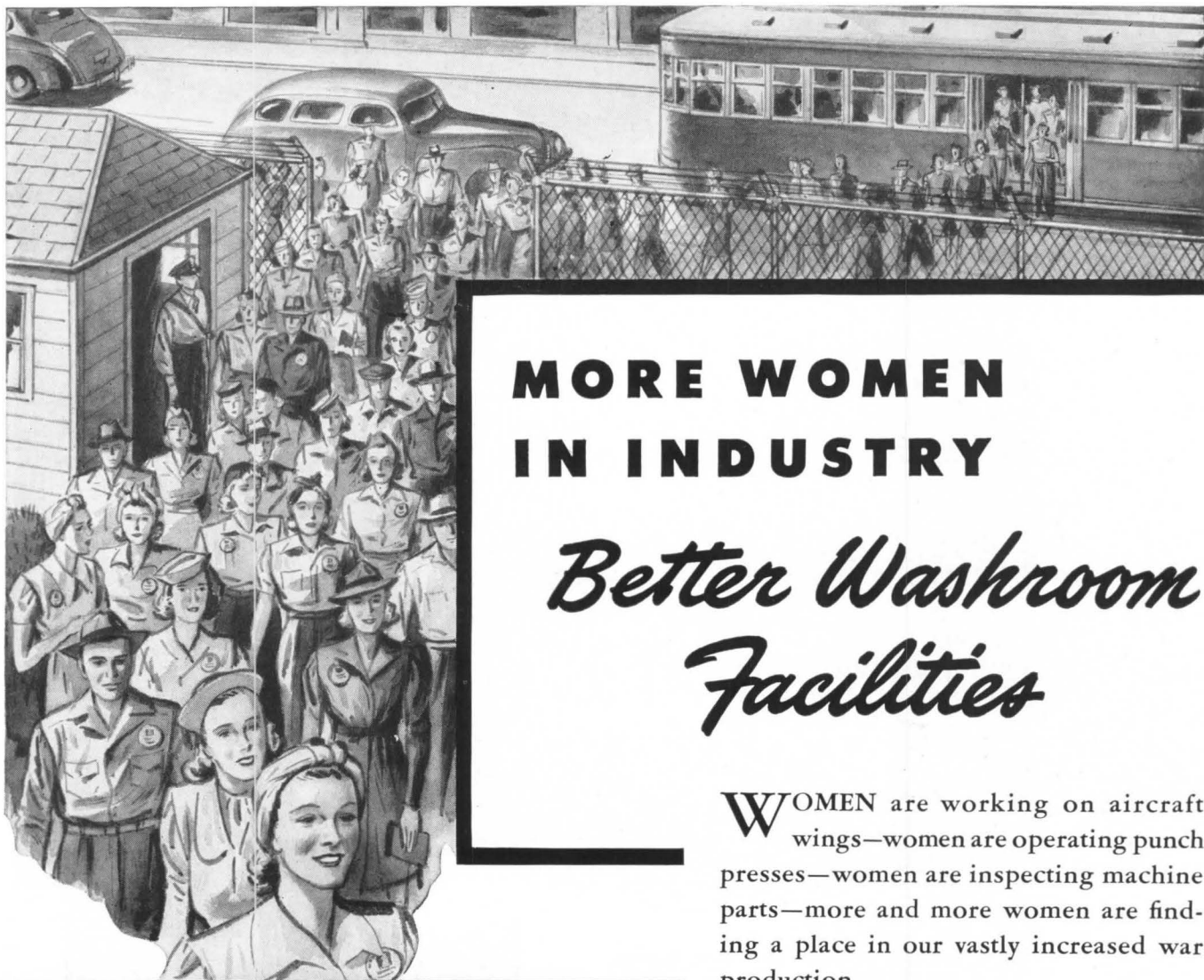
To help get the maximum service which Architectural Concrete can render, the Portland Cement Association's specially trained staff of technicians is available to assist designers and builders of major war buildings.

Do not hesitate to call on us for this service or for concrete data on any type of war construction that will help expedite work or save steel and transportation.

PORTLAND CEMENT ASSOCIATION

Dept. 9-8, 33 W. Grand Ave., Chicago, Ill.

★ BUY WAR SAVINGS STAMPS AND BONDS ★



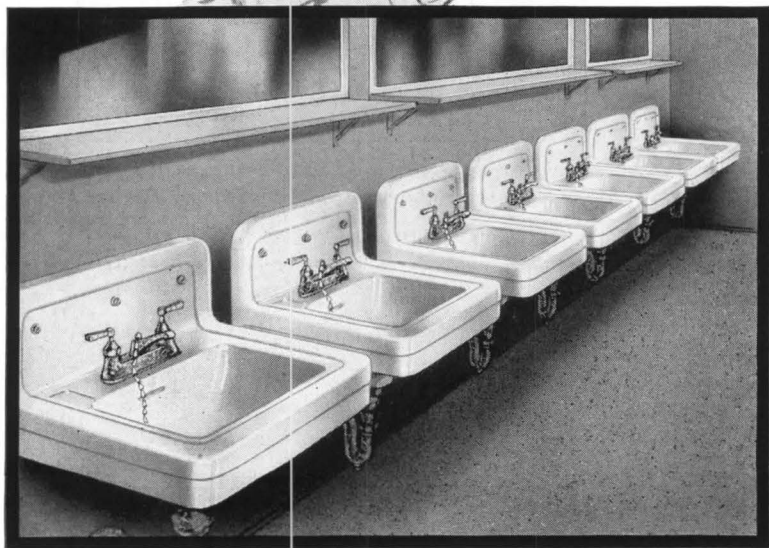
MORE WOMEN IN INDUSTRY

Better Washroom Facilities

WOMEN are working on aircraft wings—women are operating punch presses—women are inspecting machine parts—more and more women are finding a place in our vastly increased war production.

And women in industry need washrooms—more of them—with better facilities—washrooms equipped for the tough service of a none too careful public.

Crane plumbing is designed to give industry the service it has a right to expect from washrooms. And what is more, Crane engineers have designed this equipment to use a minimum amount of critical materials. When adding to your washroom facilities, or modernizing your present plumbing equipment, be sure that your Plumbing Contractor installs Crane fixtures.



CRANE

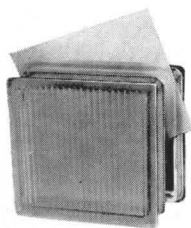
CRANE CO., GENERAL OFFICES:
836 S. MICHIGAN AVENUE, CHICAGO
PLUMBING • HEATING • PUMPS
VALVES • FITTINGS • PIPE

NATION-WIDE SERVICE THROUGH BRANCHES, WHOLESALERS, PLUMBING AND HEATING CONTRACTORS

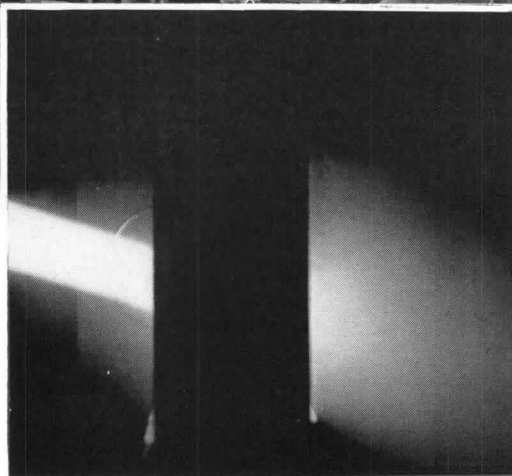


PC BRISTOL LX-75

Light-diffusing glass blocks



THIS PC Glass Block is specially designed to accomplish three things: (1) to diffuse and soften transmitted daylight; (2) to decrease objectionable glare; and (3) to reduce solar heat transmission. It is therefore particularly suitable for use in defense plants, such as that shown above, and is being widely used in their construction today. A Fibreglas screen is inserted between the two halves of the block before they are fused together, and this insert, combined with the face pattern of the block, produces maximum light diffusion while sacrificing little in light transmission. And the appearance of a panel of these blocks is unusually attractive. Like all other PC Glass Block patterns, the Bristol LX-75 is immediately available. Complete information, including installation details, will be sent you upon request. Pittsburgh Corning Corporation, 2101-2 Grant Building, Pittsburgh, Pa.



THIS PHOTOGRAPH shows how PC Bristol LX-75 Glass Blocks diffuse transmitted daylight. The ray of light, striking the outside face of the block in concentrated fashion, is diffused by the Fibreglas screen and the face pattern of the block as it is transmitted into the room.



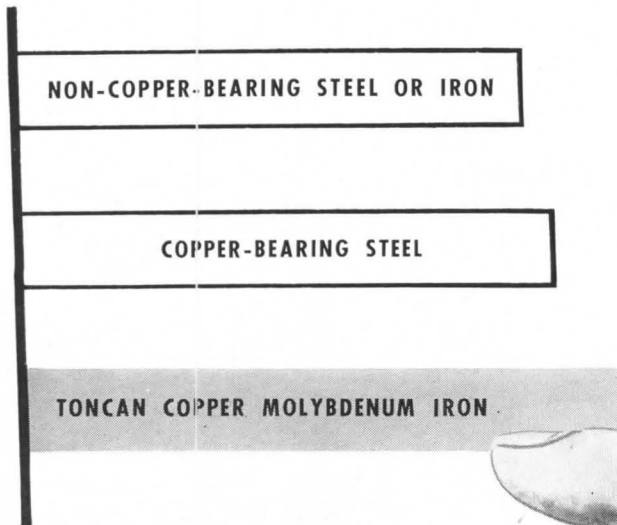
GLASS BLOCKS

Distributed by
 PITTSBURGH PLATE GLASS COMPANY
 and by W. P. Fuller & Co. on the Pacific Coast

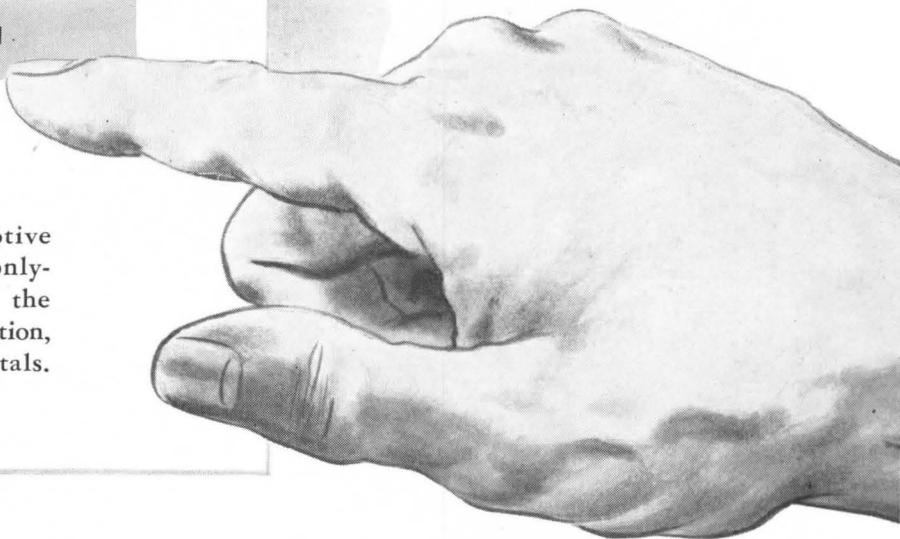
"PITTSBURGH" stands for Quality Glass

Toncan Iron has a Head Start

IN RESISTING RUST
AND CORROSION!



This chart is based on the Electromotive Force Series of Metals, the commonly-accepted, scientific demonstration of the relative "nobility"—resistance to solution, thus resistance to corrosion—of metals.



Right from the start, Toncan Iron Sheets have what it takes to resist corrosion—because Toncan Iron is an *alloy iron*. It is highly refined *open-hearth iron* with which the correct proportions of copper and *molybdenum* are alloyed to obtain the best rust-resistance of all ferrous metals in its price class.

Toncan Iron is *not* a copper-bearing steel. We make copper-bearing steel, too. But it's not like Toncan Iron—there's *nothing* just like it.

Because it is processed to Republic's *exclusive* formula—because it contains *molybdenum* (the element that endows many fine alloy steels with their excellent qualities)—because it has *twice as much copper* as the best copper-bearing steel or iron—Toncan Iron has a head start over all other ferrous materials in the battle against rust and corrosion. And the head start is more and more evident in tough service—when

Toncan Iron continues to last after other sheet metals have failed.

To serve your clients better in Construction for Victory, specify Toncan Iron Sheets for rust and corrosive applications.

REPUBLIC STEEL CORPORATION

General Offices: Cleveland, Ohio

Berger Manufacturing Division • Culvert Division
Niles Steel Products Division • Steel and Tubes Division
Union Drawn Steel Division • Truscon Steel Company
Export Department: Chrysler Building, New York City



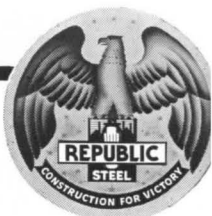
Write for the new book, "A Few Facts about Toncan Iron for Architects and Engineers"—and see Sweet's 13/6. Also see Section 27/3 for pipe; 23/5 for Steel and Tubes; 9/1 and 21/2 for Berger; 15/18 for Truscon Products.

REPUBLIC

Toncan Iron SHEETS

Reg. U. S. Pat. Off.

An alloy of refined open-hearth iron, copper and molybdenum—that grows old slowly





WHERE EYES SEE VICTORY BORN

Here is man-made daylight for the eyes that first see America's blueprints of victory.

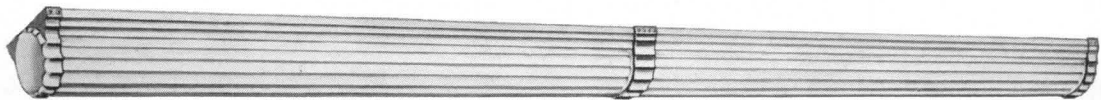
In the nation's longest unobstructed drafting room, Westinghouse ceiling-mounted fluorescent units function as a single light source—help guide the pen that draws the sword. These continuous lines of fixtures deliver fifty footcandles of diffused light, without glare or shadows on vital materiel designs.

Lighting that eases the strain on hard-worked eyes and nerves, we at Westinghouse call *engineered seeing*. It is illumination created by scientifically designed lighting equipment, expertly applied to achieve the best possible visibility conditions. *Engineered seeing* is at work in hundreds of American industrial

offices, drafting rooms, and on miles of 'round the-clock production lines.

Today we are turning out a complete line of lighting equipment—*engineered seeing* for practically every phase of America's battle of production. From our Lighting Division come fluorescent and incandescent luminaires for all types of industrial operations, lighting equipment for airfields and seadromes, and lighting units for night-time protection against sabotage.

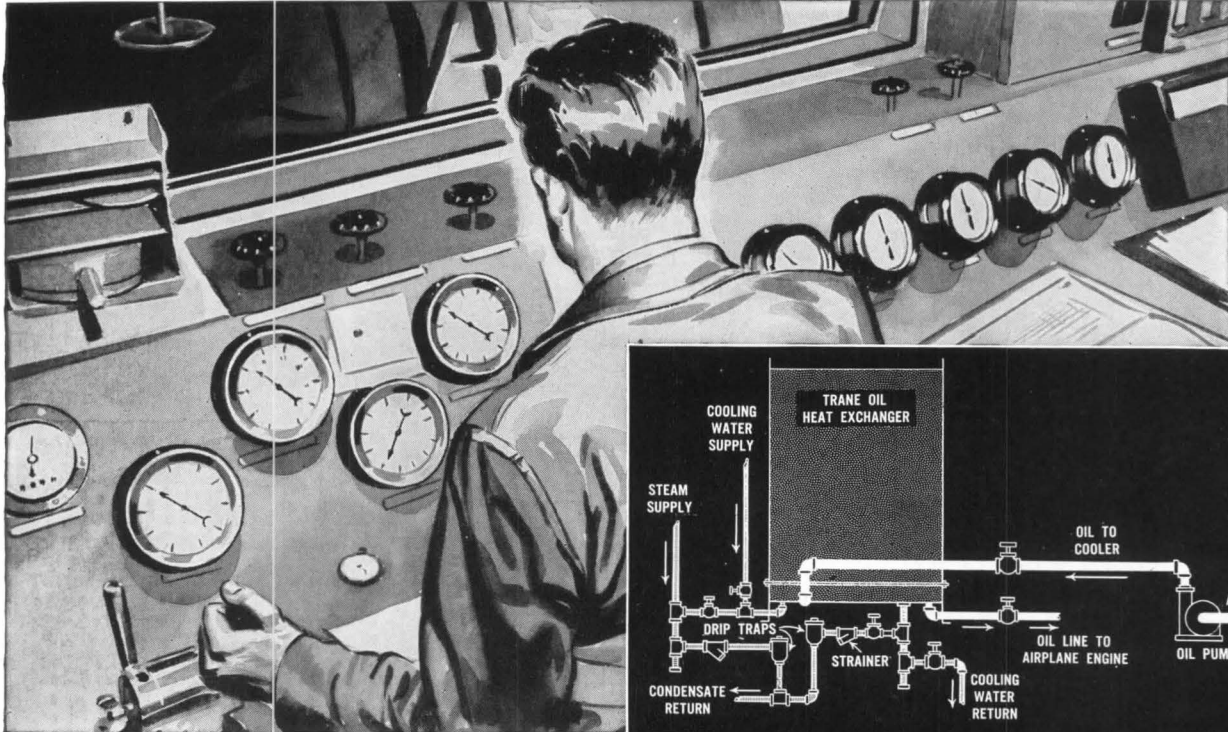
These lighting systems and expert engineering help are available through 117 Westinghouse Electric Supply Company Offices and Independent Lighting Distributors. Westinghouse Electric & Manufacturing Company, Edgewater Park, Cleveland, Ohio.



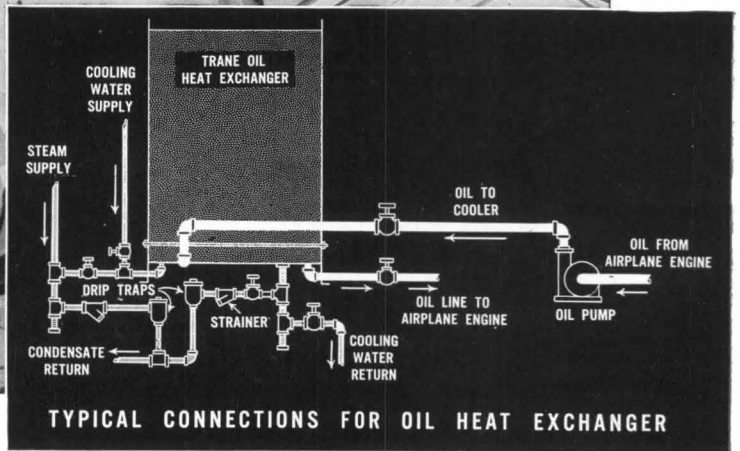
Westinghouse 2-CL-40, Ceiling-mounted, Continuous Strip Fluorescent Luminaire



Westinghouse *Lighting Equipment*

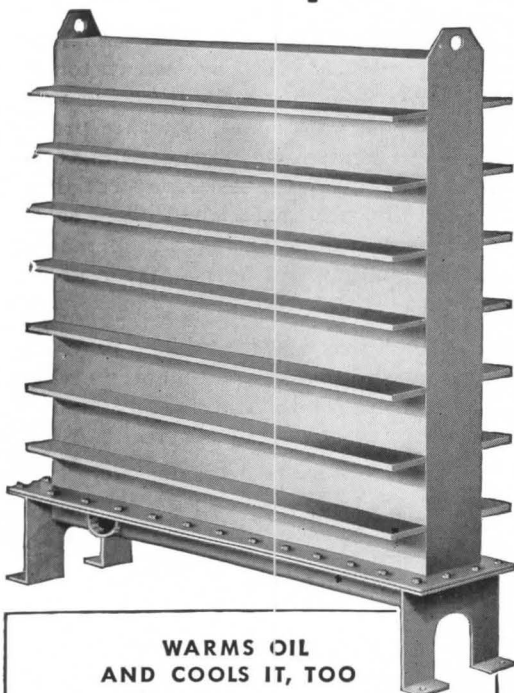


Showing piping connections which make it possible to use the Exchanger for warming oil as well as cooling it.



NEW TRANE OIL HEAT EXCHANGER

speeds aircraft engine testing



WARMS OIL AND COOLS IT, TOO

This Trane Oil Heat Exchanger warms the oil with steam, cools it with water. Externally ribbed to enable the flat surfaces to withstand the necessary pressure without excessive weight. This represents another of the many problems solved through the use of Trane heat transfer equipment of both standard and special design.

AN IMPORTANT producer of airplane engines needed a combination unit to control oil temperature of engines on test.

During the starting-up period, the unit was required to deliver warm oil to the engine, and during the running period the unit was required to hold the temperature below a certain limit.

Specifications called for a light, compact, durable heat exchanger that would be easy to mount and take down for cleaning. It had to have a casing that would withstand 30 pounds oil pressure, and, finally, only a limited amount of cooling water could be used.

The Oil Heat Exchanger illustrated here was designed by Trane engineers to fill the requirements. Going a step beyond the letter of the specifications, Trane engineers produced a unit that could be thoroughly cleaned without disconnecting any of the heating, cooling, or oil line piping.

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The facilities of the Trane design engineering department are at the disposal of government and industry in the design of new and refined equipment to meet the many demands created by a nation at war. Because standard Trane heating, cooling, drying, air handling and related products are used in so many fields of industry, Trane engineers have a thorough knowledge of the equipment requirements of industry. Your nearby Trane field office will be glad to furnish additional details.

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as much

CALDWELL SASH BALANCES require a minimum amount of that scarce material, steel. They weigh only 1/10 as much as weights, chains and pulleys. Architects not only save a tremendous amount of metal when CALDWELL BALANCES are specified for industrial building, but they also can plan with strictest economy in keeping with the country's policy of producing the most with least time and material.



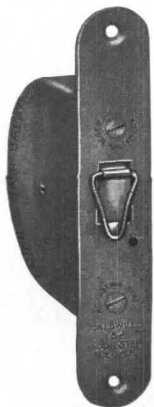
save time and
labor costs

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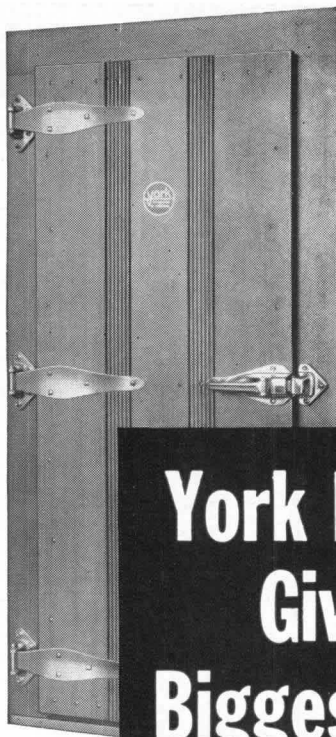


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at least 25%

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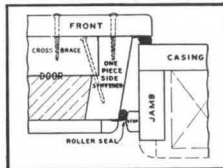


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TOMORROW

because this Acousti-Booth is being widely applied to the problems of



TODAY —in war plants

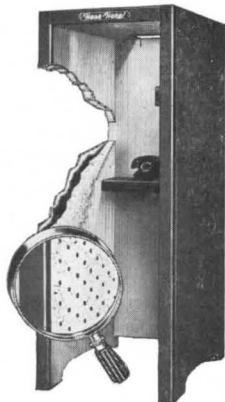
to eliminate the noise and confusion of



YESTERDAY



A built-in Burgess Acousti-Booth makes it easy to telephone—even in busy stores, offices, and other public places.



Cut-away photo of Burgess Acousti-Booth, showing perforated walls and sound-absorbent material which soaks up noise.

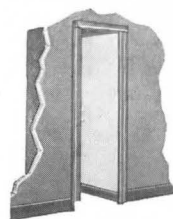
It's no longer necessary to provide stuffy, closed-in telephone booths in order to give telephone users privacy. Here's a modern, doorless telephone booth which is ideally suited for built-in use wherever a really quiet booth is needed. It can be finished to match any style of interior decoration which may be planned.

Acousti-Booths are patented units built on the Burgess acoustic principle, which provides a "zone of quiet" for the telephone user without the use of doors. Noise entering the booth strikes the walls—passes through the thousands of tiny perforations—and is soaked up by a thick blanket of sound-absorbent material behind this perforated facing.

The Burgess Acousti-Booth provides ample

room for comfortable use. The absence of doors means there is nothing to jam or cause trouble. With hundreds of these booths already in constant use in busy factories, their satisfactory performance under all kinds of noise conditions is assured.

Burgess Acousti-Booths are available either for built-in use or as a standard telephone booth.



Acoustic panels are also available for lining existing booths. For full information, mail the coupon below.



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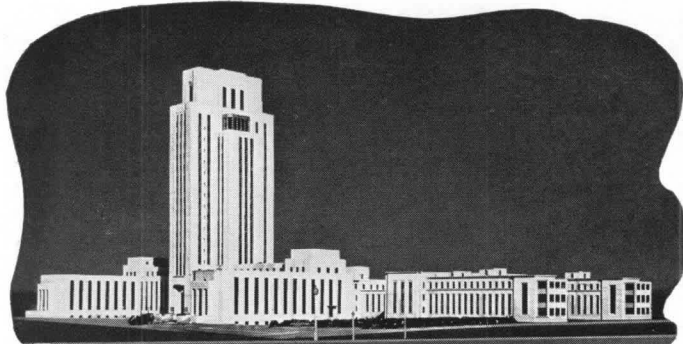
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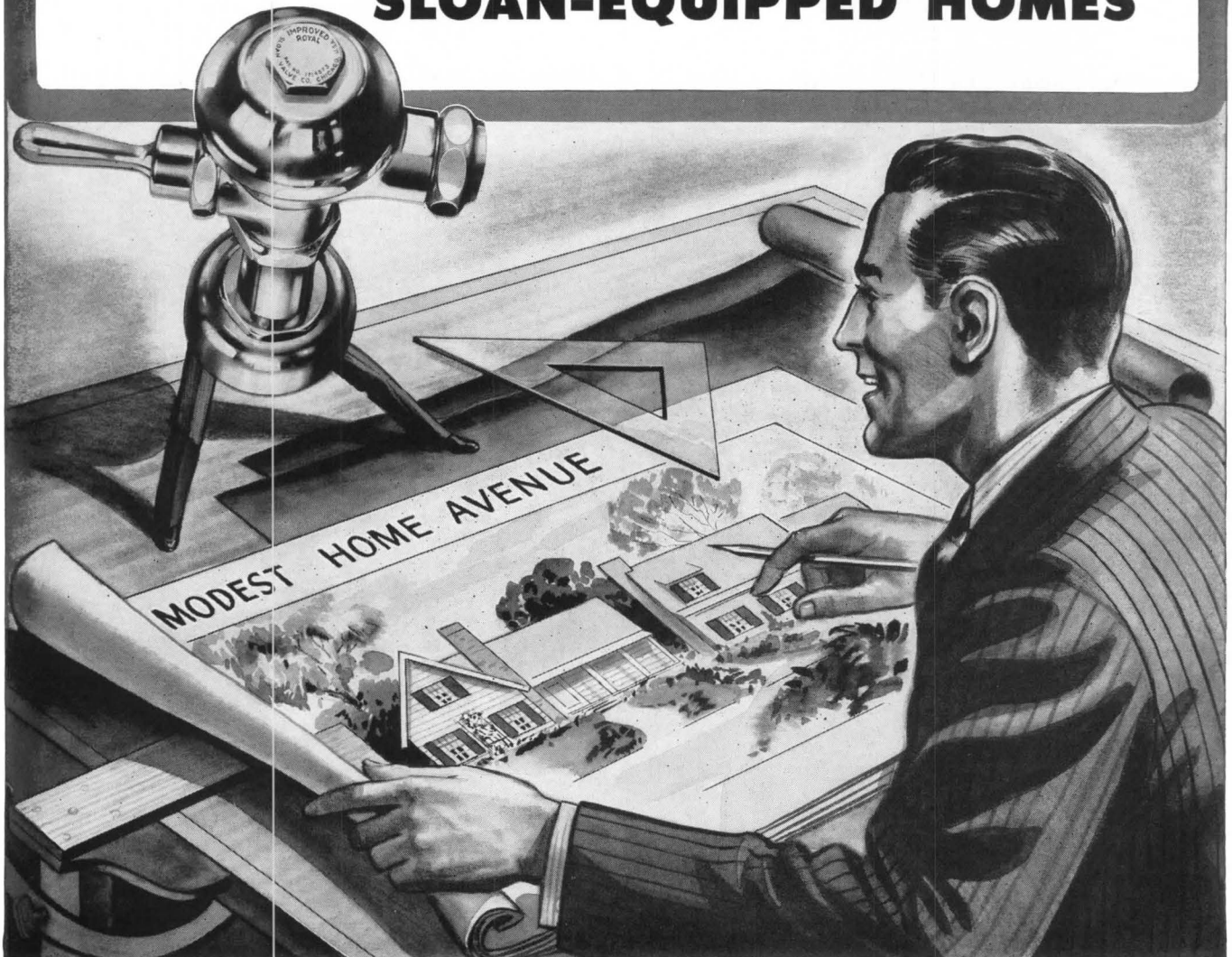
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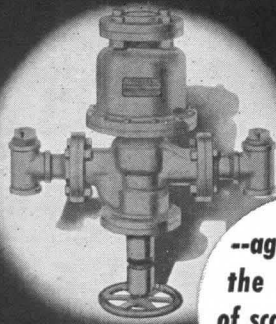
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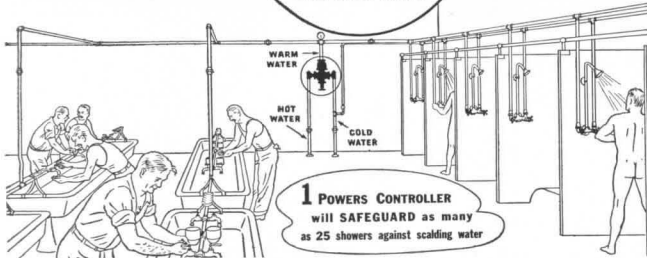
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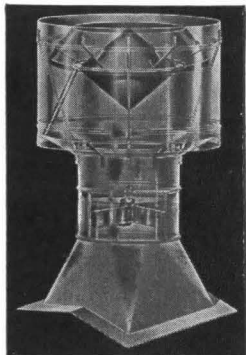
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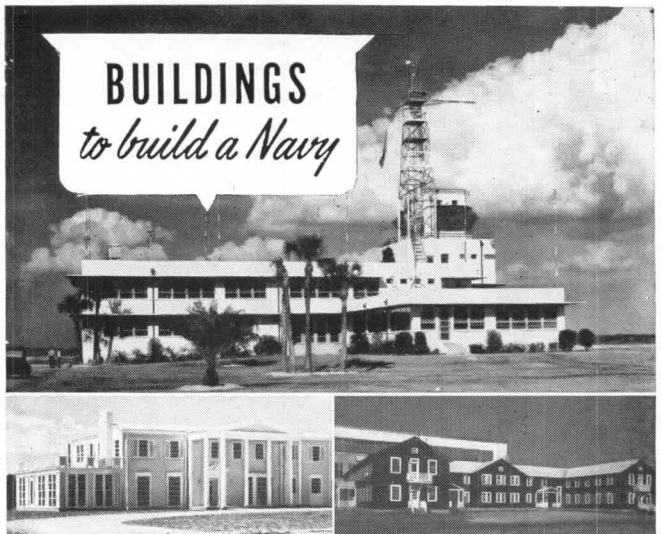
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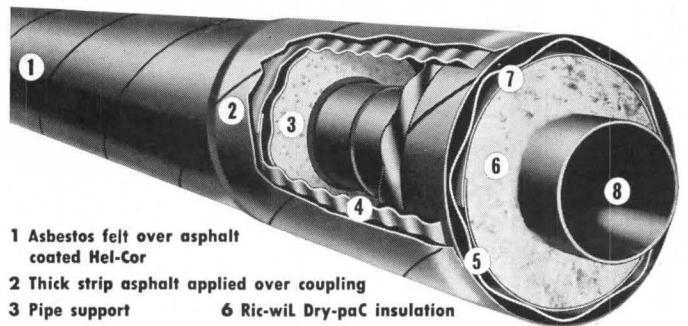


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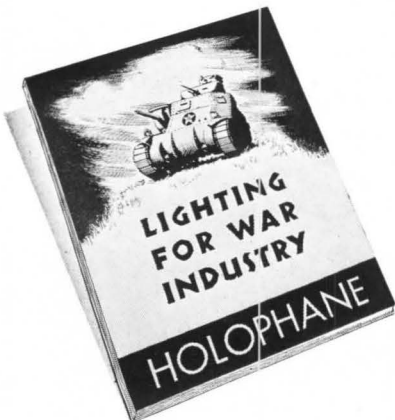
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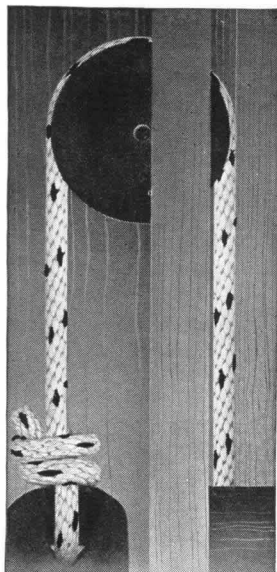
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perfect and permanent

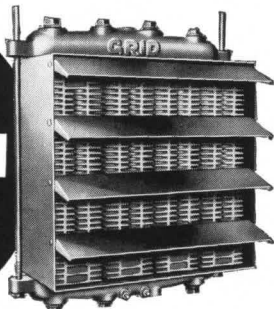
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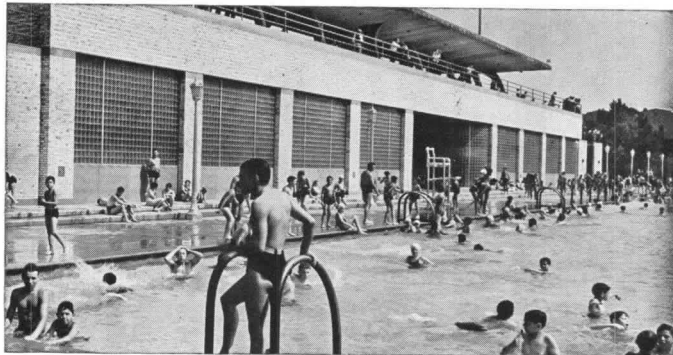


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who has — imagination and vision

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- a background of technical knowledge of and experience in architecture and building

and who may seek an opportunity in professional journalism devoted to the interests of the creators of buildings.

Write full summary of training and experience to

BOX 101

CARE OF ARCHITECTURAL RECORD

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An Architect-Engineer Reviews



Many Years' Experience With OIL BURNING EQUIPMENT

C. H. Higginson is a member of the firm of Wm. Higginson & Son, New York Architects and Engineers, who have long been identified with outstanding buildings throughout the East and who are now planning many million dollars' worth of war construction. Mr. Higginson is one of the first users of Petro Oil Burning Systems. Included in his Petro jobs are such buildings as the Conde Nast Printing Plant in Stamford, Connecticut, and four George Loft Markets throughout Westchester County, New York. He expresses these opinions concerning Petro Burners:

"Our experience with the use of Petro equipment extends over 15 years and gives us adequate reason to say that it is absolutely reliable, precise in operation, and that it cuts down fuel and labor costs . . . Like most architects and engineers, we are now confining our efforts to war building. We consider it highly praiseworthy to know that the skilled services of such concerns as Petroleum Heat & Power are available for the production of maximum efficiency and economy for firing equipment in war industries."

Petro Oil Burning Systems

are available only—"for duration", on orders carrying high preference ratings.

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—24 hour operation, far above normal ratings, day after day, week after week;

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Through Fog and Storm we heard a Mother's Cry

Daddy—away on business the one most important but unpredictable night—when baby came. Fortunately, he stopped at a hotel where he was easily reached. Though such emergencies are rare, the "reachability" of persons who stop at hotels is often an advantage without price.

AMERICAN HOTEL ASSOCIATION



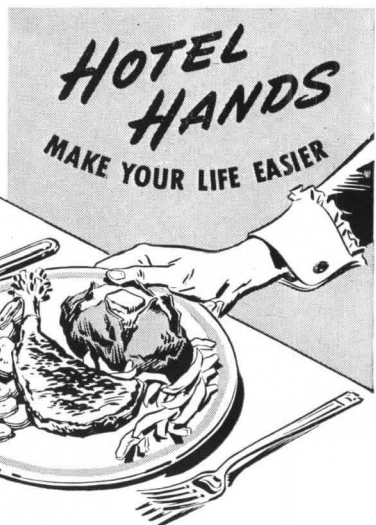
UNEXPECTED DINNER GUESTS—Lady, you know that feeling—with not enough in the cupboard. Save the day by dining at a hotel. You'll flatter your guests, save yourself much work.



WEEK-END AT A HOTEL—When your hard-working wife suggests a week-end in your own home-town hotel, don't snicker. This home-town hotel vacation idea is rapidly becoming popular.



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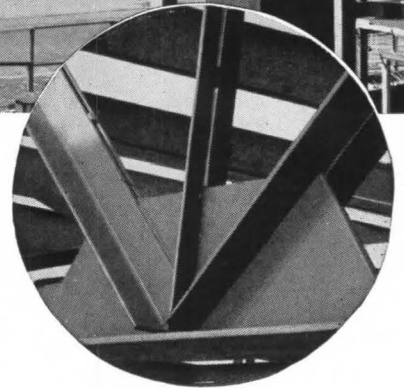
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HOW STRUCTURAL WELDING *Saves 10%* IN STEEL!

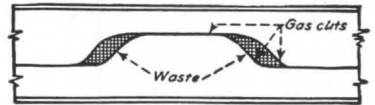


Comparatively long trusses such as those illustrated above, and long girders, offer a particular opportunity to save steel by using arc welding and oxyacetylene cutting. In general it is agreed that welded construction results in an average saving in steel of better than 10%, when such members are involved.

Three main factors make this possible: First, welded construction does not require the punching or drilling of weakening holes, therefore permits the use of lighter plates and sections and lowers shop costs. Second, plate edges to be welded need not be overlapped to provide maximum efficiency. Third, less connection material, if any at all, is required to join members or plates at their intersections.

The services of Air Reduction's Applied Engineering Department for consultation on design problems is readily available.

Detail of welded panel point connection of a truss, utilizing the increased depth of the unique one-piece chord and "gusset plate" made by splitting a beam section.



Sketch showing the way the beam section was split by oxyacetylene cutting to make the chord sections shown above.

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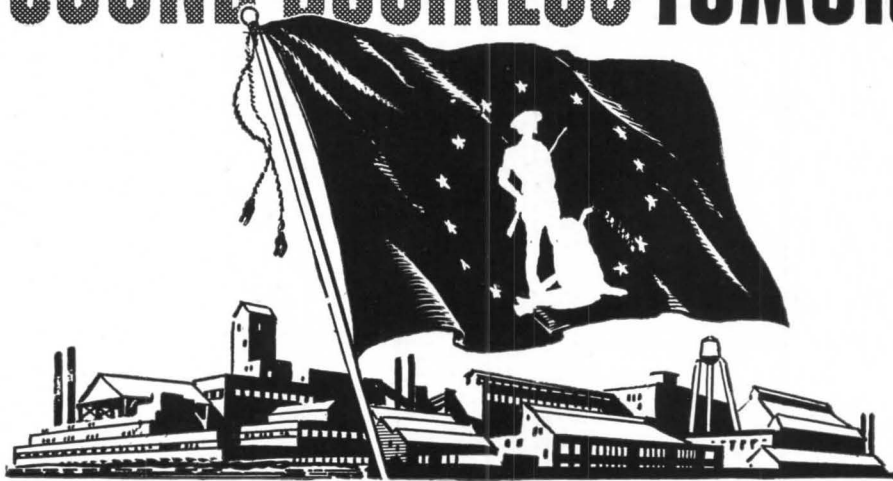
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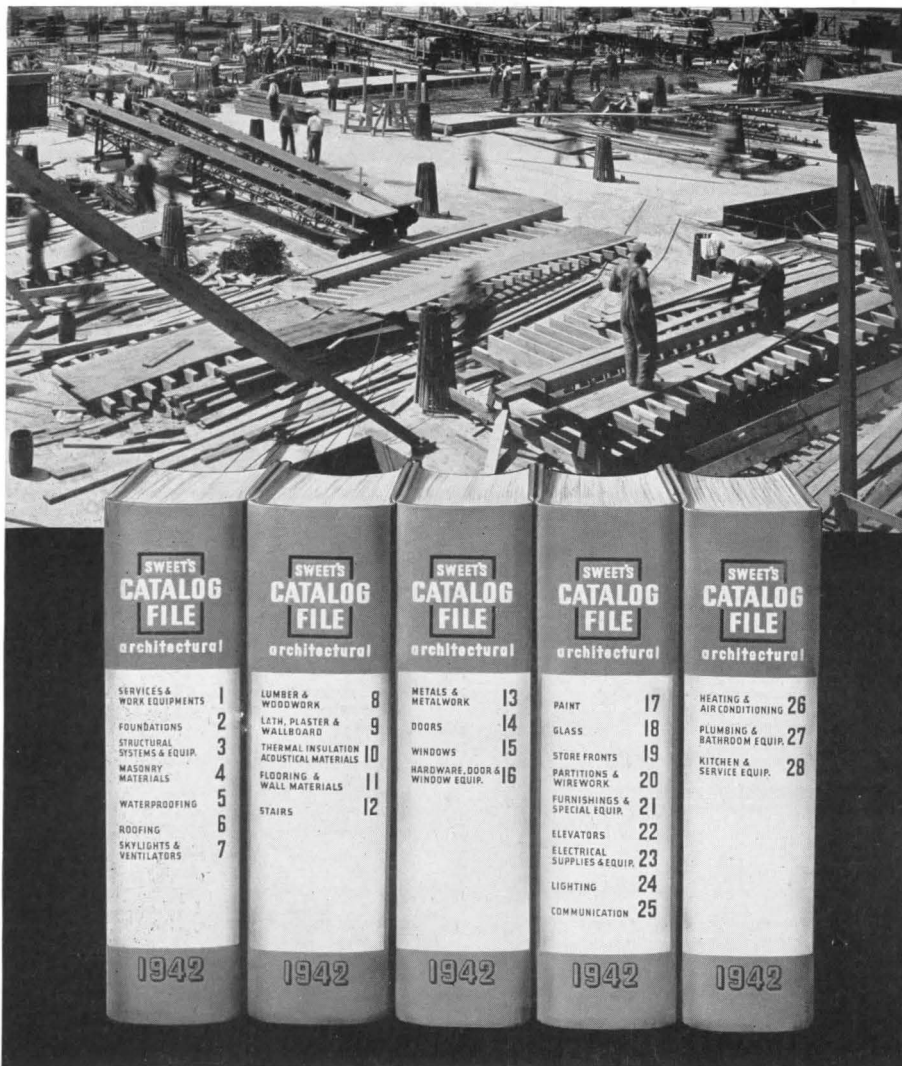
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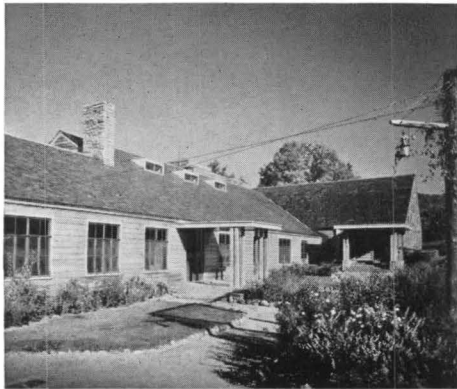
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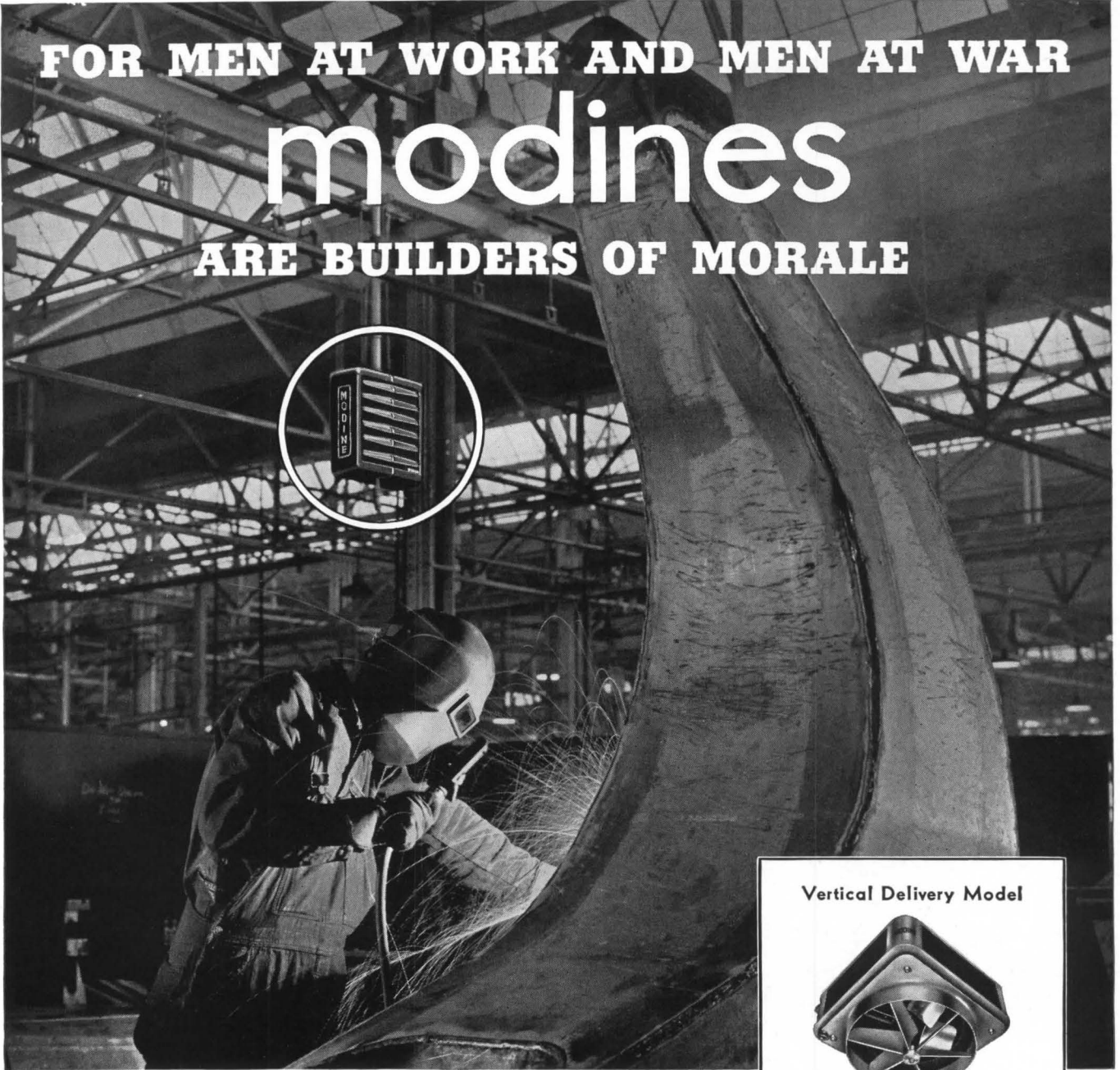
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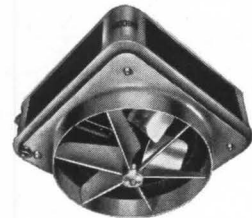
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