# CIVILIAN DEFENS

## REFERENCE NUMBE

95



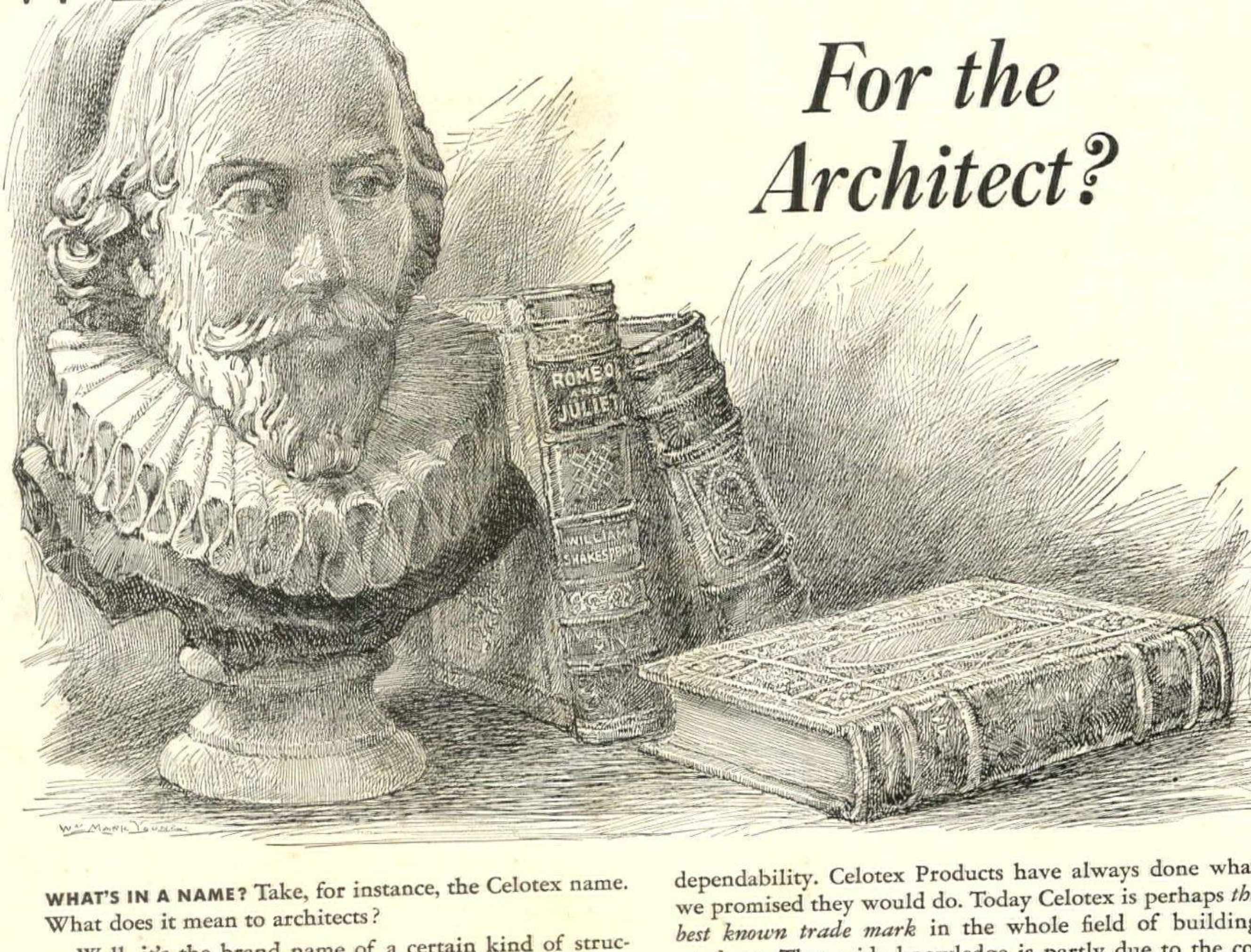
ANUARY 1942

ONE DOLLAR A CO

# THE ARCHITECTURAL
# FORUM

# WHAT'S IN A NAME...

## *For the Architect?*




**WHAT'S IN A NAME?** Take, for instance, the Celotex name. What does it mean to architects?

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Published monthly by Time Inc., Orange, Conn. Yearly subscription, U. S. A. Insular Possessions, Canada and Cuba, $4.00. Foreign Countries in the Postal Union, $6.00. Single copies of this January issue, $1.00. Entered as Second Class Matter at the Post Office at Orange, Conn., under the Act of March 3, 1879. Additional entry at New York, N. Y.


VOLUME 76
Number

ARCHITECTURAL FORUM





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*Publisher,* Howard Myers; *Managing Editor,* Ruth Goodhue; *Associates,* Paul Grotz, Joseph C. Hazen, Jr., C. Theodore Larson, George Nelson, Henry Wright; *Assistants,* John Beinert, Richard E. Saunders, Madelaine Thatcher, Nadia Williams. THE ARCHITECTURAL FORUM is published by Time Inc., Henry R. Luce, Chairman; Roy E. Larsen, President; Charles L. Stillman, Treasurer; David W. Brumbaugh, Secretary. Publication and Subscription Office, Orange, Conn. Subscriptions may also be sent to 330 East 22nd Street, Chicago, Illinois. Executive, Editorial and Advertising Offices, 19 West 44th Street, New York. General Manager, Robert W. Chasteney, Jr. Advertising Manager, George P. Shutt. Address all editorial correspondence to 19 West 44th Street, New York. Yearly subscription, payable in advance, U. S. and Possessions, Canada, Cuba, Mexico, South America, $4.00. Elsewhere $6.00. Single issues, including Reference Numbers, $1.00. All copies Mailed Flat. 
VOLUME 76—NUMBER ONE

# LETTERS

## LANHAM BILL

FORUM:

The new Lanham bill appropriating funds for war housing has now passed the House and awaits Senate action. If enacted in its present form it must seriously threaten the war effort.

The bill would appropriate $300,000,000 with which to build housing in war production centers. It would also authorize the building of houses at costs up to $3,750 each instead of $3,500. This part of the bill is satisfactory. However, as a condition for the appropriation, provisions have been included which would render the whole housing program unworkable. If the program is not to bog down completely, the bill must be amended in the Senate before passage. The more objectionable features of the bill are these:

1. It repeals the provisions of the first Lanham act which enable defense housing projects to be let at rentals "which shall be within the financial reach of persons engaged in national defense" and substitutes a requirement that rentals be based on the "value" of the houses.

This would bar war housing to all but a small percentage of war workers with high incomes. Eighty per cent of war workers earn less than $1,500 annually. If 20 per cent of income is the proper sum allocable for rent, even the top section of that class cannot afford more than $25 monthly. Most of that 80 per cent must have subsidized housing whether we like it or not. Even a $4,000 FHA house, purchased with a $100 down payment, costs about $56 monthly to carry during the first eighteen months.

Only a family with an annual income of $3,360 can afford to pay such monthly charges, and not more than one out of fifty war workers is in this category. At no time could FHA houses, even with a full 10 per cent down payment, be built for the lower-paid workers. With no private building for this group and now with no public housing either, where are most of our war workers expected to live?

2. The bill proposes to have all war housing construction built through the Public Buildings Administration, the Army and the Navy.

The provisions of the original Lanham act authorized the Federal Works Agency to allocate the funds to various agencies. Of all the agencies equipped to build houses, the three the bill designates stand out as the most unsuited for the job.

The Army and the Navy have their own vital responsibilities at this moment and they should not be burdened with construction details and management problems. The Public Buildings Administration, while qualified to build post-offices, has had little experience in the building of houses, nor is it staffed or equipped for the job. Those houses it has constructed under the defense program confirm this. The restriction to these agencies is opposed not only by all public housing organizations but by Charles F. Palmer, the housing coordinator, who states that local authorities are in most cases more efficient and that the USHA should supervise work through these authorities. There is little doubt that these local agencies have in the last four years shown an ability and aptitude for building and operating houses with efficiency, economy and speed.

3. The bill would direct that the "housing shall be sold and disposed of as expeditiously as possible."

Most war workers are in no position to buy houses and should not be forced into buying them. Nine out of ten of FHA's Title VI defense houses are being sold, and now it is proposed that all other war housing be sold, too. War workers, many of them migrants with temporary jobs, would be forced by the pressure of a housing famine into buying homes in alien communities, most often on terms they cannot possibly continue meeting when the emergency is over.

4. The bill proposes barring the sale of all war housing to any "public or private agency organized for slum clearance or to provide subsidized housing for persons of low income."

This provision would not only bar the acquisition of properties by any agencies which might wish to rent to war workers with lower incomes, but it would prevent the sale after the war of any of this housing for social purposes. Thus, projects which can be planned today so as to be utilizable after the war to rehouse slum dwellers can never be devoted to that use—not even if the full cost is paid to the government.

The record of the debate in the House indicates that these crucial questions were hardly considered and that much in them was misunderstood. The bill had been recommended by the Lanham committee before the declaration of war. Doubtless, committee members, not then aware of the approaching emergency, sought to write into the statute their personal opposition to the slum-clearance program and make its curtailment a condition for their recommending the defense housing appropriation at all. The war emergency, however, ought not to be made an occasion for renouncing peacetime social programs, nor should appropriations be conditioned upon it.

Houses are necessary for war workers now. These houses should, in the opinion of many, be used after the emergency to rehouse slum dwellers. Some say only a portion should be used for that purpose. But to say that none shall be so used, and to insure that they will not be by expressly forbidding low-income workers from now or ever occupying these houses, is dangerous nonsense.

If the bill is not changed it will upset the production timetable and turn up as one of the most serious obstacles to impede the war program.

CHARLES ABRAMS.

*New York, N. Y.*

Mr. Abrams' thoughtful comments obviously make sense. It is rumored that the Administration is backing the Senate version. When such separate travelers as the USHA and the National Association of Real Estate Boards likewise favor the Senate bill, all doubts should be removed—Ed.

## POST-WAR STANDARDIZATION

Forum:

. . . If THE ARCHITECTURAL FORUM can stimulate effective action on the formulation of standards, as recommended in the last section of the November article, you will have achieved not a harmful combination in restraint of trade, but a helpful combination to facilitate trade. The beneficiaries, as you indicate, will be not only the architectural profession and the building industry but, most of all, Building's customers.

HAROLD S. BUTTENHEIM

*New York, N. Y.*

### Major Undertaking

Forum:

. . . In presenting this Post-War planning program THE FORUM is very definitely assuming a position of leadership for mobilizing the forces of the building industry for a task which promises to be a major undertaking of the Post-War period. . . .

G. C. DENEBRINK

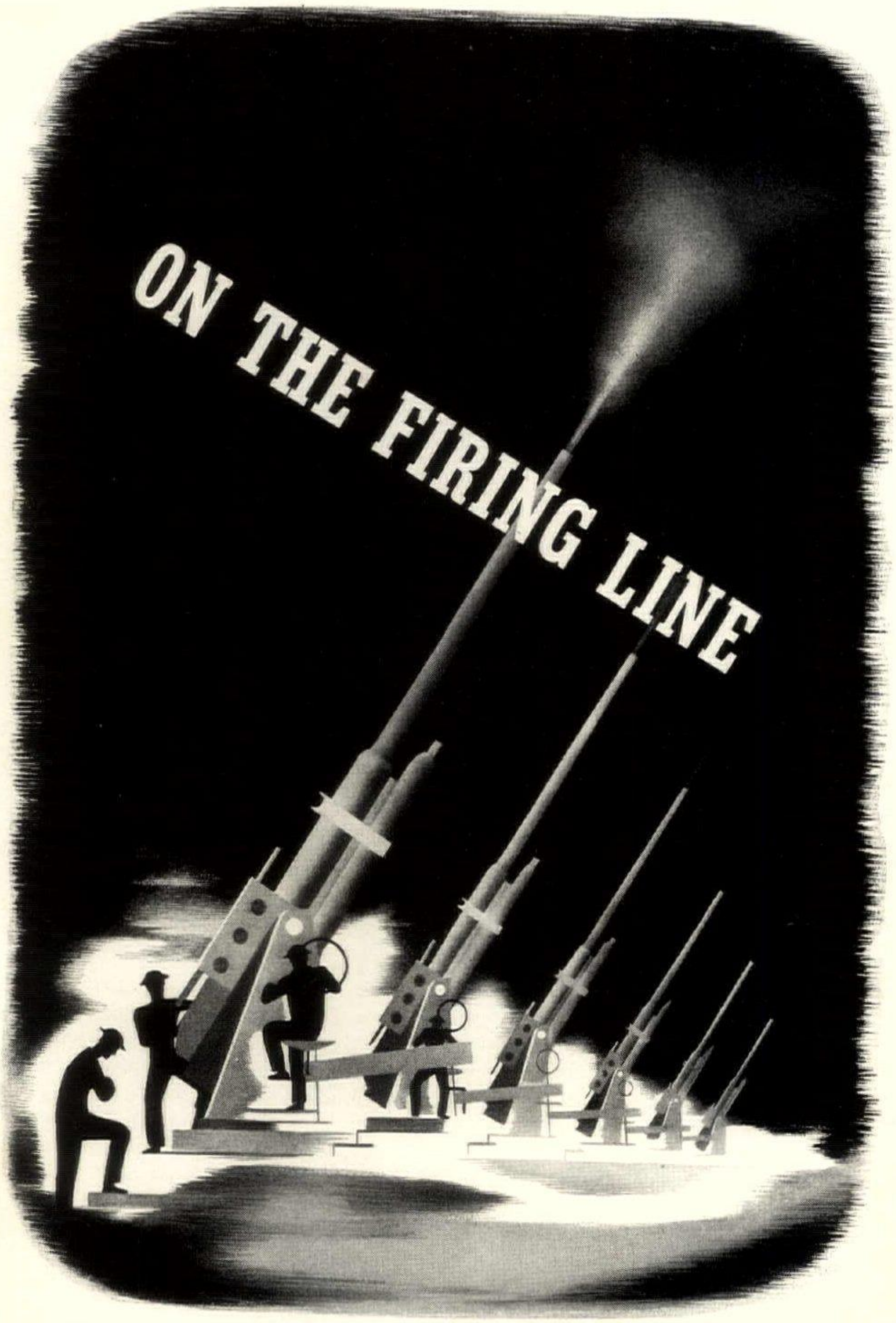
*Lancaster, Pa.*

### Standard Mortgages

Forum:

. . . In the mortgage financing field great strides have been made in the last dozen years in standardizing mortgage financing terms, prices and methods. . . . When a

*(Continued on page 4)*

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# LETTERS

(Continued from page 2)

person wants to get a home loan nowadays he can go to the bank, insurance company, savings and loan association or mortgage broker and get almost an identical loan from any one of these sources. Furthermore, costs of financing are being standardized. We are getting away from the multiplicity of financing charges, and when a person is quoted a 6 per cent rate by one lender he can be pretty sure that a 6 per cent rate quoted by another will actually represent about the same costs to him. There is some room for improvement here. For example, we still hear of some talk of the 4½ per cent FHA loan rate when actually it is a cost of 5 per cent to the borrower and compares with the 5 per cent interest rate on a non-FHA loan which the borrower might secure from a savings and loan association.

While the standardization of mortgage instruments, loan terms and methods of repaying home loans has contributed a great deal to bringing order into the nation's mortgage financing system and increasing public understanding of methods of home financing, I think we should be careful that the essential competitive elements in mortgage financing are maintained. Each type of lending institution should be free to develop its own procedures and methods which it feels will enable it to better serve the community and the borrowers and not feel bound to accept the practices of others in the field. . . .

. . . Standardization in mortgage banking is not worth while if it is achieved at the cost of partial solidification of mortgage credit. This is a field which can and should be served on a private enterprise basis but as one watches the rural credit field and sees the steps that have been made during the past two decades toward almost complete socialization, one becomes apprehensive about the trend in the urban mortgage picture. In the farm mortgage field we had a situation where standardization was brought on by government supervision and control over loan terms and interest rates. If standardization is to be bought at the price of freedom and individual initiative, then it is not worth the price.

With this thought in mind I was pleased that your article advocated that the impetus for progress and standardization come from the construction industry itself rather than from a government department. I believe in the theory and fundamental objectives of this policy completely.

MORTON BODFISH

*Chicago, Ill.*

### Challenge to Gadgeteers

Forum:

. . . It is by far the best statement on standardization that I have yet read and I wish to compliment you on it. . . .

In the section dealing with standardized design, you specify the ways in which the architect can benefit from standardization and indicate how kitchen and bathroom layouts could be simplified and certain types developed in order to cut the architect's job considerably. I agree with you unreservedly and I would like mightily to see the modern architect released from this compulsion to smalltime inventiveness. For years I have regarded him as a gadgeteer de luxe rather than as a trained designer; his energies have been spent in piddling around with finicky little bathroom details, hooks and hangers and toilet paper racks when he could have been thinking creatively about fundamental design problems. The smaller the house, the more important the architect's playing around with unimportant gadgets becomes. This form of mental masturbation has persuaded the designer that he is doing something important when he is actually overlooking the demands of plain construction and general design, the props which are basic to a top-notch piece of residential architecture. . . .

. . . You do not make clear why the architect has resisted standardization. Yet he is clearly to blame for such resistance. Do you feel, in the light of past experience, that the standardization you suggest here can be imposed by force, or by the process of education? We know that the architect likes to consider himself an original thinker even when he is not and that he reacts instinctively to anything that remotely resembles regimentation as a damper on this much vaunted design ability out of which he creates everything from a new bathtub to a new town. If this psychological barrier is inherently a part of the mental phenomena of our architects, how would you propose meeting it? I would like to see this article charge it up as a challenge to such attitudes. . . .

CARL FEISS

*New York, N. Y.*

### Clear Definition

Forum:

Your clear definition of standardization should do much to further its adoption by Building.

By approaching Building's problem with the conviction that "There must be a better way," you challenge all factors in Building. How to achieve the better way in standardization is clearly shown in your article covering that subject.

I wish it were possible for your articles on the Post-War Pattern to be more widely circulated.

ED MENDENHALL

*High Point, N. C.*

### Reflection of Progress

Forum

. . . Standardization of architectural units fosters large-scale developments. In fact, the lower construction costs of large-scale operations is largely the result of mass production of interchangeable units. The extent and degree to which products of various kinds have been standardized and come into general use in accepted sizes is a reflection of our social progress.

V. B. STANBERY

*Berkeley, Calif.*

### Opportunity for Education

Forum:

. . . Standardization can be very effective in making savings and in producing good results, but it can also, if carried too far, interfere with changes that come with experience, new materials or new ideas. The standardization that went on in the development of the automobile was of enormous advantage and covered points in which the attempt to be different had led to increased costs and much confusion.

There is good opportunity for educational institutions, where architects and others interested in housing are trained, to present in an adequate manner all of these problems. . . .

. . . Bring out the significance of closets and storage spaces. They can easily be pre-planned, and are so commonly neglected in most small houses.

RAY LYMAN WILBUR

*Stanford University, Calif.*

### Standards and Proportion

Forum:

. . . Prof. Wm. R. Ware, who was once head of the architectural department at Columbia, used to tell his students that a door, two squares high, a window two squares wide, and three squares high, a room whose width was the side of a square and whose length was equal to the diagonal of the same square were all pleasing proportions, but you did not have to be "finicky" about it. A window 1⅞ x 3 for instance, is just as good as one 2 x 3, because even a trained eye could not tell which was which.

In other words, the architect who refuses to use a stock or standard size because it is not just exactly to the fraction of an inch, the size shown on his drawing is slowing down progress. . . .

W. T. WARREN

*Birmingham, Ala.*

(Continued on page 6)

(Continued from page 4)

### To Protect Building

Forum:

. . . It is exceedingly well done, leading logically to the conclusion that somehow or other—some of these days—the building industry must formulate standards of final performance to protect itself as well as the public. . . .

*New York, N. Y.* J. W. FOLLEN

### Static Building Laws

Forum:

. . . When Mr. Hoover was Secretary of Commerce under President Harding in the early 1920's, the writer was one of twelve first called to Washington to confer in respect to Standardization in the Construction Industry. . . .

. . . I had been thinking in terms of much the same meaning as covered in your article "Primary Standards," "Dimensional Coordination," "Standardized Procedures," and "Formulation of Standards." But when I offered anything along these lines, I soon discovered that I represented an unpopular minority of one. It was all right to talk about the *dimensional* standardization of brick, lumber, tile, nuts and bolts, but it was decidedly not all right to talk about establishing specification standards, etc. covering processes and materials, for to do so would be to confine competition to price, and that, it was assumed under the criteria of Business as Usual, would ruin manufacturers who supplied materials to the Construction Industry. This reference to those early Hoover conferences is to point out that in the early 1920's your article, which discloses what is actually being done by the A.S.A., many Trade Associations etc., and many other activities, now accepted as a matter of course, would have then been viewed as a most dangerous tendency and likely to wreck the institution of Business and the Constitution of the U. S. . . .

. . . In contrast to this revolutionary change in direction during the last two decades we have our static building laws and ordinance. It is true, one may point to the New York City Administrative Building Code which makes a brave show of giving legal and judicial sanction to mathematical formulae derived from experiments and experience in the field of Science and Engineering. But basically that code, the same as all other building codes, was conceived as a compromise between the Welfare aims of the Municipality or the State, and powerful special interests. Producers of Material, Owners of Real Estate, Lenders and Organized Labor, wage a relentless war against changes in Building Laws which might, under a short-sighted view, give promise of affecting them adversely. Quite recently I went through the New York State Multiple Dwelling Law trying to determine how much of that law had been drawn in the interest of Welfare and how much of it for the benefit of Special Interest having sufficient power to jamb amendments in their own interest through the State Legislature. In that law there are section after section and page after page of weasel worded, all but incomprehensible sentences which have nothing at all to do with the broad Welfare Clauses of the Constitution, upon which all such laws rest.

The New York State Multiple Dwelling Law has become primarily a body of decisions by the Legislature and Judiciary acting as referee in the never ending war of the powerful vested interests. . . .

FREDERICK L. ACKERMAN

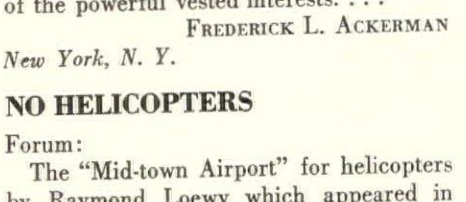
*New York, N. Y.*

### NO HELICOPTERS

Forum:

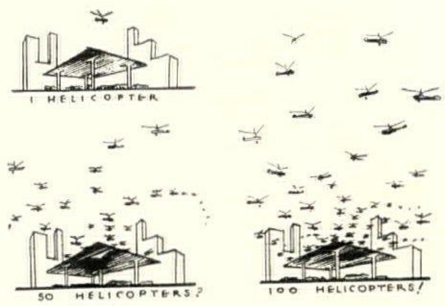
The "Mid-town Airport" for helicopters by Raymond Loewy which appeared in the November issue of THE ARCHITECTURAL FORUM demands a rebuttal. Since you thought it worthwhile to publish his imaginative design, I hope you will also consider it worthwhile to print an outburst of vehement objection.

Let us assume the economic and structural feasibility of such a structure. Elevated flying fields of one sort or another have often been proposed for congested districts but never built. The reason is simple: airplanes of any type are subject to wind conditions, and wind conditions in turn are influenced by features of topography whether natural or man-made. Mountains, tall buildings, trees, and houses cause dangerous eddies and down-drafts, acting in the wind like rocks in a stream.



The air over the canyons of Manhattan is especially turbulent; attempts to moor dirigibles to the Empire State Building failed on this account. A helicopter like any other airplane is subject to wind conditions. Imagine a helicopter, dropping down for a landing between crowded buildings, hazards in themselves, drawn from its course by a treacherous unexpected gust, momentarily out of control, and dashed against towering steel and stone! There is good reason for locating airports in wide open spaces where there are stable wind conditions and plenty of room for maneuvering. You can't pull over to the curb if you have an accident in a plane.

But for further protest let us assume that the dangerous air approaches and unpredictable wind conditions of mid-town Manhattan can somehow be overcome. Do we still want to land helicopters behind our Public Library? What will be the result of superimposing a new travel center in the midst of an already overburdened street and transportation system? The Forty-second Street district is already one of the most congested spots on the face of the earth; is the solution for existing congestion more congestion, not only on the ground but in the air as well? Consider ten planes, fifty planes, one hundred planes




an hour converging on mid-town Manhattan from the outlying airports: Newark, Westchester, LaGuardia, Idlewild, Floyd Bennett. How will this air traffic, coming and going, be controlled? Will circling planes overhead make life more pleasant for the man on the street? Will the man who now sits in the sun by the fountain and feeds the pigeons in Bryant Park be better off with a flight deck overhead? Will it be quieter for the student in the reading room of the Public Library? And will the bookkeeper in the building across the street find it easier to work with a helicopter rising outside his window and the roar of motors in his ears?

Elevated structures for surface transportation are now being torn down in New York as obsolete. Are we so neglectful of experience as now to consider elevated structures for sky transportation?

I raise these questions to Mr. Loewy's very delightful sketch because I feel that the problem of providing adequate facilities for increasing air transportation is becoming too serious for specious, ill-advised, and short-sighted solutions. Before many years air traffic over populated

(Continued on page 60)

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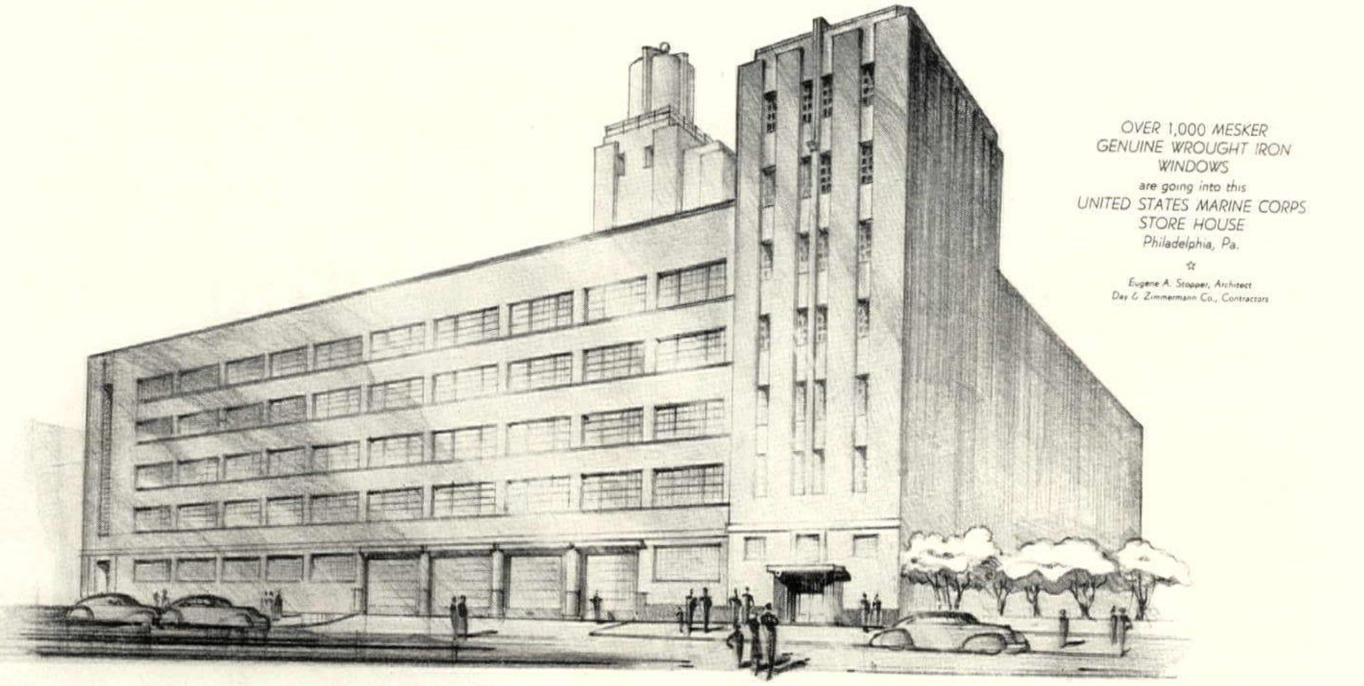

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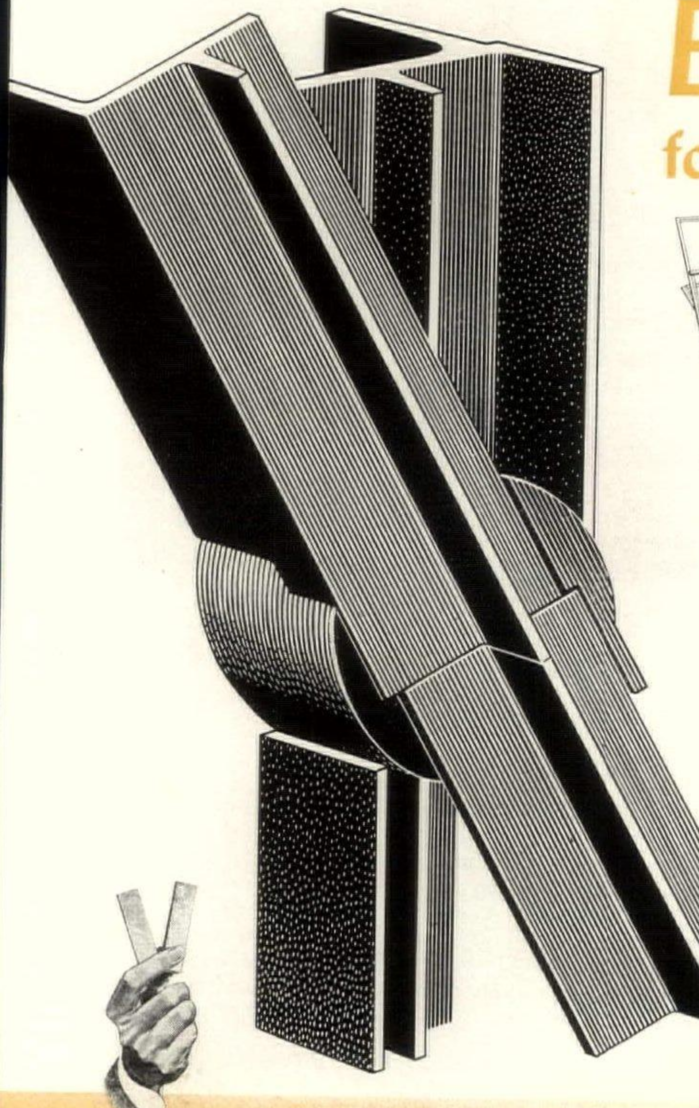
☆

Eugene A. Stopper, Architect
Day & Zimmermann Co., Contractors



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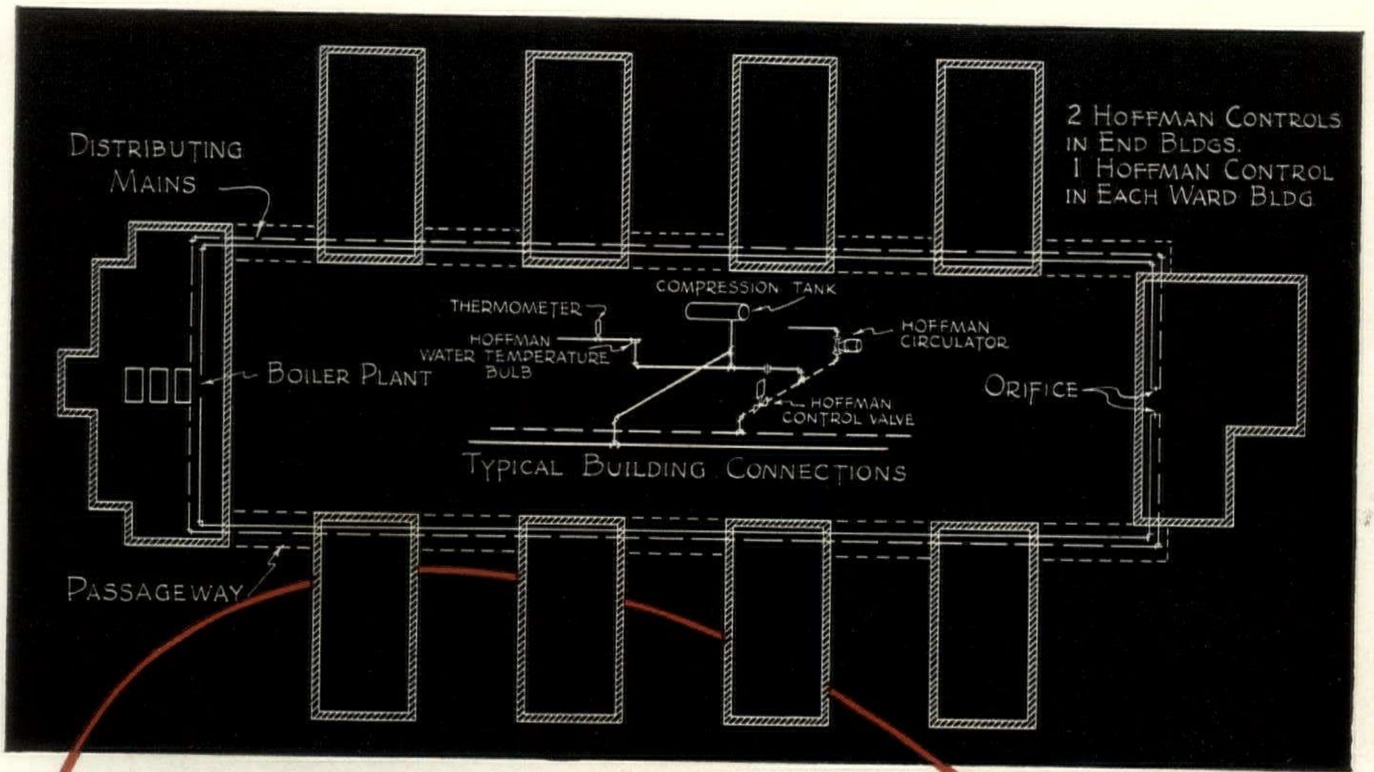
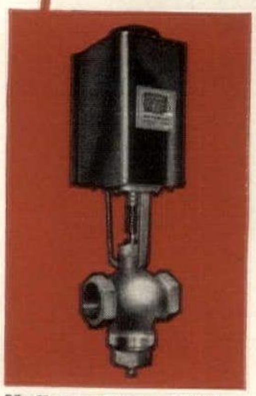
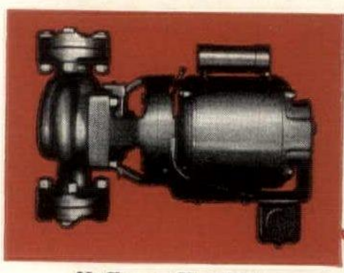



# CONTINUOUSLY CIRCULATED HOT WATER

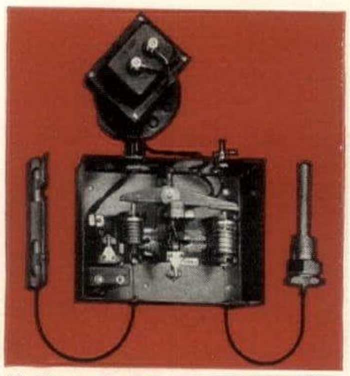
## Wins heating contract in Defense Hospital!



**Hoffman Control Valve**



**Hoffman Circulator**



**Hoffman Temperature Controller**

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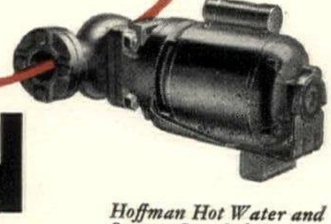
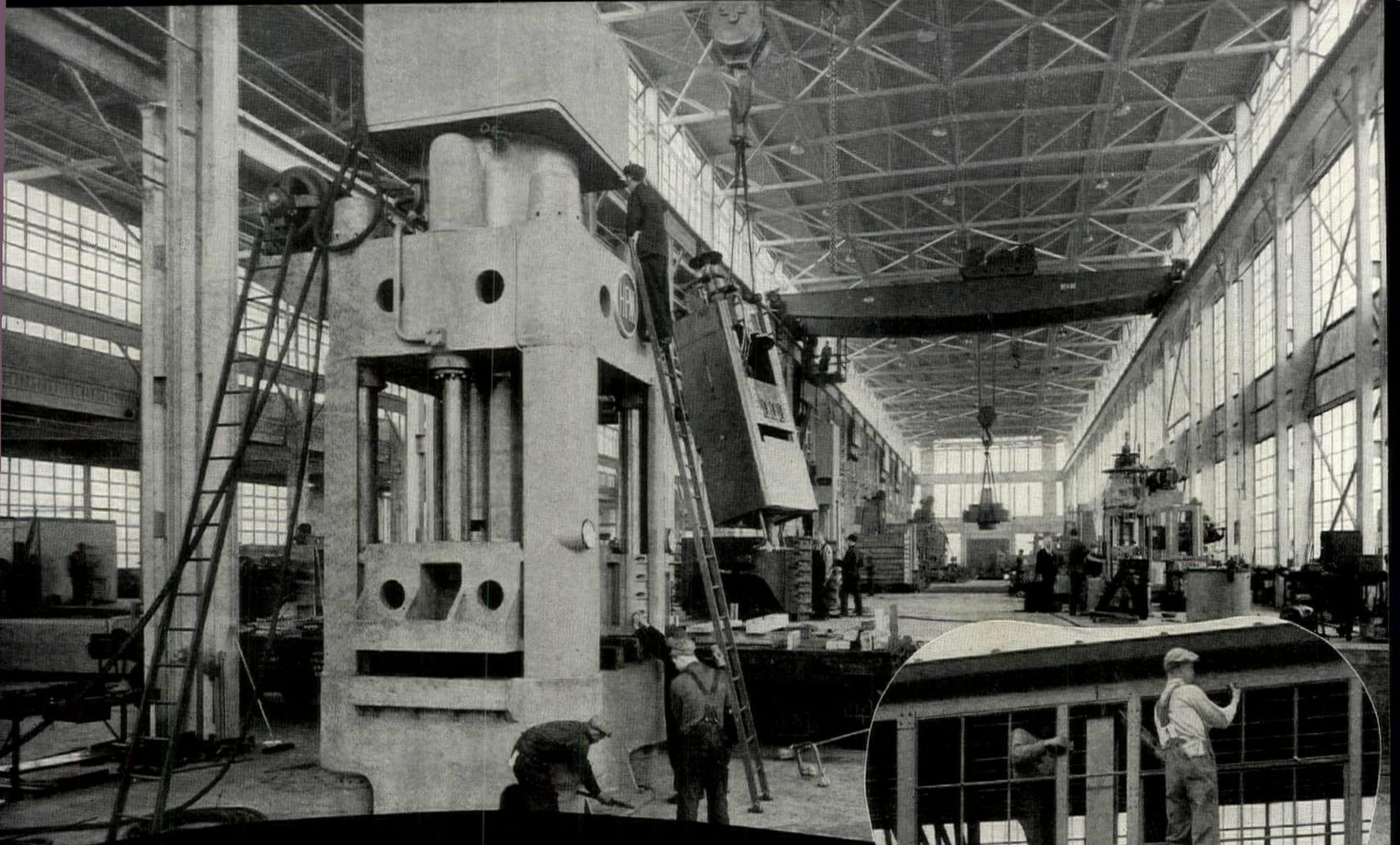
**HOFFMAN SPECIALTY COMPANY, Dept. AF-1, Indianapolis, Indiana**



# HOFFMAN *Hot Water* CONTROLLED HEAT

*Hoffman Hot Water and Steam Specialties are sold everywhere by leading wholesalers of Heating and Plumbing equipment.*



# Save weeks and months *of Building Time*

*Above*—Fenestra Steel Windowalls daylight new plant of The Hydraulic Press Manufacturing Co., Mount Gilead, Ohio; The Austin Company, Engineers and Contractors. *Right*—An erection crew installing a wall of Fenestra Steel Windows.

• It's "ALL-OUT" SPEED from now on! On many plants right now and on many more during the next few months miles of enduring Fenestra Windowalls will help save building time. This is because Prefabricated Fenestra Steel Windows are delivered to the job, already fitted, assembled, prime-painted, COMPLETE . . . and because experienced crews (see right) are making remarkable erection records.

Most exacting specifications of the U. S. Army and Navy have been fully met by Fenestra Products. Such engineering data and construction details as may be desired will be promptly furnished. Use the coupon.

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Fenestra Steel Window Systems will save you money NOW—in building cost, in cost of equipment for lighting and ventilation, in plant operating cost; and LATER—in cost of post-emergency conversion to peacetime production . . . Ask Fenestra engineers to help you plan your new plants so they will be assured of ample natural light and ventilation *before they are built.*

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**PREFABRICATED WINDOWS • DOORS • ROOF DECK**

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Name__________

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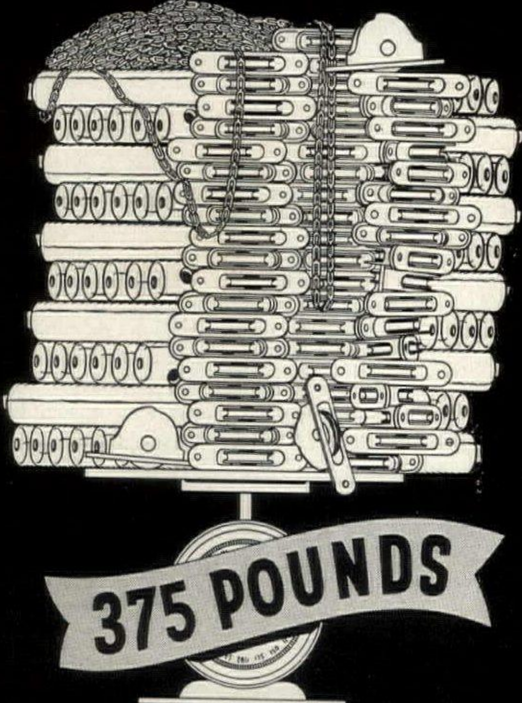
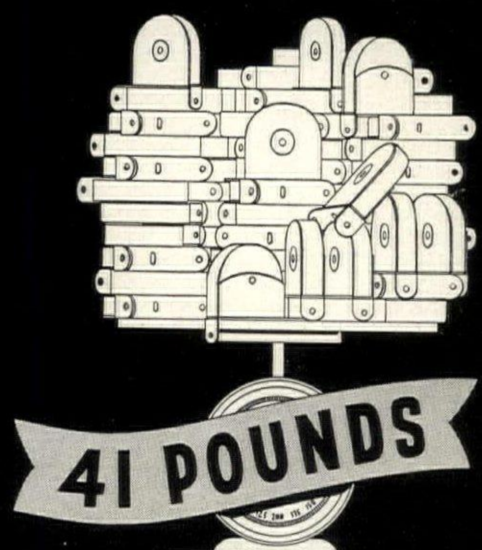
# "...TO USE MINIMUM QUANTITIES OF SCARCE MATERIALS . . . ."

Builders of privately financed defense housing units are promised priority assistance in securing delivery of scarce building materials. But it is specified that "it must be demonstrated that such housing will be built in such a way as to use minimum quantities of scarce materials." For double-hung windows—for small homes, hospitals, schools or industrial plants—Pullman Balances conserve iron and steel, speed up construction and save expense.



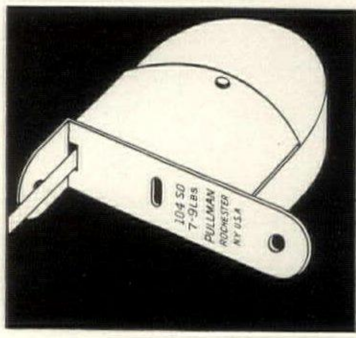

# DOUBLE HUNG WINDOWS TAKE IRON AND STEEL ... BUT HOW MUCH?

Consider the average one-family defense housing unit. For fifteen window openings, sash weights, chain and pulleys weigh about 375 pounds. Pullman Balances for the same windows weigh 41 pounds. The saving on sash weights alone, for 200,000 defense houses, would provide 37,500 tons of scrap iron, enough to process 95,000 tons of steel. Add to this the fact that use of Pullman Balances *speeds up* construction, and that such procedure *costs less* than conventional construction, and you see why so many contractors demand Pullman Balances. Pullman Manufacturing Corp., Rochester, N. Y.

## *MODERN* LOW-COST WINDOW UNITS ARE PULLMAN-BALANCED

It's patriotic to use Pullman Balances. It's smart building practise, too. House for house, the cost is lower. Pullman-balanced windows permit modern narrow trim, provide smooth counter-balanced operation, serve faultlessly for the life of the building.

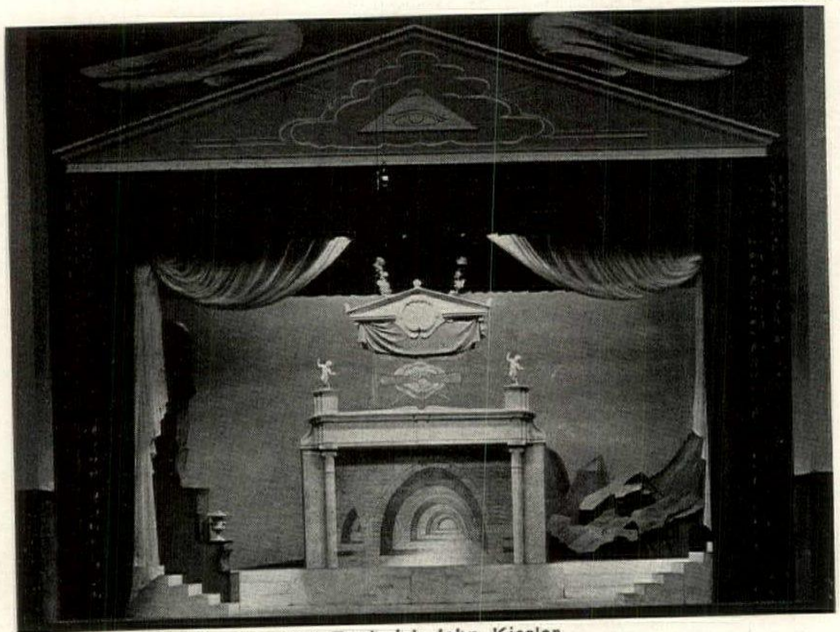
Many millwork manufacturers offer complete pre-fit window units, Pullman-balanced. They offer *fast* construction, *low* cost, top performance.




# Specify Window Units with PULLMAN Sash Balances

S. H. Gottscho

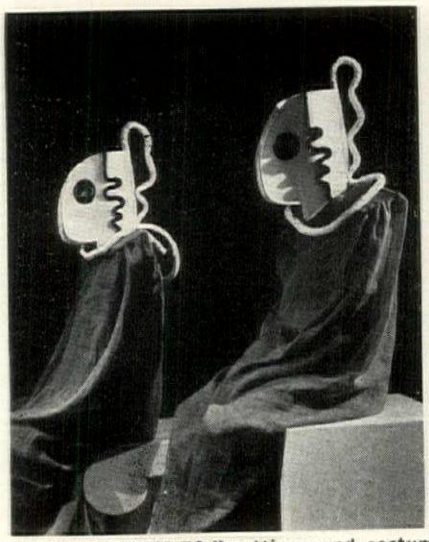
# AMERICAN OPERA DESIGNS

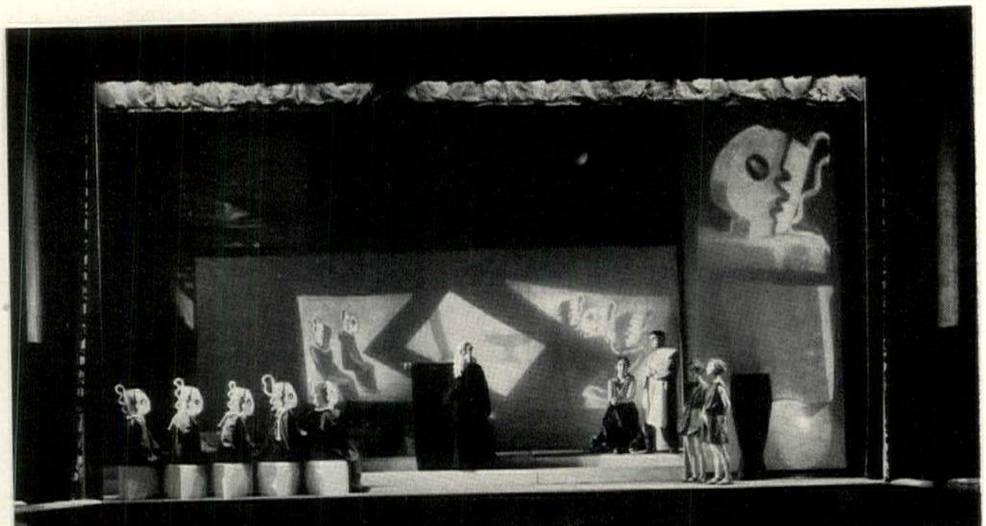


"MAGIC FLUTE," setting by Frederick John Kiesler

Last month the New York Public Library presented an exhibition without parallel in U. S. art history: a series of drawings and photographs of opera sets and costumes, prepared over a period of ten years by American designers for American productions. Sponsor of this unique activity is the famed Juilliard School of Music, which has been producing operas staged and sung by its students in its own theater since 1931, with Frederick J. Kiesler as director of scenic design. As remarkable as the fresh, imaginative quality of the work is the fact that it was all done by architects — by Kiesler himself and by selected students from the Columbia School of Architecture. Typical of the unconventional and highly successful solutions developed is the setting (left) for the "Magic Flute," in which a continuous roll of eleven paintings, set in a baroque frame, met the problem of simplifying a great variety of required backgrounds.

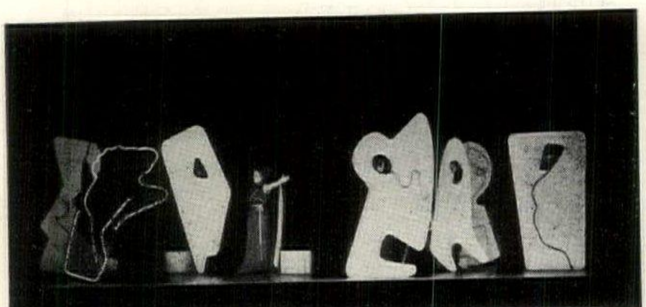
S. H. Gottscho





"HELEN RETIRES," settings and costumes by Frederick John Kiesler

Gray



"HELEN RETIRES"

For "Helen Retires" Kiesler invented a mask with a front opening for the comfort of the singers, used projected images (above, right), and quarter-inch plywood shields for Greek heroes in the underworld. The setting for "Abduction from the Seraglio," by Nathalie Swan and Daniel Brenner, provided a single set for an opera normally considered to require three.

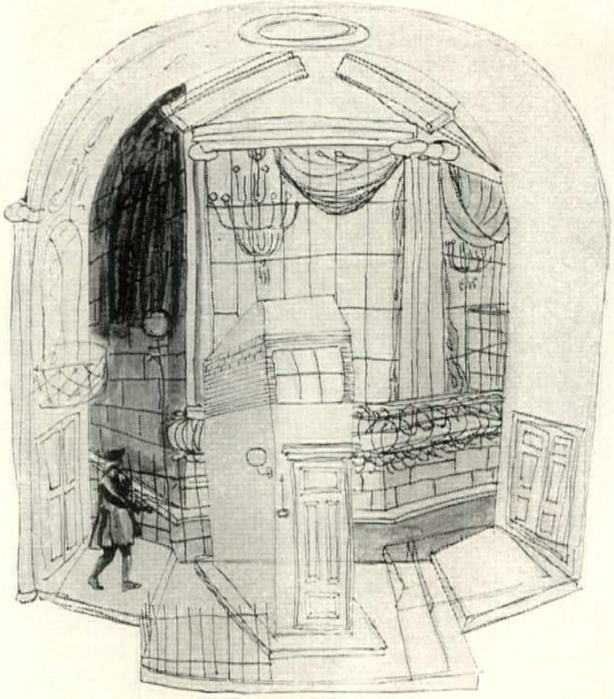
"ABDUCTION FROM THE SERAGLIO"

## OPERA DESIGNS, continued

Kiesler claims that not only do architects make first-rate stage designers, but that stage design makes better architects. Reason is that in a few weeks the architect must meet and solve a myriad of problems involving both people and esthetic considerations. He must create a setting that permits every action of the singers to be properly carried out, take care of all mechanical requirements of lighting and scene-shifting, and produce a suitable atmosphere. Since the "clients" to be satisfied include the audience, stagehands, director and singers, Kiesler's argument has a great deal in its favor.

S. H. Gottscho

"MARIA MALIBRAN"

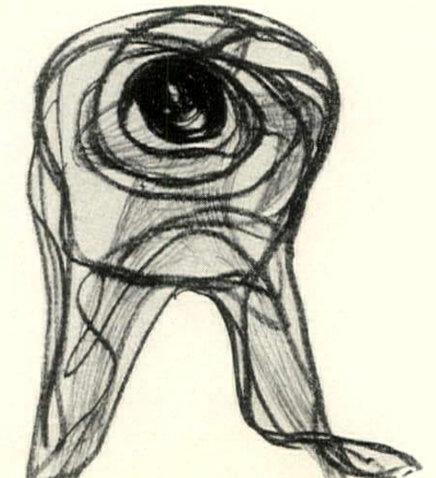


Vandamm

"Maria Malibran," an opera set in New York of the 1800's, shows a correct handling of detail in a background freely distorted for dramatic effect. "Ariadne on Naxos" has a two-story set, with changes provided mainly by curtains. The stage design for "Helen Retires" harks back to Constructivist experiments, depends largely on lighting for its effect. All settings on this page were designed by Mr. Kiesler.

S. H. Gottscho

"ARIADNE ON NAXOS"



COSTUME SKETCH FOR "HELEN RETIRES."

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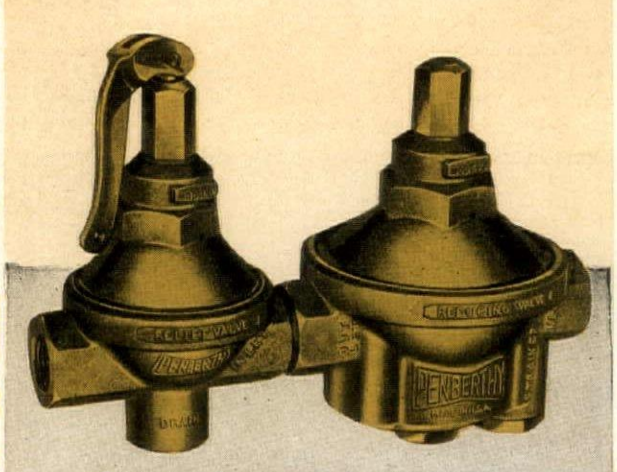

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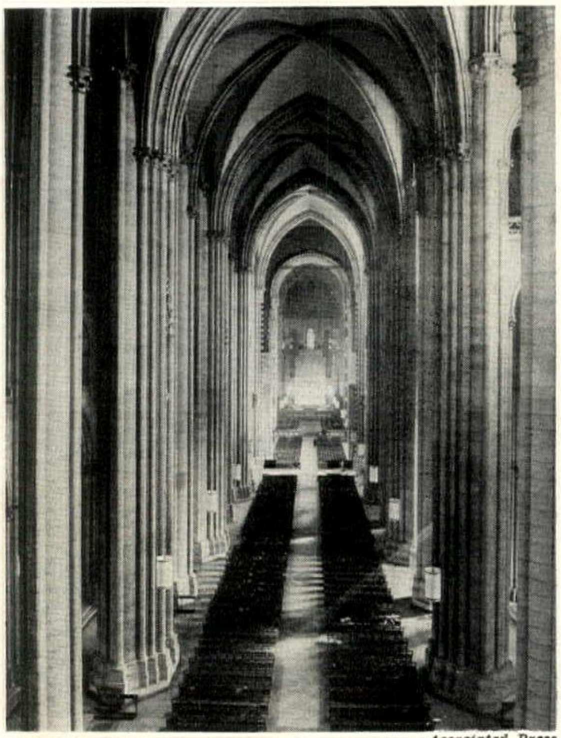
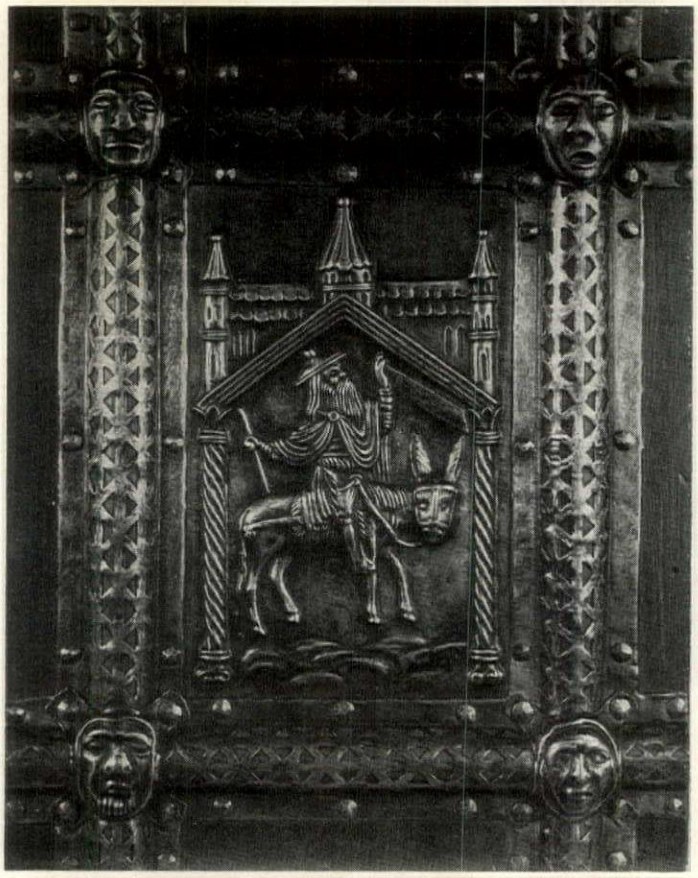
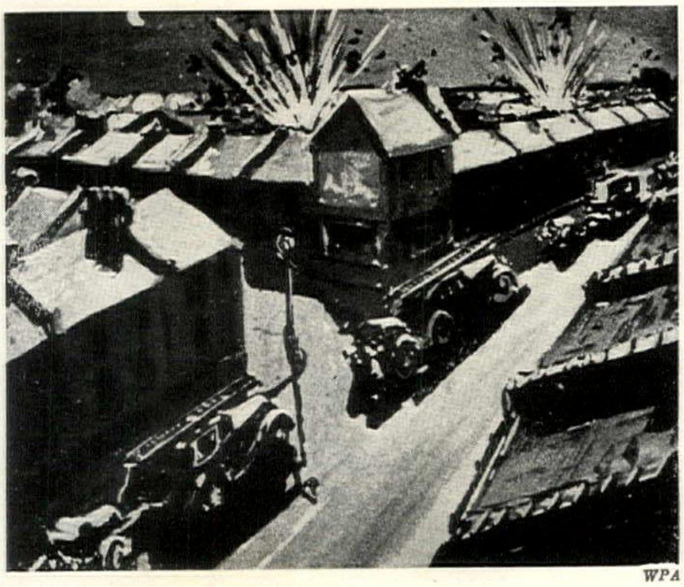
# FORUM OF EVENTS

**New York Openings.** Over half a century in the building, the Cathedral of St. John the Divine (right), has now opened its full interior to the public. With a vista of more than a tenth of a mile from front door to High Altar, the Cathedral is the largest Gothic church in the world, cost $18,000,000, and still needs funds to complete the towers and transepts. Also opened (below, right) was a show at the Museum of the City of New York, "The Fire Blitz," a series of paintings by artist-firemen in London. The illustration is a water color by Auxiliary Fireman Rudolf Haybrook, showing a moonlight raid. At the Architectural League, the first public exhibition of the work of Samuel Yellin (below) went on view last month. Some two hundred samples showed the extraordinary versatility and inventiveness of Yellin, who, before his death in October of last year, had achieved recognition as the greatest master blacksmith this country had ever seen. The example below is one of fifteen bronze panels for the Templeton Crocker residence at Pebble Beach, California.



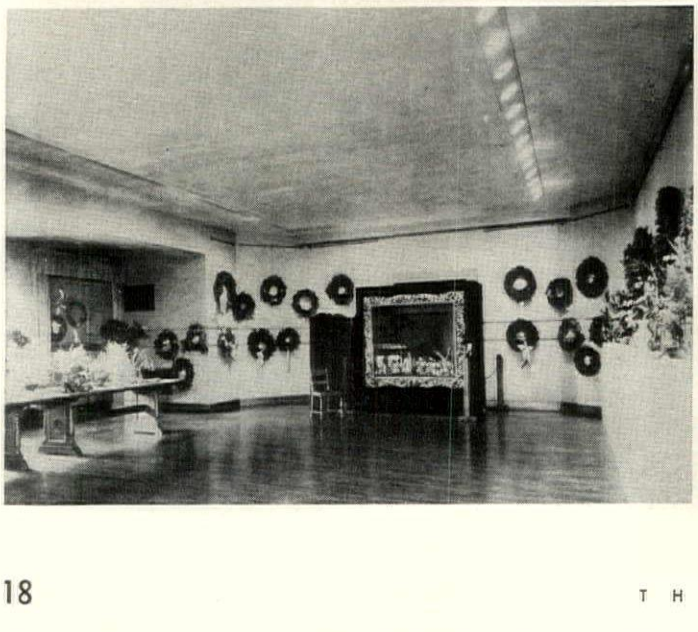
Associated Press





WPA

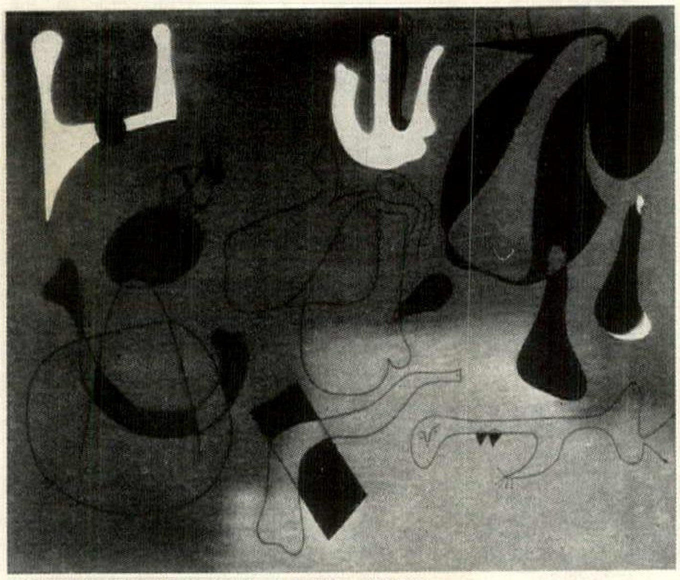
**Recipe for Museum Basements.** The views below show a basement room in the Baltimore Museum of Art, before and after treatment by able and energetic Director Leslie Cheek, Jr. New lighting and painting, plus well-chosen furniture and fabrics have produced a comfortable members' lounge with facilities for reading, smoking, tea, music and small exhibitions.

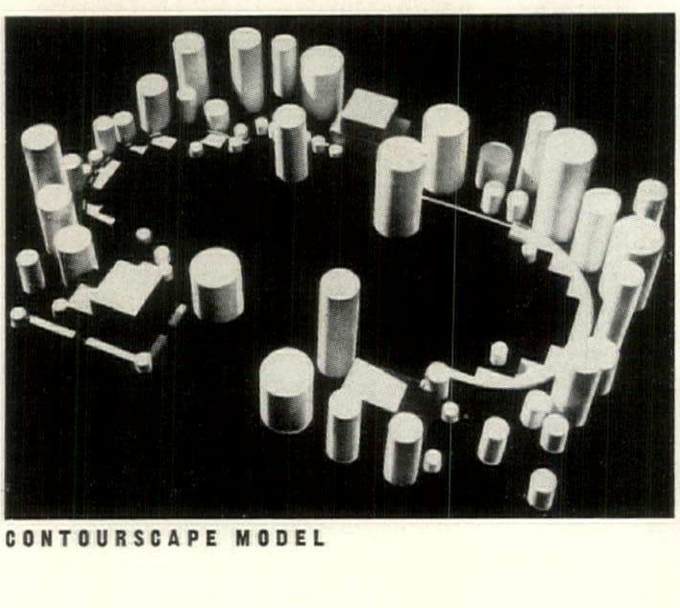


(Continued on page 62)

# BOOKS


PETTINGELL-FOWLER HOUSE, NEWBURYPORT


COMPOSITION BY JOAN MIRO


CONTOURSCAPE MODEL

**THE ARCHITECTURAL HERITAGE OF THE MERRIMACK,** by John Mead Howells. Architectural Book Publishing Co., New York. 302 plates. 9¾ x 12½. $10.

This is Mr. Howells' second fling at the architectural history of a river, the first having been a study of the Piscataqua. This method of presentation is far from arbitrary, as the rivers in the pre-industrial period constituted the most effective link between communities, and inevitably the architecture in a given valley took on a specific local character. In this volume, identical in format with its monumental predecessor, Colonial and Federal buildings in seven of the main towns along the river are shown. The presentation is essentially that of a picture-book, with practically no plans or other measured drawings. The scope and variety of the illustrations is impressive, and they form a valuable addition to existing documents on the period.

**JOAN MIRO,** by James Johnson Sweeney. The Museum of Modern Art, New York. 87 pp., illustrated. 7¾ x 10¼. $2.00.

Joan Miro, one of the most noted of modern painters, was born in Barcelona in 1893, spent most of his working life in Paris, and, since the fall of France, has been living on the island of Majorca. A confirmed experimenter like so many of his contemporaries, he has passed through a whole series of phases — cubist, dada and surrealist among others —to arrive at the technique, indicated in the accompanying illustration, with which he is most frequently identified. The vague, restless forms, so oddly reminiscent of shapes found in advanced highway plans and machine and engineering designs, are among the most interesting of all attempts to solve contemporary decorative problems, and have had a very obvious influence on architecture. The book was published as a catalog to accompany the exhibition of his work at the Museum of Modern Art. Handsomely designed and fully illustrated, it is an admirable example of the precedent set by the Museum in changing the conventional exhibit catalog into a fine book. There is a biographical essay, a chronology and bibliography. Several excellent reproductions in color are included.

**CONTOURSCAPING,** by Ralph Rodney Root. Ralph Fletcher Seymour, Chicago. 235 pp., illustrated. 8 x 10¼. $10.

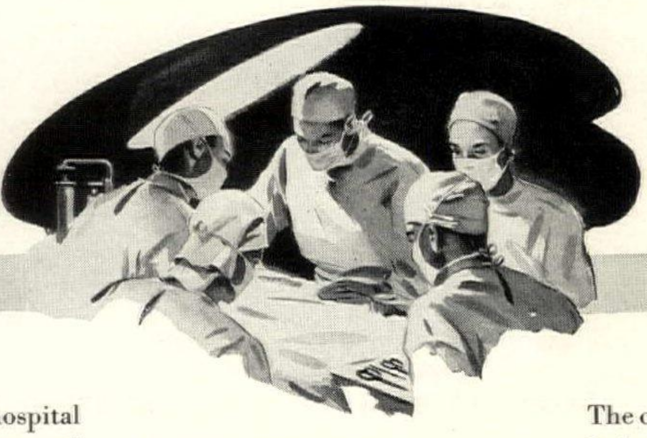
"Contourscapes," says the author, "are compositions of natural areas, in three dimensions, made up of these earth shapes and accompanying natural materials, color form plant materials, and sky areas, all exhibiting progressive movement and combined by the landscaper's original visualization of the project becomes a plastic composition." The word "contourscaping" was coined by the author, apparently, as being more satisfactory than "landscaping" or "landscape architecture." In essence the book is a plea for more functional landscape design. Commendable as the idea may be, the presentation leaves much to be desired. The book is composed of a series of short paragraphs, of which the above quotation is a sample, giving the impression that the writer jotted down notes until he had enough to fill a book. The result is anything but readable, although some of the ideas, such as the use of cylinders for three-dimensional studies, are interesting.

(*Continued on page* 52)

# Now...

# A STATIC-CONDUCTIVE AND SPARK-RESISTANT RUBBER FLOORING

## *for hospital operating rooms*



EVERYONE familiar with hospital construction has encountered the problem of static electricity in surgery flooring — and knows its hazards.

Goodyear is happy to announce that it has now met this problem with the development of a static-conductive and spark-resistant rubber flooring destined to mark a notable advance in the design of surgery rooms.

This new flooring is made of the highest-quality compounds. It embodies all the features that have made Goodyear flooring first choice with institutions everywhere.

The cost is moderate — approximately that of standard Goodyear Rubber Flooring.

Goodyear static-conductive rubber flooring is made only in plain black, 3/16" gauge, sheet form.

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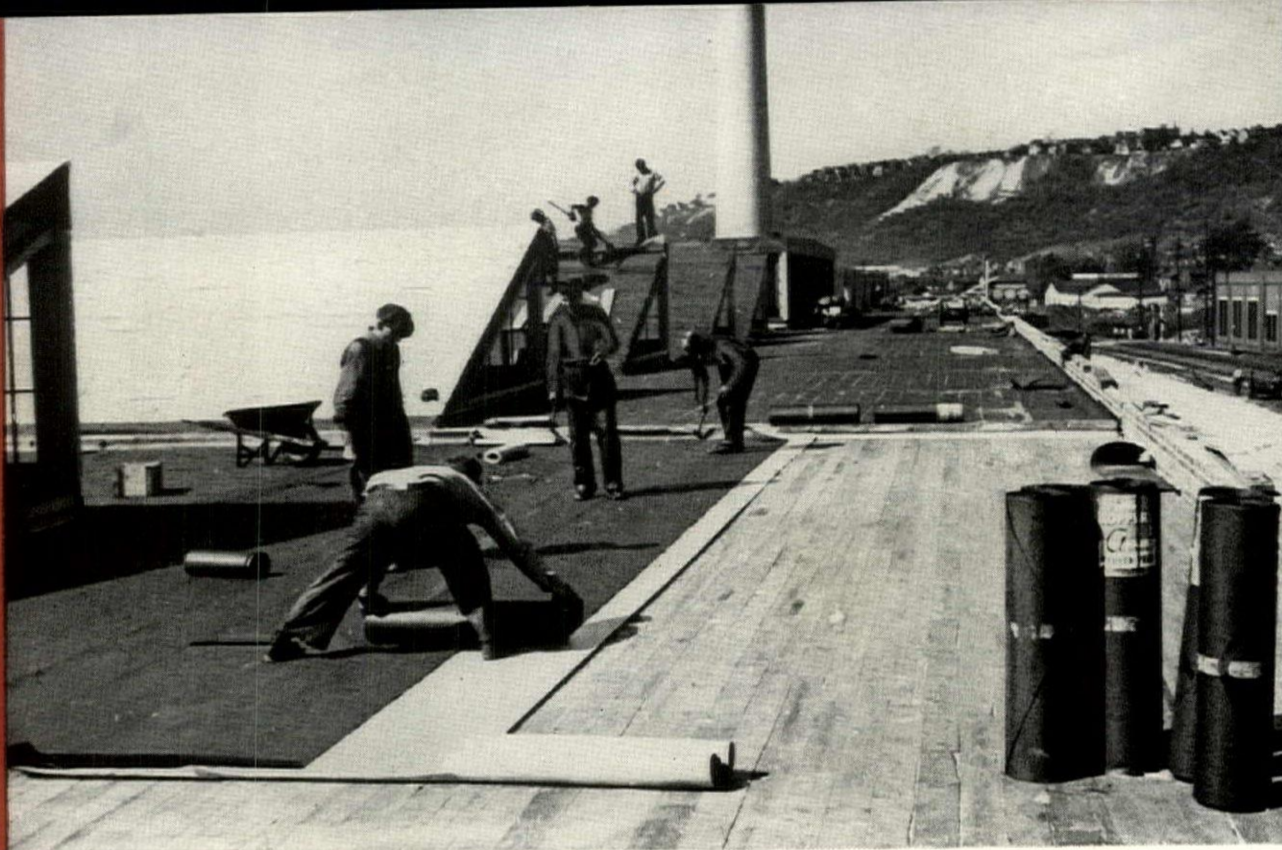

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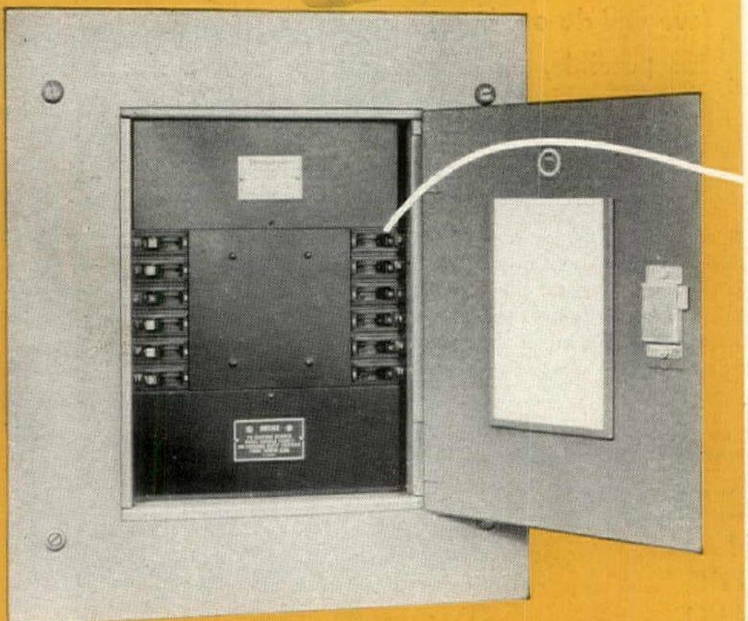
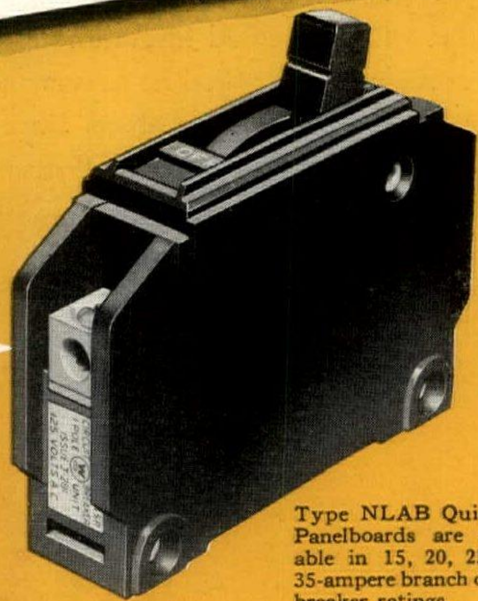
# Westinghouse announces...
# the QUICKLAG "De-ion" Circuit Breaker Panelboard





Type NLAB Quicklag Panelboards are available in 15, 20, 25 and 35-ampere branch circuit breaker ratings.

**Thermal (bi-metal)-magnetic co-operative trip action results in:**

- **Full-time-Delay Action on harmless overloads**
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*Quicklag* — a quick-make, quick-break, fast-trip action, "De-ion" circuit breaker panelboard for lighting and appliance circuit protection—answering industry's needs for fast tripping action on short circuits and advantageous time delay on temporary overloads.

Ideal for lighting and appliance circuit protection, Quicklag panelboards are being announced at a time when circuit breaker protection is proving its value to high-speed production . . . saving hundreds of thousands of production hours annually. For sale by over 100 Westinghouse Agents everywhere.

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**Westinghouse** NOFUZE CIRCUIT PROTECTION

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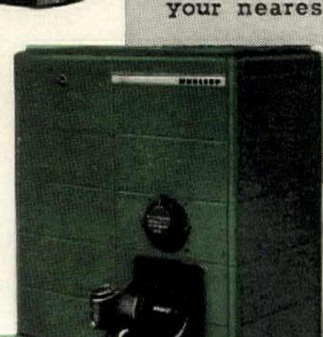

*New* MUELLER SERIES OHP HORIZONTAL OIL-FIRED WINTER AIR CONDITIONER. Designed especially for basement installations.

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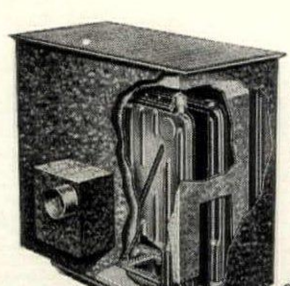

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# MORE LIGHT and SUNSHINE!

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THIS BOOKLET SHOWS HOW CECO CASEMENTS PROVIDE IT!

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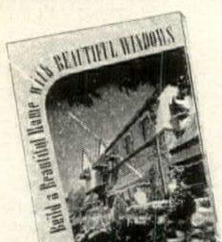


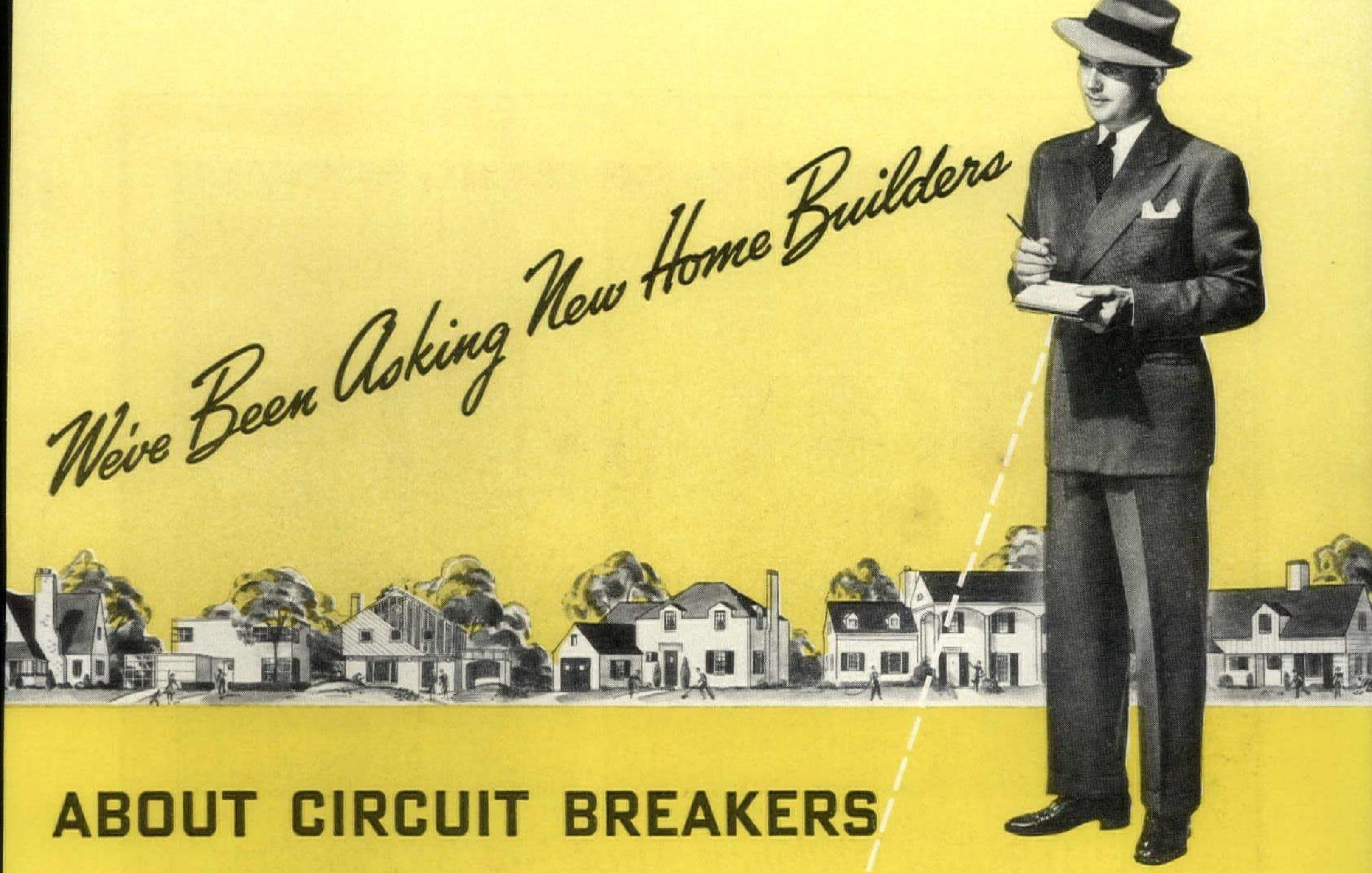

● You bet! . . . beautiful windows *make* a beautiful home! The families who buy *your* homes want the floods of sunshine that Ceco Casements provide. And they want loads of fresh air. Ceco gives that . . . at the twist of a wrist. Hardware is easy to operate; sticking, warping and rotting are unknown! Then for durability, tell your prospects that Ceco Steel Casements are BONDERIZED against rust destruction. Ceco offers lifetime window satisfaction . . . at the cost of ordinary windows.

**CECO STEEL PRODUCTS CORPORATION**

*Manufacturing Division:* 5701 W. 26th St., Chicago, Illinois

## *Ceco Steel Windows*

# *We've Been Asking New Home Builders*



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There are Square D Multi-breakers for homes of every size. There are Multi-breakers, too, for all types of commercial and industrial buildings.


*See our Catalog in SWEET'S 23/12*

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***MULTI-BREAKERS ARE NON-TAMPERABLE***

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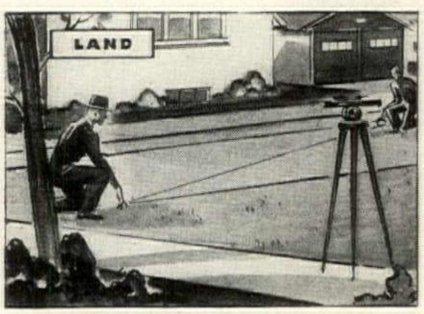
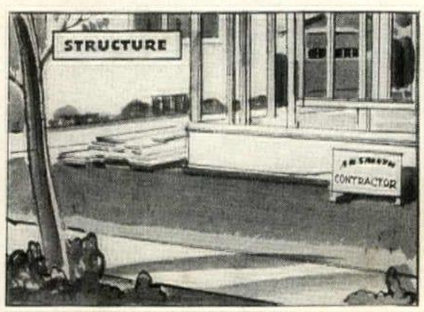



**LAND FIRST,** *then . . .*

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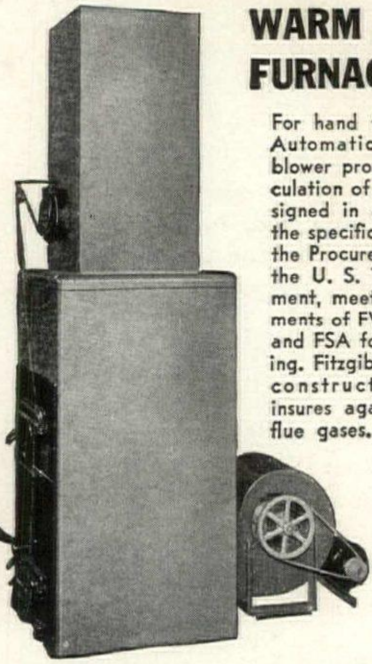

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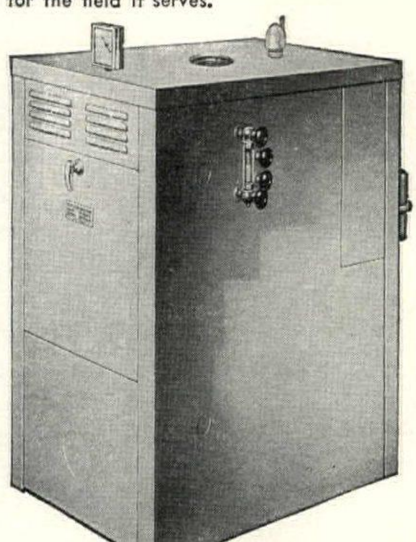

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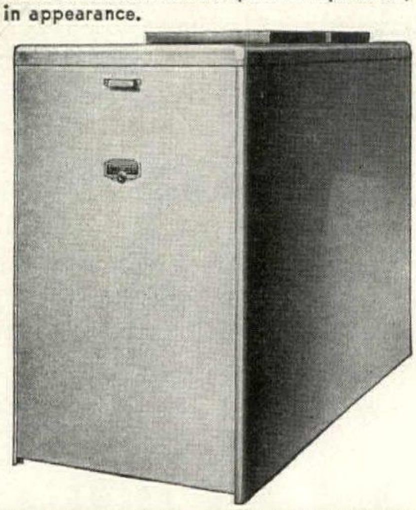

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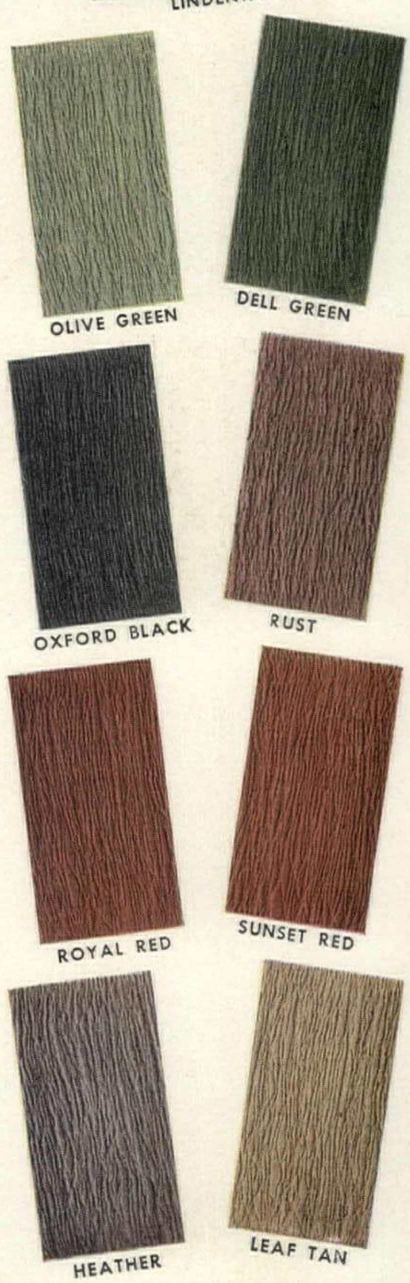


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*The Lindenwold Shingle (above) was reproduced directly from a full-size shingle reduced 6 times in size. The swatches show the eight other colors in the same reduction. Notice the beautiful graining.*



# Flexwood FOR MODERN WOOD TREATMENT

[WOOD IN FACILE FORM]


*Birch Flexwood treatment, Secretary's Corridor, Home Office Building, Employers Mutual Liability Co., Wausau, Wisc., Childs & Smith, Architects.*

*Curved corners and soffits add interest to the President's office treated in Figured Teak Flexwood.*

*Photos: Hedrich*

Using the coloring and figure of rare woods to complement clean, flowing design, the Flexwood-treated interiors created by Childs & Smith, Architects, are enduringly beautiful. They provide an atmosphere which is both permanent and gracious. Exotic veneers such as Teak, Paldao, Rift Oak, Red Birch, and Figured Walnut were selected for the Board Room, ten offices, corridors and entranceway; 10,000 sq. ft. of Flexwood was required. Flexwood, easily and speedily applied, is a logical choice when the distinction and beauty of real wood are desired, and where the limitations of normal decorating budgets must be observed.

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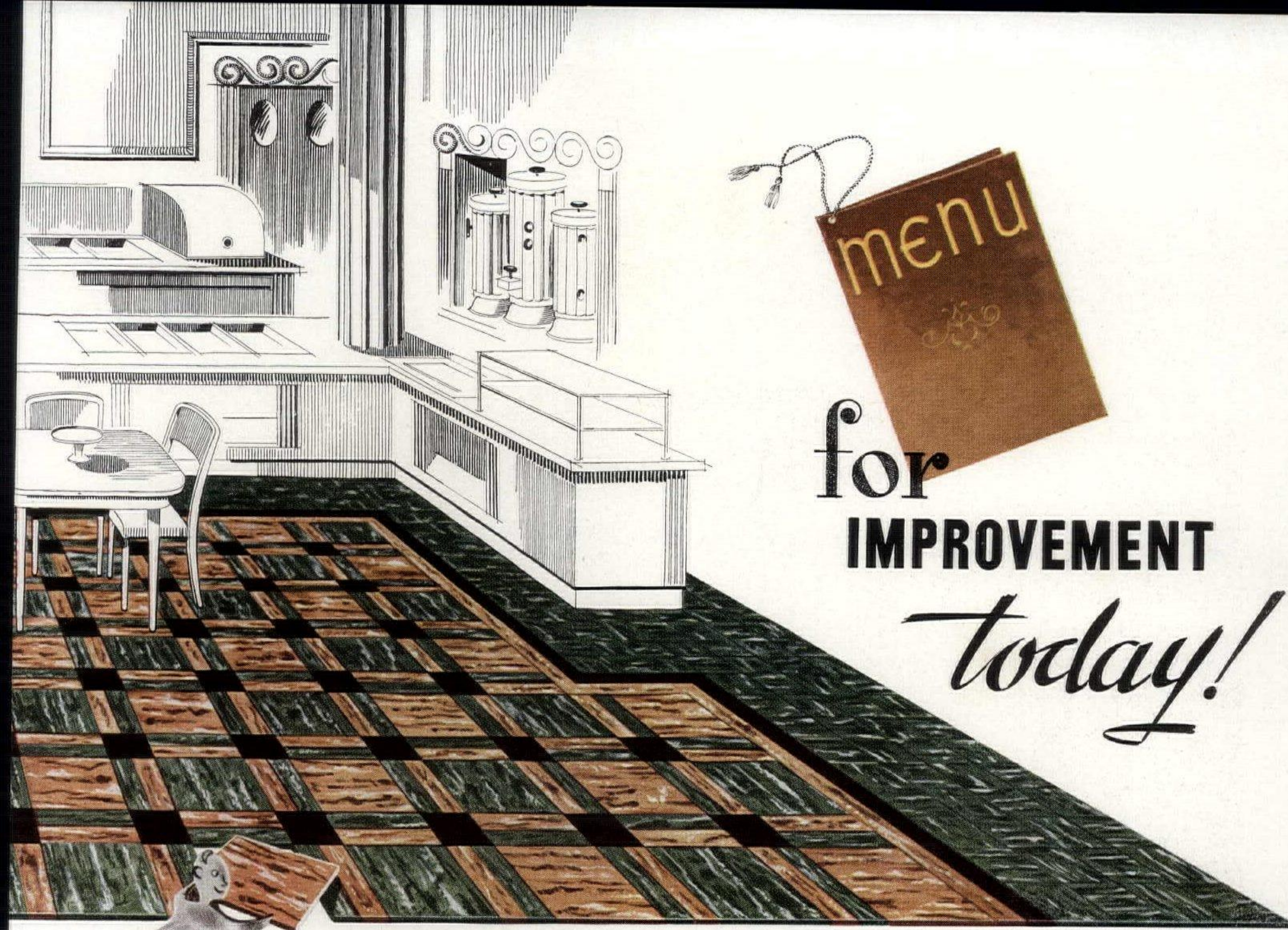


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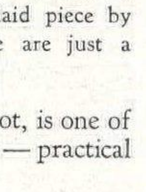

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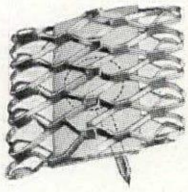

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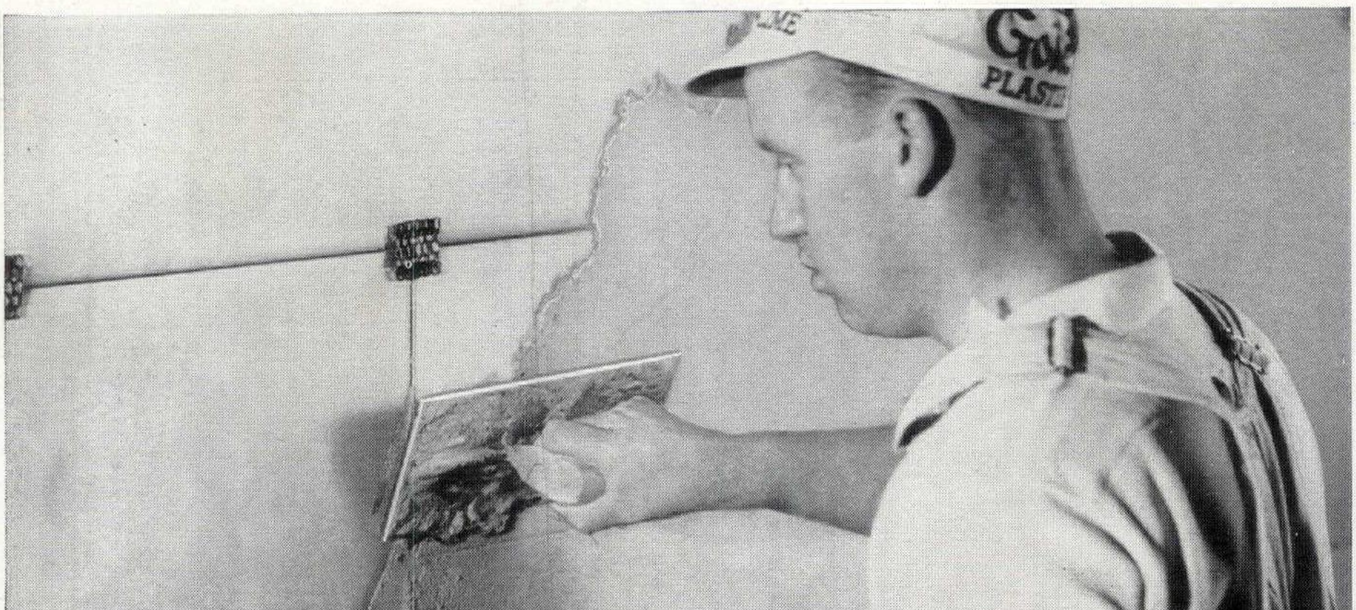

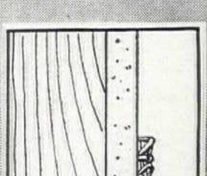

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# CIVILIAN DEFENSE

## REFERENCE NUMBER

As long ago as 1915, two Zeppelins crossed the English Channel, dropped bombs on Yarmouth and nearby villages. Thus was born the horrible art of air attack on civilian populations. But not until the recent Axis experimental war in Spain did this new offensive technique reach a fiendish point of perfection. Today, the odds have shifted and a variety of stout defenses against the attacking bomber have vastly reduced its effectiveness in destroying structures, creating civilian panic and interrupting productive work.

Now, for the first time, the U. S. is in a world war where the non-combatant is not in the completely safe role of the man behind the man behind the gun. There is no assurance that anyone is far enough back of the lines to avoid all danger.

Civilian defense against bombing is of two kinds: that provided by the Military (detection and interception of invading bombers by fighter planes, balloon barrages and anti-aircraft fire) and that provided by passive protective measures (blackout, camouflage, shelters and other structural means). The design, construction and maintenance of the latter are the major defense contributions of architects, engineers and their colleagues in Building. For this reason the Editors have abandoned the regular January issue which was ready for press, and present this special Reference Number designed to assist all those responsible for civilian defense, in particular Building's trained and experienced professionals.

It should not be assumed that this issue of THE FORUM could be assembled, edited and produced in three weeks without advance preparation. However, no amount of planning would have sufficed had not a substantial amount of data existed in official agencies. Year and a half ago, the Army's Corps of Engineers was directed to study passive defense for the U. S. Since then, they have carried on extensive programs, have maintained close liaison with the Navy and the Office of Civilian Defense and have enlisted the services of a top-flight scientific and engineering group for fun-

**SAN FRANCISCO—DECEMBER, 1941**

damental research—the National Academy of Science's Committee on Passive Protection Against Bombing: California Tech's Richard Chase Tolman, M. I. T.'s Karl Taylor Compton, Princeton's Luther Pfahler Eisenhart, Forest Ray Moulton of the American Assn. for the Advancement of Science and M. I. T.'s John E. Burchard, Executive Officer. More recently, representatives of the Corps of Engineers and the Committee have visited England to study the extensive ARP research conducted there and to view actual installations and results in the largest bombing laboratory in the world.

THE FORUM acknowledges cooperation in the preparation of this issue by the Army's Corps of Engineers, the Committee on Passive Protection Against Bombing and the OCD's Technical Committee, including Lt. Col. Milton C. Mapes, C. E., of OCD, Sherwood B. Smith of the Corps of Engineers' Fortification Section and Prof. John E. Burchard of the National Academy of Science. Finally, be it recorded that our intrepid allies, the Building technicians of Great Britain, have set an example of skill, ingenuity and courage which makes it possible for the U. S. civilian to meet this war threat with high confidence in the result and in the ultimate victory.

—*The Editors*

# Can U. S. Coastal Cities be Bombed?

Last month's surprise bombing of Pearl Harbor—3,100 miles from Japan—is proof enough that the Continental U. S. is not immune to air attack. For the time being, however, the country is subject only to sporadic raids by carrier-based bombers and, to a much lesser extent, by long range heavy bombers on suicidal one-way missions from distant land bases.

The possibility of carrier attack holds more significance for the West Coast than for the East, for, while Japan is prowling in the Pacific with perhaps a dozen comparatively small carriers whose planes (30 to 50 on each) have a 300-mile radius of action, across the Atlantic Germany is known to have not a single carrier and Italy's are tightly bottled up in the Mediterranean. Nevertheless, it should be remembered that Germany has at least one warship equipped with two or three catapult bombers capable of carrying heavy bomb loads long round-trip distances — perhaps 2,500 miles. Moreover, this menace to the East Coast, even though it is small at the moment, would be increased substantially should Germany seize Vichy-France's 26-plane, four-catapult sea plane carrier and its two 18,000-ton, 40-plane carriers. (France's largest carrier—the 21,000-ton Bearn—is at Martinique and would probably be acquired by the U. S. at the first sign of French naval collaboration with the enemy.)

Although Japan has set a world's distance record of more than 7,000 non-stop miles in a single-engine plane loaded only with fuel and crew, no Axis power is believed to have a bomber capable of a round-trip flight to the continental U. S. from the nearest enemy land bases—Japan's Marshall Islands 4,900 miles out in the Pacific or Germany's occupied France 3,000 miles to the east. Today's maximum range for a land-based bomber is roughly 4,000 miles round-trip. This means that, in order to raid the continental U. S. regularly with such super-long-range planes, the enemy would first have to establish bases in Hawaii, the Azores, Iceland or the Aleutian Islands (all about 2,000 miles away) or in Martinique (1,400), Greenland (1,200), the northern coast of South America (1,000), the southern tip of Mexico's Lower California (600) or in Newfoundland (400)—unlikely, of course, but not impossible.

From this analysis of the probabilities and possibilities of assault by enemy bombers, it appears eminently reasonable to conclude that the present civilian defense program should be regarded as a precaution against sporadic air raids — not against incessant heavy bombing of the European variety.

## Would the Enemy's Gain be Worth the Risk?

What would be the enemy's purpose in staging occasional bombing raids? Principally —to lower civilian morale, to plague U. S. war efforts with a spreading case of civilian jitters, to incite civilian demands for a shift of military and naval protection from strategic outposts to continental shores, to touch off waves of bomb shelter construction and strictly defense industrial production which would divert labor and materials from more important channels.

For instance, if the 26.5 million persons living only in cities of 50,000 or more population within 300 miles of the Atlantic, Caribbean and Pacific were to demand bomb protection in 24-person shelters similar in construction to the simple model presented on page 53, the U. S. would be hard-pressed to satisfy them. Since each shelter would cost close to $1,800 and require 224 man hours of labor during construction, the shelter program for these coastal inhabitants alone would involve about $2 billion and 246 million man hours of work. Since not more than half of all the 574,000 AF of L building trades workers are located in these coastal areas, such a shelter construction program could not be completed in less than 100 days even if all other types of construction (including vital Army and Navy projects) were to be stopped.

If the enemy's raids produce any such hoped-for results, the high cost in planes, ships, ammunition, fuel and men would be considered well spent, and the raids would probably continue with increasing vigor. On the other hand, if U. S. citizens meet occasional raids coolly and with calm, deliberate preparation, chances are that the raids would soon be discontinued. Recent European history proves that the Axis partners are not spendthrifts, that their military operations must produce results comparable with their costs. Hitler's daylight bombing of England in August and September 1940 involved tremendous losses in men and equipment, served only to unify the people and was promptly called off. His subsequent night raids on England's industrial centers were equally expensive in relation to their effect and were also suspended.

Thus, while U. S. citizens must immediately plan and prepare in all details of passive defense for any emergency, they should not undertake the execution of any of the construction which might seriously impair or jeopardize the major U. S. objective of wide spread preparation for winning the war. This may require that the citizen, now for the first time in history in almost as dangerous a position as the soldier, take some of the same chances that every soldier takes. Like the soldier, he cannot expect to be entirely safe from aerial bombardment. Under these conditions the soldier develops a certain mental attitude—a psychology—which the average citizen must now acquire.

## What Passive Defense Should the U. S. Provide?

The same economy of action that will determine the frequency and force of enemy air raids should guide the precautions to be taken against them:

►Under Federal direction, air raid warning systems should be (and are being) perfected to blanket immediately the coastal regions and ultimately the entire country.

►Every community along the currently vulnerable coast lines should organize itself for passive defense, enact emergency legislation and train its volunteer personnel to meet all possible air raid contingencies—gas, fire and destruction. (Massachusett's state-wide program, serves as a model and has gained OCD commendation. Emergency powers assumed by the Governor have made unnecessary the time-consuming passage of local civilian defense ordinances.)

►These communities should practice blackouts, using temporary and inexpensive materials for the time being. While initial practices may be only partial in effect, subsequent efforts should lead progressively to the achievement of total blackout.

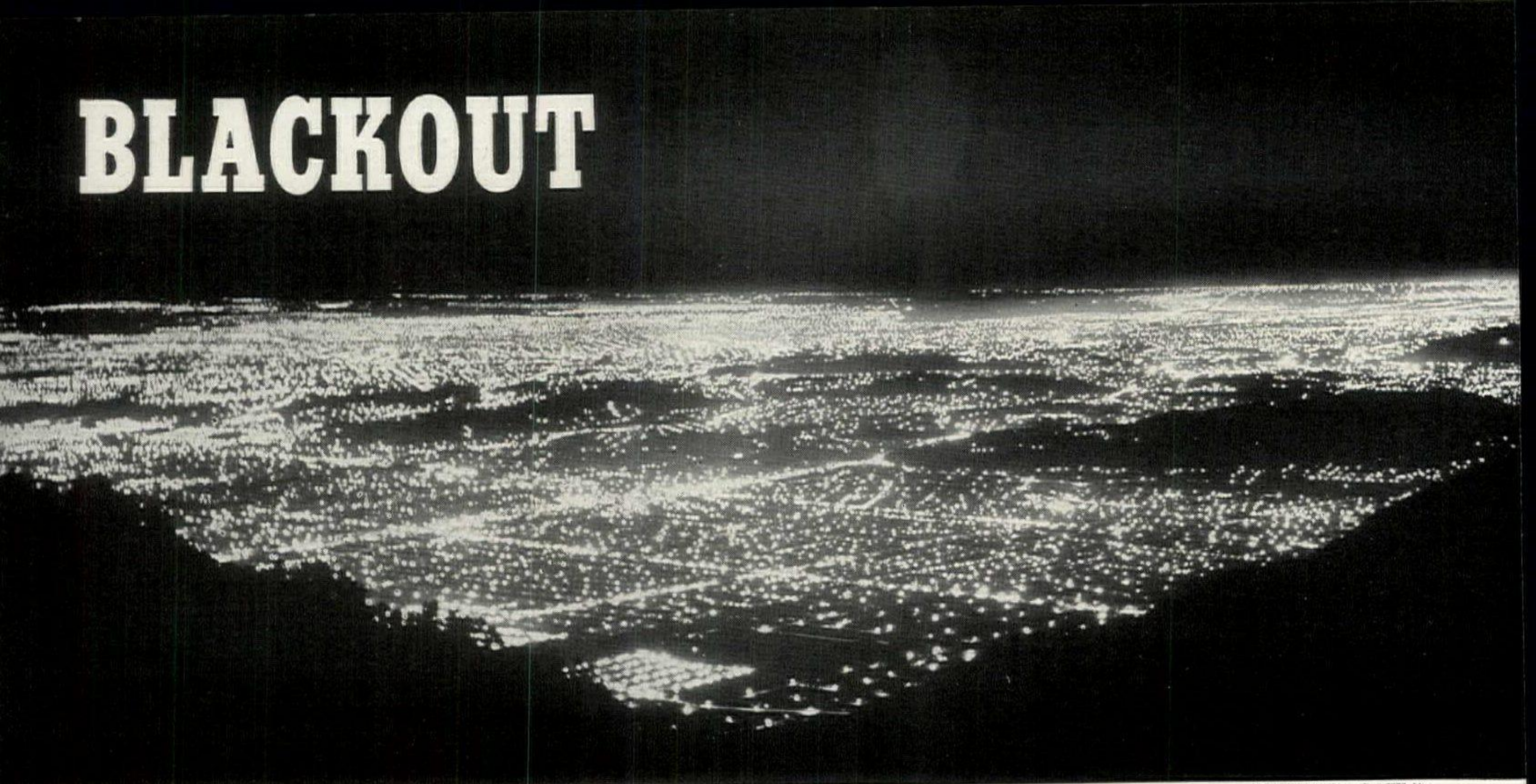
►Upon the recommendation of military or civilian defense officials and under the guidance of recognized experts, some existing public utility and industrial structures should be camouflaged. All new structures in these categories should be located, designed and built with full attention to protective concealment—both camouflage and blackout—and to protection against bombs (stopping incendiaries and limiting the effect of explosives) without loss of production efficiency.

►Owners and managers of existing buildings of all types should immediately acquaint themselves with the technique of air raid protection.

►Construction of air raid shelters for the present should be discouraged.

►Most important, the U. S. public in general and the U. S. building industry in particular should immediately *plan* for all contingencies by studying permanent blackout installations, comprehensive camouflage, fire and gas protection, strengthening of existing structures and the actual construction of splinter-proof shelters. *Planning* "all-out" passive defense measures is vigorously encouraged by defense officials. Some of these plans must proceed at once, others, it is hoped, may always remain on paper. Building's current civilian defense duty is to be informed and therefore prepared to act.

# BLACKOUT



Margaret Bourke-White

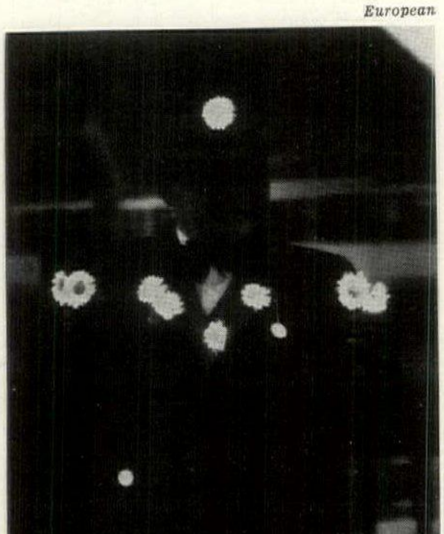
No. 1 weapon of U. S. civilians in their passive defense against hostile bombers is blackout. At night, it supplements active defense by the Army's interceptor squadrons and anti-aircraft batteries and may prove equally effective in protecting property and lives—both military and civilian.

### WHY

The three-fold purpose of blackout is 1) to obliterate the tell-tale light patterns of communities (see photograph above) which would facilitate the spotting of specific air raid objectives within the communities, 2) to conceal the identity of localities which enemy airmen might use as sign posts on their way to more important military and industrial objectives and 3) to discourage haphazard civilian bombardment frequently resorted to by hostile aircraft which, unable to find their assigned targets, dump their bombs on any recognizable scenes of activity before returning to their bases.

To accomplish these purposes it is apparent that every community within range of enemy bombers—no matter how "innocent" in character—must participate in the blackout programs of officially "alerted" areas. An area blackout is effective only with the participation of all communities within it and only with the complete cooperation of everyone in each community. Except where deceptive lighting may be deemed advisable as a means of camouflage, blackout must be total to be effective—achievement of a 95 per cent blackout in a community or an area may be nullified by the nonconforming 5 per cent and with fatal results.

European



**Phosphorescent boutonnieres,** on sale by Berlin street vendor. Flowers aid in distinguishing fellow-pedestrians during blackout.

### WHERE AND WHEN

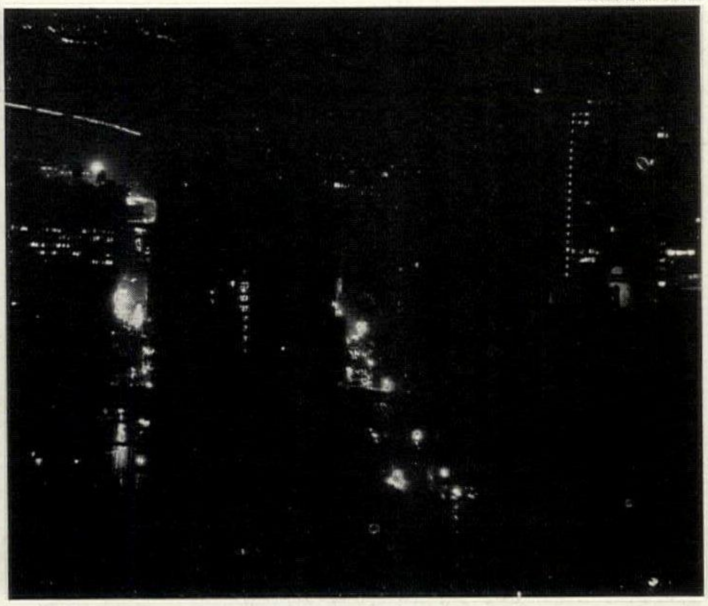
Assuming continuance of the present balance of military, naval and air power, most of the U. S. need never be blacked out. All of it, however, must now prepare for the possibility of a change in the balance and the universal need for protective concealment. Actual blackout should take place only where and when required by the Office of Civilian Defense or local military commanders. For the present this activity will probably be limited to areas within 300 miles of the coasts.

Preparations for blackout have been divided by the War Department and OCD into three distinct phases: 1) Initiated locally, the first phase is one of planning for blackout—the division of responsibilities, the listing of materials required and the determination of sources for these materials. 2) Begun only upon the advice of local OCD authorities, the second or the "preparatory" phase embraces the purchasing of blackout materials by property owners and managers and their preparation for installation. In some cases, actual installations may be made. 3) During the final phase, initiated by OCD itself, all permanent blackout installations are completed, all temporary installations are made ready for

Associated Press

1 **All lit up,** Pittsburgh's downtown area looks like this from Grandview Heights. This photograph was taken last spring just before the blackout experiment pictured to the right. Brightly lighted are Penn and Liberty Avenues.

Associated Press



2 **Same view** during partial blackout spots "necessary lights" left on for safety's sake. During actual blackout, they would be deemed unnecessary and would either be turned out or obscured. Note vertical lights in skyscraper stair wells.

immediate application and restrictions may be imposed on outdoor lighting.

When the officer heading the local air force interceptor command decides that his "air defense area" is vulnerable to attack*, he will "alert" the area, require that it be immediately blacked out except for street lights (screened and dimmed during the third phase of preparations) and whatever lights are necessary to safety and the efficient operation of essential industry and transportation. Upon the actual approach of enemy bombers, these essential lights remain on even after the receipt of the "preliminary caution" message and subsequent "lights warning" message from the interceptor command. (Both of these messages are confidential, sent only to local government offices and the offices of essential utility, industrial and transportation companies.) Blackout becomes total with the issuance of the "action warning" message to the public in general. This message or alarm means that a raid may occur within five minutes, that total blackout must be maintained until the "all clear" or "raiders passed" message is issued, at which time the area reverts to its more lenient "alert" conditions.

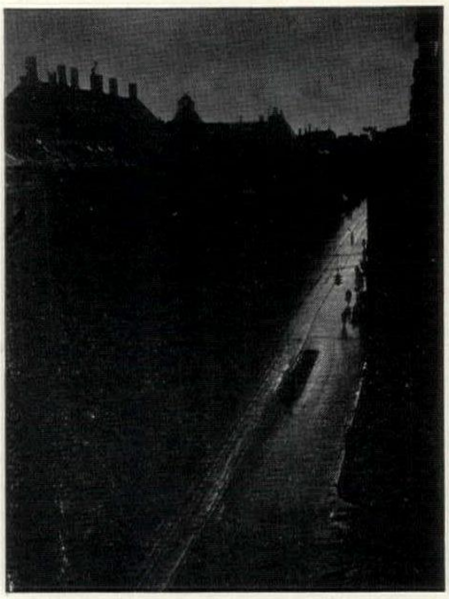
Strict adherence to this official time table is essential, first, because planning and advance preparation are essential to effective blackout and, second, because unnecessary blackout may seriously interfere with the nation's war effort. Comments the War Department on the former reason: "The effectiveness of a blackout system depends upon the knowledge and the cooperative spirit of the people at large. . . . An effective blackout is not achieved by spectacular efforts at the beginning or during an air raid. Except for meeting contingencies, little or nothing can be done to increase the effectiveness of a blackout while a raid is in progress." Equally important is the second reason—the prevention of unnecessary blackout. One of the purposes of air raids is to disrupt industrial production and lower civilian morale; unnecessary promiscuous blackout of factories and homes may achieve these objectives quicker than actual bombardment. Moreover, the untimely purchase of blackout materials in areas not immediately vulnerable to attack may cause critical shortages in areas where they are actually needed.

## WHAT

Due to the brilliance of moon or starlight, it is not possible on clear nights wholly to conceal the presence of communities, rural buildings and interconnecting highways, even with the aid of total blackout. This passive defense measure should, however, completely blanket all artificial illumination visible from the air and tone down as far as practicable all reflections of natural light, searchlights, fires and aerial flares (fig. 3, right). Primary light sources include windows, skylights, factory roofs, store fronts, outdoor building lights, street lights, electric signs, vehicle lights, beacons, and such comparatively open industrial plants as coke ovens and steel mills (fig. 4, right). More difficult to conceal, light reflections spring primarily from windows, glass and metal roofs, paved areas, rivers, lakes and reservoirs.

## HOW

Easiest way to plunge an area into total darkness is to shut off all electric power at the generating stations. Unfortunately,

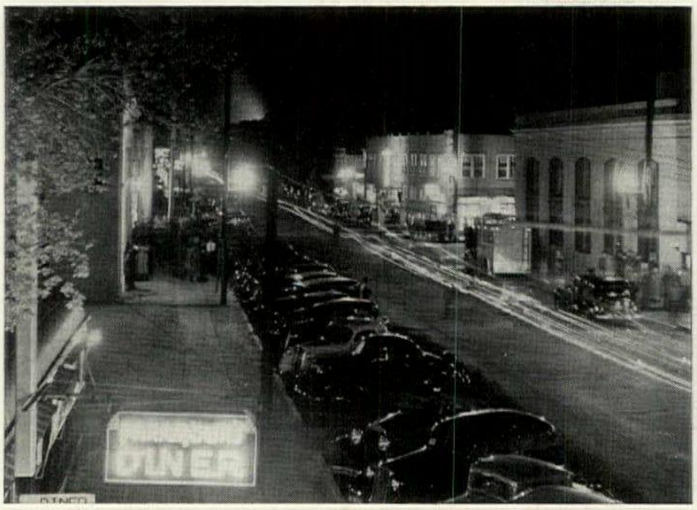


3 **Total blackout** in Copenhagen. Reflection of moonlight on street would not be so obvious at high altitudes and different angles.

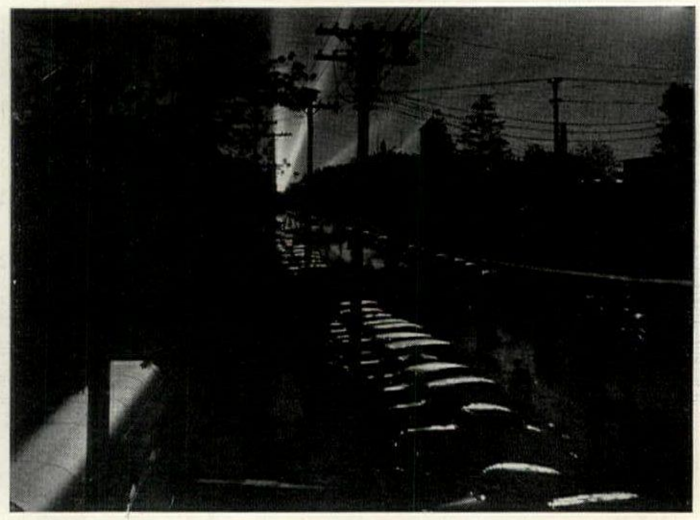
4 **Tough obscuration problem** presented by the glow and glare of steel mills is illustrated by this night view of a Republic Steel Corp. plant with its Bessemer converters in operation.

*There are four interceptor commands with headquarters near New York City, Tampa, Seattle and Riverside (Calif.)

*Photos, Otto Hagel*



**1 A small town main street** under normal night conditions illustrates the brightness of light sources—street lights, store windows and signs—and reflections from shiny automobile tops. Army vehicles are painted a matt finish to reduce this reflection.



**2 Blacked out,** the same street would be easily visible from the air due to reflections from auto tops and diner roof. Light sources: anti-aircraft searchlight in background and airplane flares. Full moon would produce somewhat similar results.

this is not feasible, for it would stop public transportation in its tracks, leave elevators stranded between floors, stop electrically operated war production machinery and extinguish essential illumination in control rooms, hospitals and other centers of vital activity. Moreover, the total absence of light for protracted night periods would play havoc with civilian morale and require wide-spread construction of emergency lighting systems.

Alternative means of accomplishing blackout include the turning off of individual lights or light circuits, painting glazed areas or covering them with opaque materials. Reflective surfaces may be toned down with light-absorbing matt finishes. The following discussion and illustrations cover certain proved methods of solving typical blackout problems. They are necessarily brief and serve only as guides, for actual installations will vary with specific local problems and the ingenuity of the property owner.

## LIGHTS OUT

Turning out individual lights or light circuits is, of course, the quickest and simplest means of blackout. It is the only recommended blackout treatment for privately operated outside lights—advertising signs, entrance lights, etc. And, since the U. S. may now expect only sporadic air raids and brief blackouts, this method will probably play a big part in the program.

If blackouts and raids become frequent, each family should determine which room or rooms in its dwelling will make the most satisfactory air raid refuge from the point of view of comfort, ease of obscuration and safety from the effects of bombardment (p. 43), should then prepare to black it out. At night, lights in all other rooms should be turned out or, better yet, the bulbs should be removed to prevent their being lighted by mistake.

Much the same procedure may be followed by the owners and managers of most office buildings, stores and other sizable commercial structures, for, during air raids when blackout is required, most of the occupants may wish to vacate their quarters for more bomb-resistant sections of the buildings (p. 37). Due to the great number of electrical fixtures in these buildings, light bulbs should not be removed—instead, a volunteer warden for each floor should be held responsible for the maintenance of complete darkness in all exposed rooms.

The only economical means of blacking out show windows is to douse the lights — in most stores this may be done without darkening the interior, for the show windows are usually isolated by partitions. (For other methods, see fig. 14, p. 12)

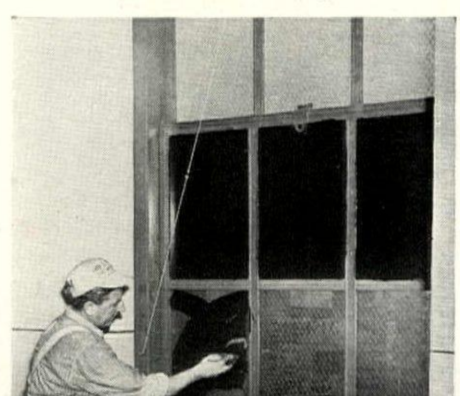
## OBSCURATION

All openings in lighted rooms to be used during blackout must be rendered opaque or lightproof. Called obscuration, this masking of interior light may be achieved by several means, — paint, adhesive materials, flexible shades or curtains, rigid screens and glass substitutes and such makeshift materials as rugs, blankets, draperies, opaque cloths and similar household items which are suitable for the initial phases of blackout. Each means has its advantages and disadvantages, and its use should be considered in the light of many controlling factors—initial and maintenance costs, probable duration and frequency of blackouts, need for the glazed area during daylight, possibility of actual bombing in immediate vicinity, etc.

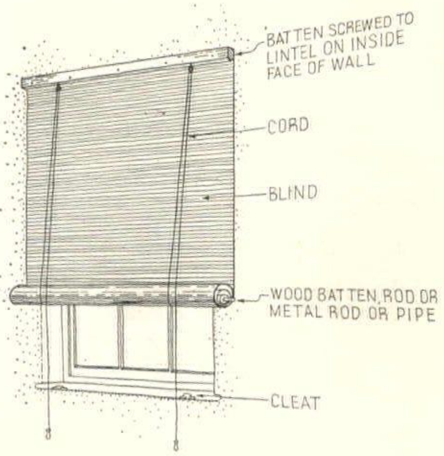
**Paint.** The simplest, cheapest (first cost) and quickest method of obscuration (excluding the make-shifts) is the painting of glazed areas. A dark, heavy outside or asphalt paint can be quickly applied with brush or spray at a material cost of less than 5 cents per sq. yd. By applying the paint to the outside of the glass it serves the dual purpose of obscuration and reduction of reflection. Paint, however, must be considered only as a temporary emergency measure, since the glass may be broken by bomb blast or splinters and may require considerable time to replace and, of course, it prevents the admission of daylight. Moreover, paint is comparatively difficult to remove and offers no protection against the splintering of glass itself—a prolific source of casualty but seldom fatal. (For specifications of industrial blackout paints—see p. 40).

**Adhesives.** Where permanent obscuration is feasible, several types of flexible opaque materials may be affixed to glass with adhesives, preventing broken glass from flying about the room. These materials are recommended: 1) thick, tough papers, preferably reinforced with meshes of cotton, linen, kemp, sisal or other fibers—i.e. building papers. They should be secured to the glass with a permanently tacky adhesive such as ordinary flour paste with 5 per cent glycerine or molasses added or gum arabic with 5 per cent of glycerine added. 2) Cardboard, wetted prior to application, may be secured to glass with paperhanger's or cold water paste or such flexible adhesives as bookbinder's glue. 3) Such textile materials

*(Text continued on page 42)*



**3 A painter** blacks out windows of rooms used all night in American Tel & Tel's Long Distance Building in New York.

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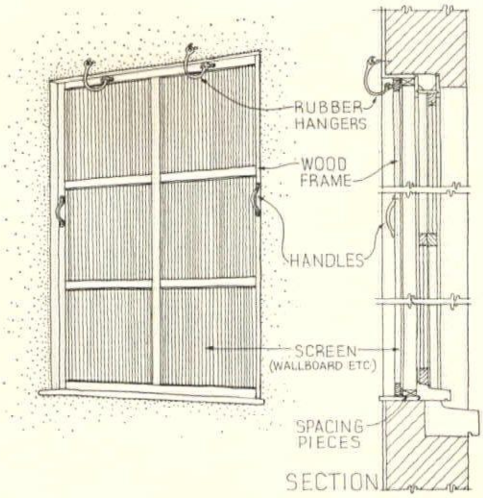


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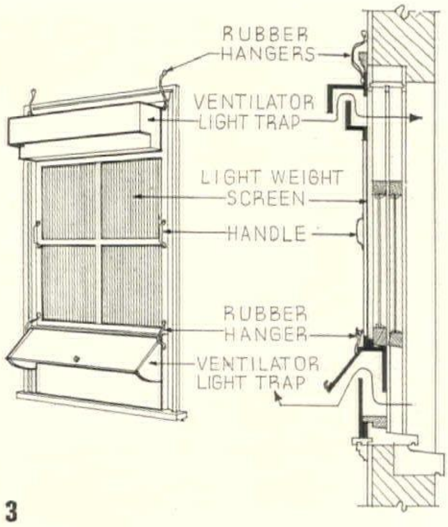


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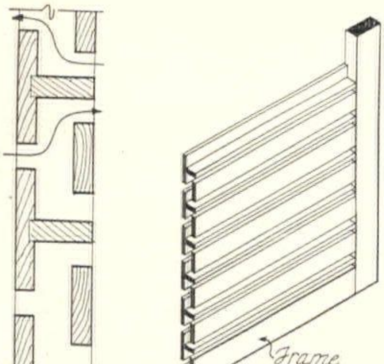


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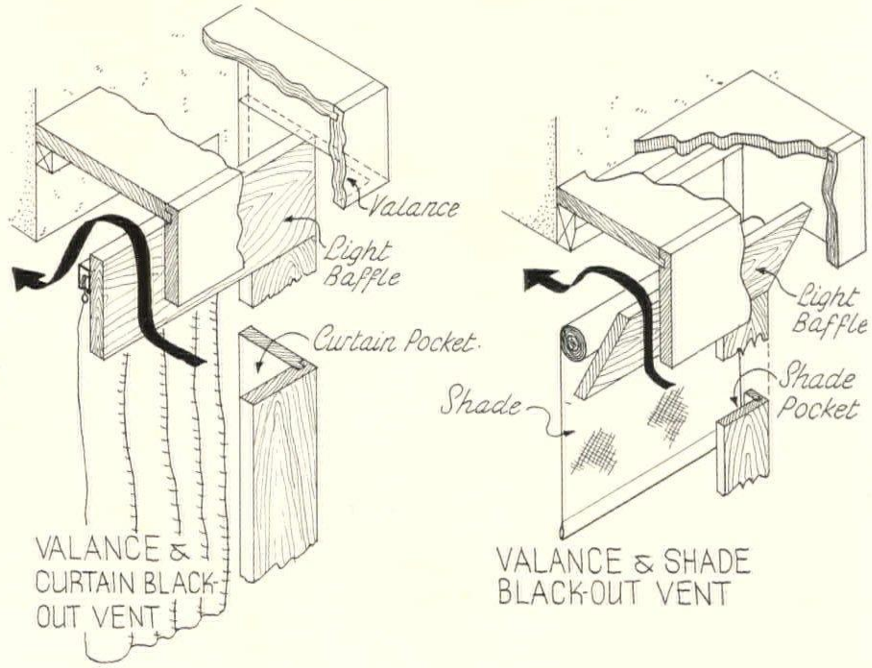



5

**Window obscuration details:** **1** A drop curtain is a simple blackout installation for occasional use. **2** Framed wallboard screen fits snugly against spacing pieces in window opening and, in case of blast, will be held against window by elastic hangers to retard flying glass. **3** A more elaborate screen equipped with lightproof ventilators, top and bottom suggested by British Ministry of Home Security. **4** Detail of a lightproof shutter. **5** Ventilator valances for blackout draw curtains and spring roller shades. All of the obscuration methods presented on this page have been used with success in England. (4 & 5 redrawn from sketches in Architects' Journal, The Builder.

*(Illustrations continued on page 10)*

*AP*

**6 Round-headed window** in English building is blacked out with heavy building paper on light wooden rectangular frame secured to inside wall surfaces. Overlap must be large enough to prevent escape of light.

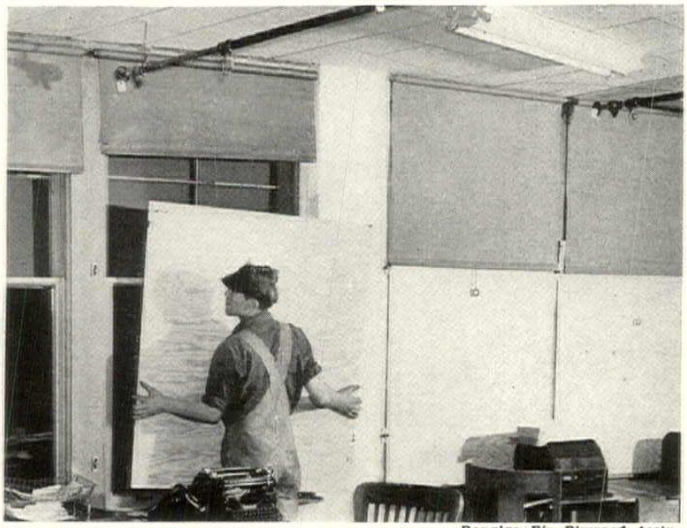
*Peter A. Ray—BPS*

**7 Outside obscuration screen** applied to English window also eliminates reflection of glass. The two small light-tight boxes in the center of each building board panel permit ventilation during blackout.

*British Combine*

**8 Ventilated curtains** obscure windows of an English hotel lobby, present a more attractive appearance than screens and may be pulled aside during the day to admit light.

# BLACKOUT



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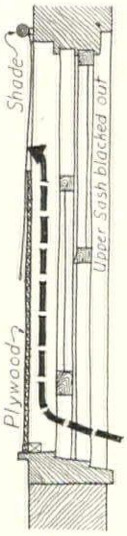
Douglas Fir Plywood Ass'n.

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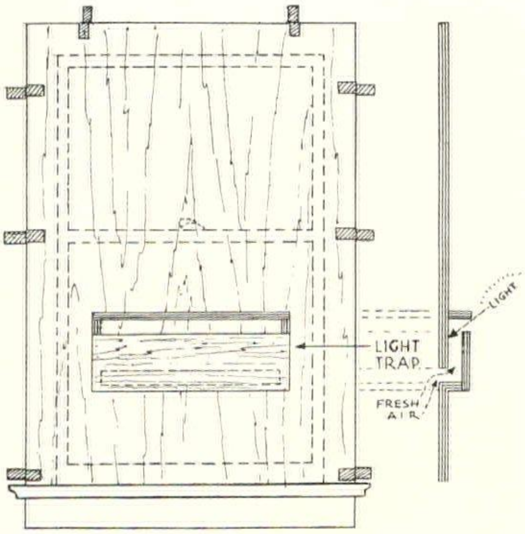
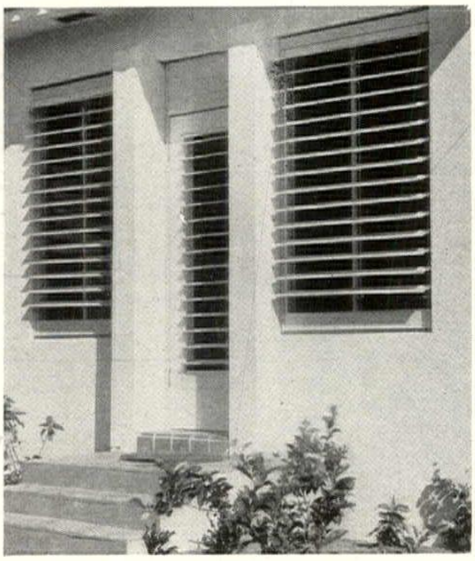


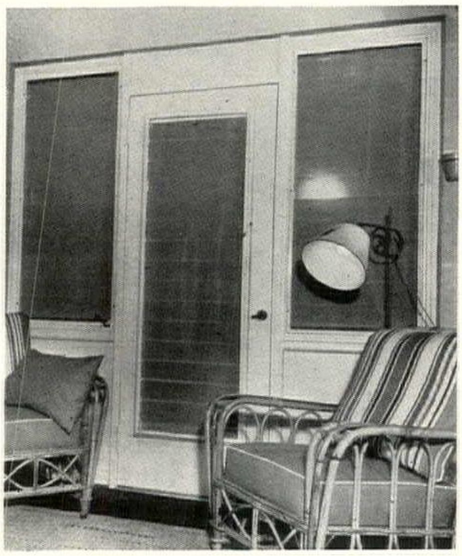

3

Hi-Tone



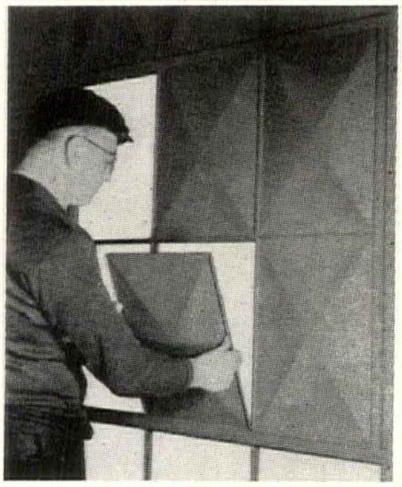
4 —Outside

Hi-Tone



5 —Inside

6



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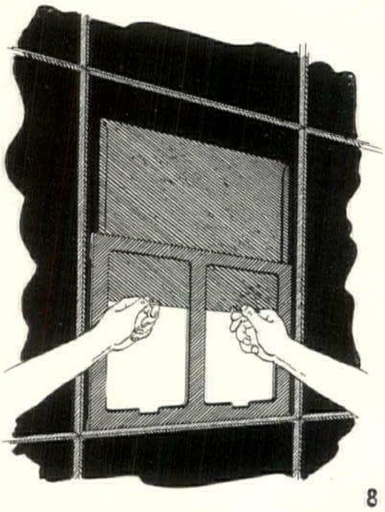

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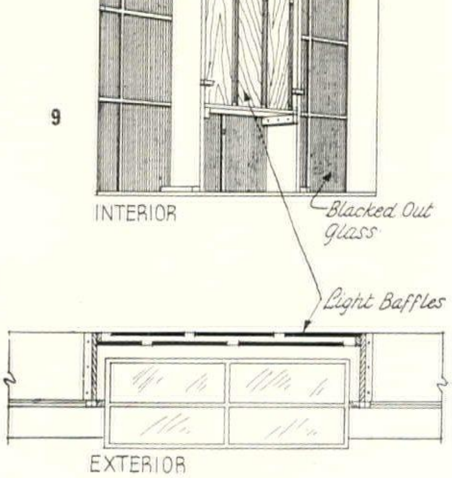
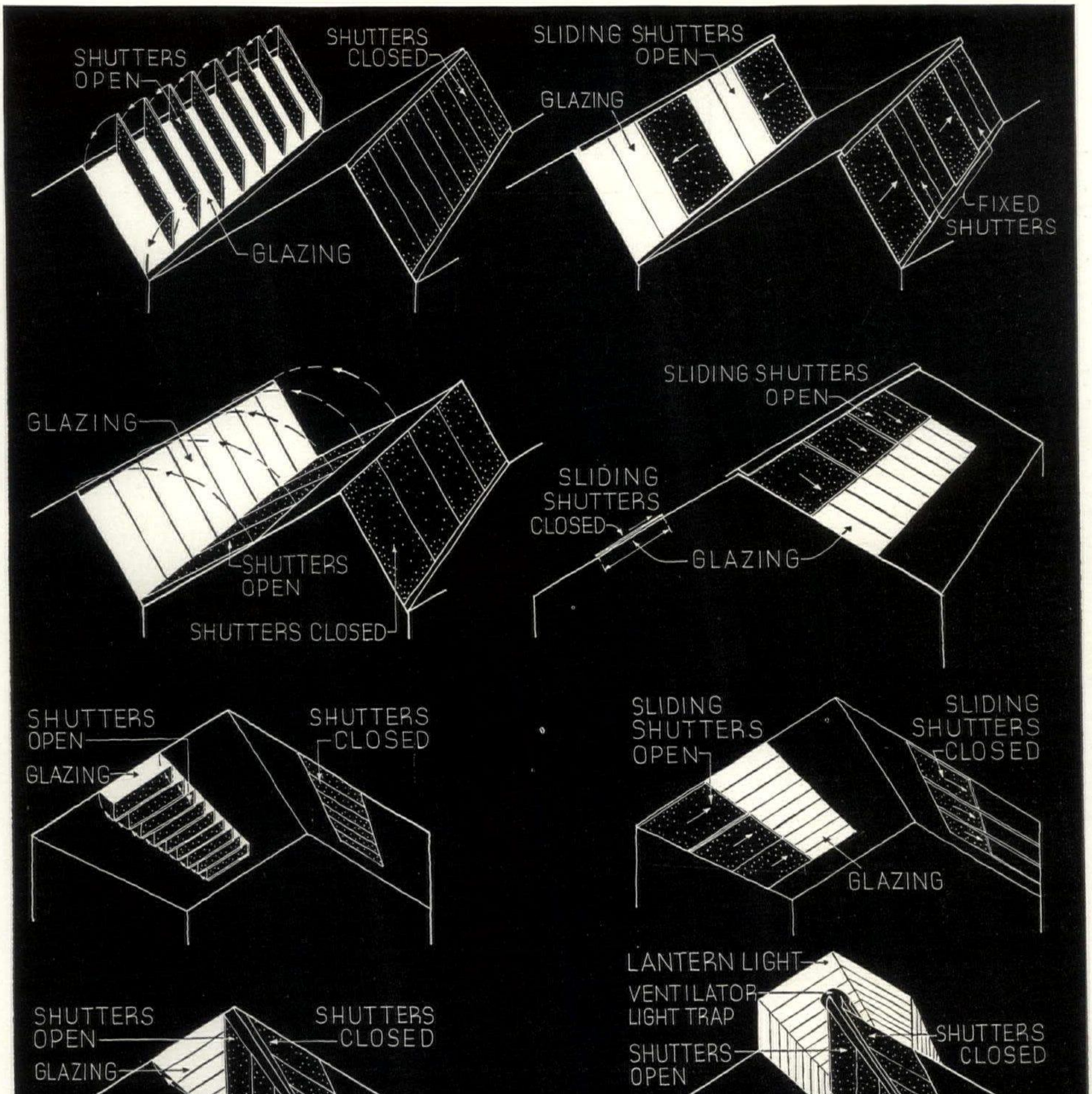



9

**Blackout suggestions by U. S. manufacturers:** **1** Plywood was widely used in the blackout of the West Coast last month; here panels are clamped in place over the lower sash of windows in the Tacoma-News-Tribune offices. Upper sash are covered from the outside (see section **2**) permitting ventilation during blackout. **3** Another method of ventilation suggested by the Douglas Fir Plywood Assn. **4** Like those recently installed in a U. S. arsenal, these "jalousies" look like exterior venetian blinds, but are more light-tight. **5** Interior of room blacked out with jalousies, manufactured by F. C. Russel Co. **6** Steel panels, intended to burglar-proof vacant houses, would stop light equally well. Manufacturer: F. C. Russel Co. **7** Truscon Steel Co, has long had these blackout covers for individual window panes on the market. **8** Lightproof sliding panels for obscuration screens may be removed to admit daylight. Manufacturer: U. S. Defense Materials Corp. **9** British Ministry of Home Security's suggestion for solving the difficult blackout-ventilation problem offered by pivoted factory sash.

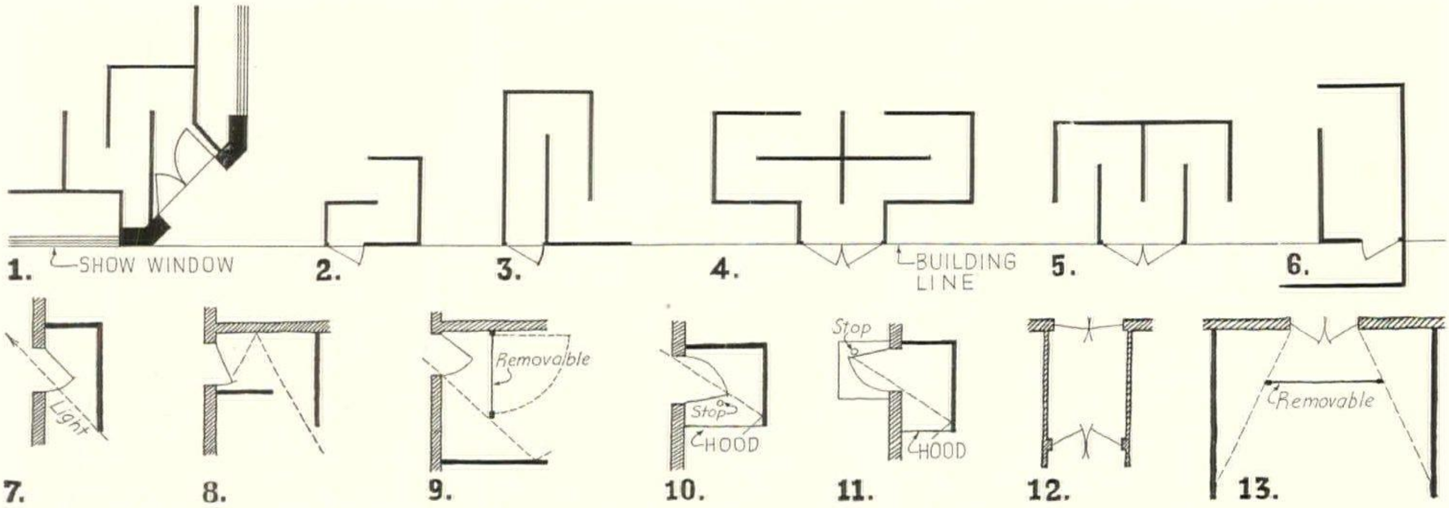



**Movable skylight shutters** presented schematically above were developed by England's Ministry of Home Security. Comments the Ministry on the four systems of external shutters at the top of the page: "Care must be taken to design for wind pressure, particularly if the system adopted has panels which, in operation, rise off the roof. Gearing for control should be so arranged that the greatest possible area of shuttering will operate as a unit . . . particularly should hand operation be decided upon. . . . Owing to the risk of breakdown, there should not be complete reliance upon electric motors for moving shutters. . . . Systems of this type must be designed to throw off water . . . by means of flashings and gutterings as in permanent roof structures, such as skylights, dormer windows, etc." Suggested materials: light pressed steel or wood framing covered with sheet metals, dense pressed building boards, asbestos cement sheeting (almost as vulnerable to breakage as glass) and impregnated roofing felt reenforced with wire netting. As for the four types of internal shutters, illustrated immediately above, the Ministry comments that, if they are "intended to remain weatherproof after fracture of the glass, internal guttering must be provided." Materials suggested for these shutters include: thin sheets of perforated metal backed with opaque fabric, wall or building boards, fabrics of the canvas or tarpaulin type, various insulating sheet materials, linoleum or matting of the grass or fiber variety. All materials should be weatherproofed.

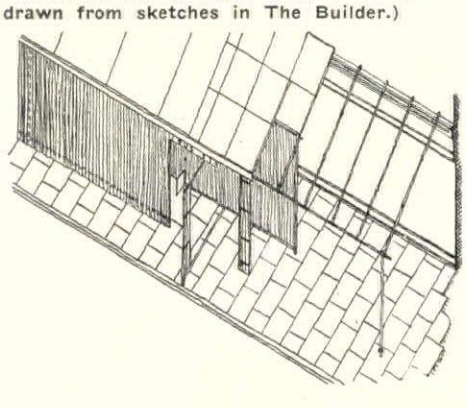
Advantages of the exterior shutters include the ease of weatherproofing, the elimination of reflection and the assistance they offer in roof camouflage. On the other hand, they offer no protection to factory workers from flying glass and, in fact, do not prevent the breaking of glass. This disadvantage is overcome in the use of internal shutters and is the chief argument in their favor. However, the interior installation does not eliminate reflections from the glass, does not assist in camouflage and may be complicated by the network of pipes and wires frequently found under the roof of a factory. Since interior shutters may be built of less durable materials, they are lower in cost.

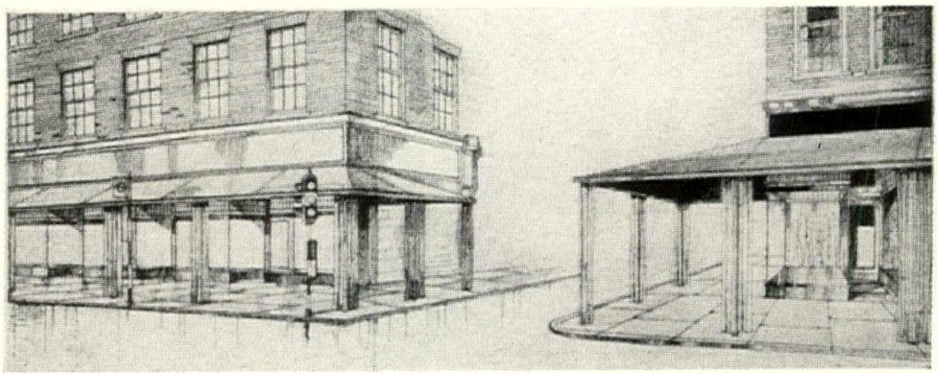
(Illustrations continued on page 12)

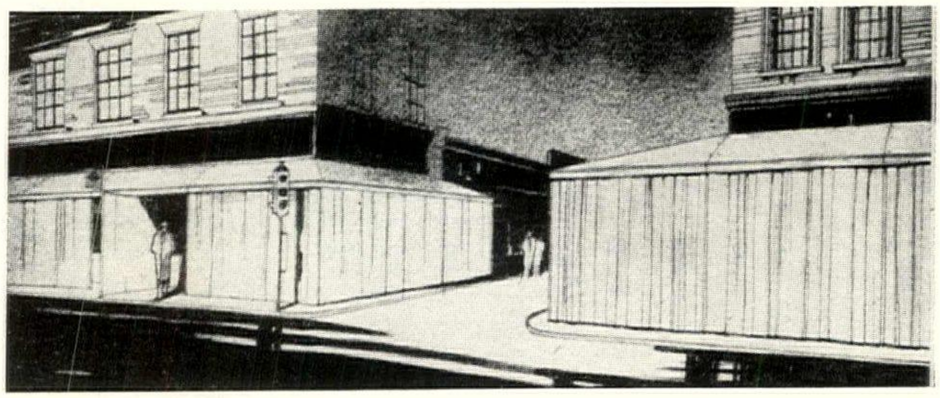
# BLACKOUT



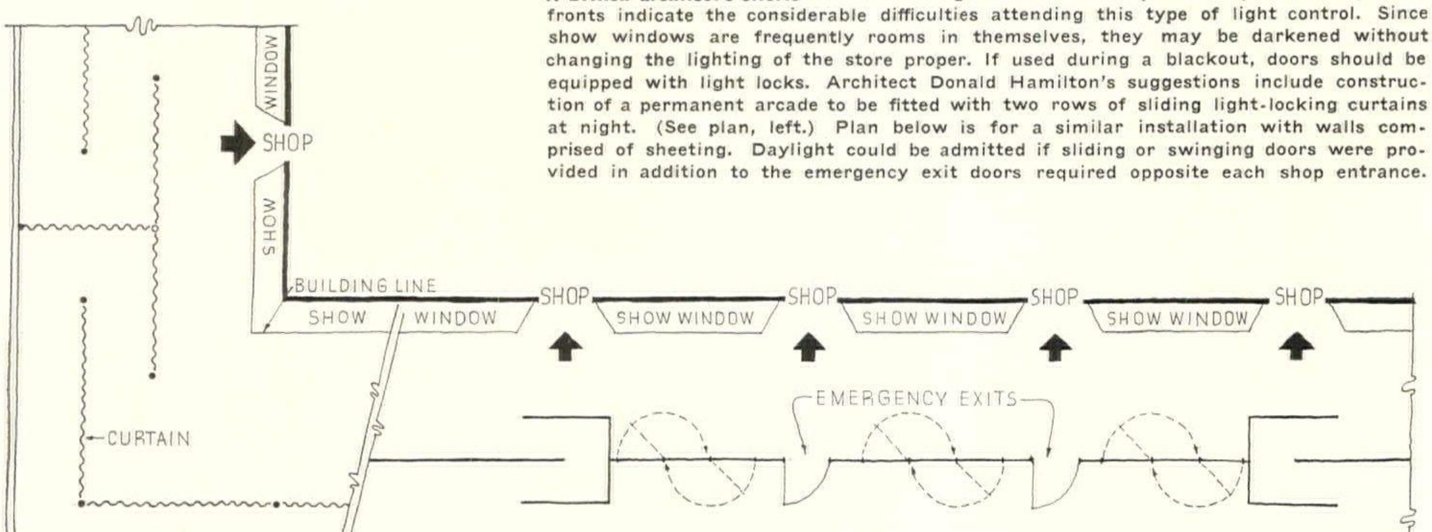

**Light locks** for doors which must be used during blackout: **1** Installation for store with corner door. **2** Installation for a single door. Minimum width of passage is 2 ft. 3 in. Minimum over-all depth in example **3** is 9 ft. 6 in. All interior surfaces are painted black. **4 & 5** Double doors with double passages. **6** Illustration of lock extending outside of building—less satisfactory. **7** Unsatisfactory, because direct light is visible through open door. **8** Light is absorbed inside lock, invisible from outdoors. **9** Removable screen is folded against wall during the day. **10** Partially opened door serves as part of lock; hood must be at level of door top. **11** Door opening outward serves as part of light lock. **12** Unsatisfactory, due to possibility of both sets of double doors being opened simultaneously. **13** Simple treatment for narrow stores or entrance vestibules of large buildings. Most revolving doors, if glass is blacked out, will themselves act as light locks. (1-13 redrawn from sketches in The Builder.)



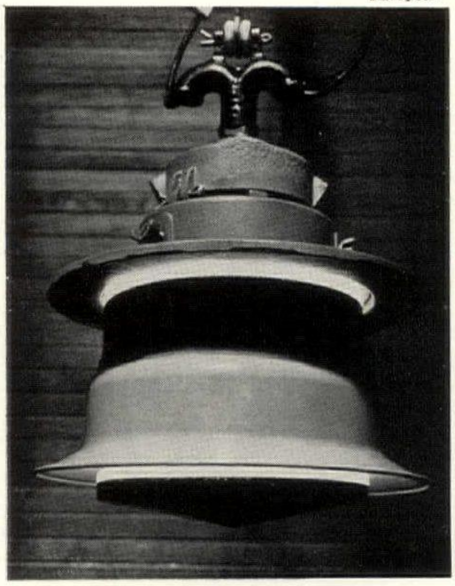




**14 A British architect's efforts** toward solving the obscuration problems presented by store fronts indicate the considerable difficulties attending this type of light control. Since show windows are frequently rooms in themselves, they may be darkened without changing the lighting of the store proper. If used during a blackout, doors should be equipped with light locks. Architect Donald Hamilton's suggestions include construction of a permanent arcade to be fitted with two rows of sliding light-locking curtains at night. (See plan, left.) Plan below is for a similar installation with walls comprised of sheeting. Daylight could be admitted if sliding or swinging doors were provided in addition to the emergency exit doors required opposite each shop entrance.



*European*



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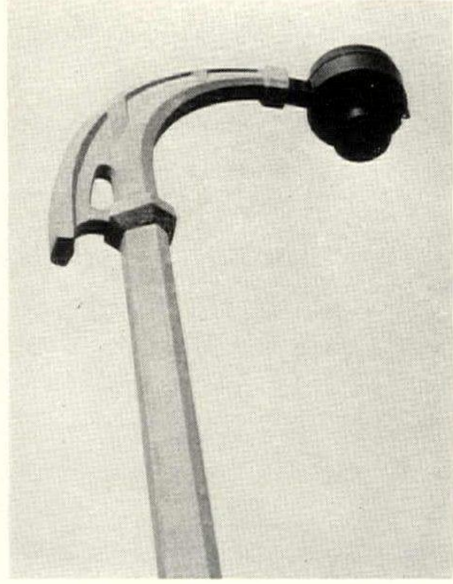
*Peter A. Ray, BPS*



2

*Wide World*

3

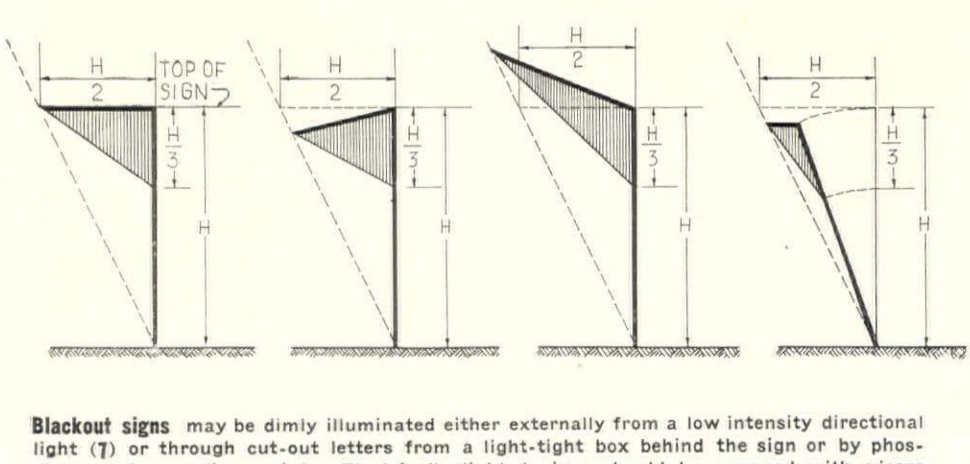
4

5

*Photos, Peter A. Ray, BPS*

6

**Public blackout responsibilities** include modification of street lighting, (**1** German, **2** English, **3** temporary U. S. installation), the marking of street curbings (as per English illustration **4**), the provision of traffic obstruction warnings (English examples **5** and **6**) and the erection of shielded directional signs (**7**—another example of English technique).

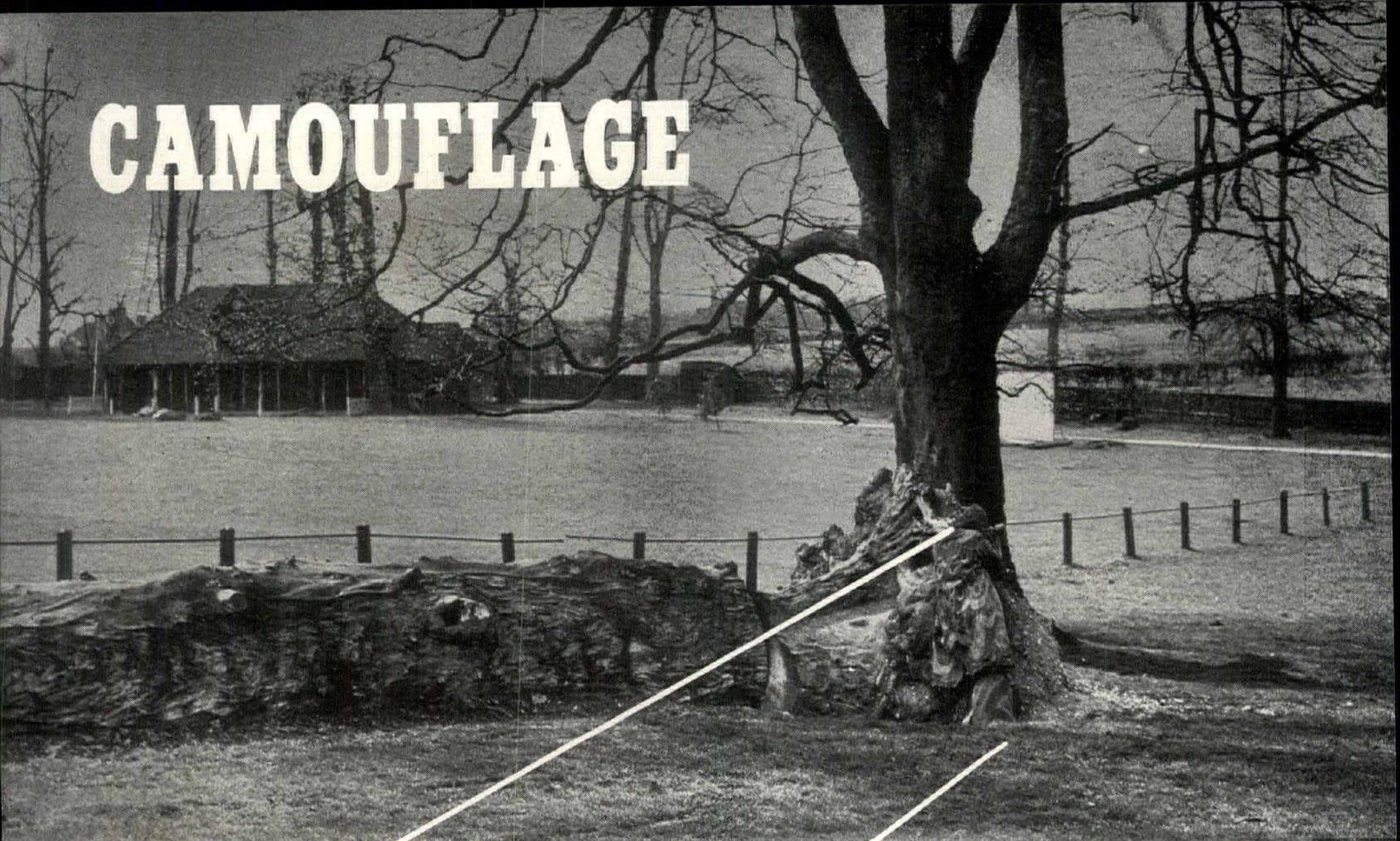




7

**Blackout signs** may be dimly illuminated either externally from a low intensity directional light (**7**) or through cut-out letters from a light-tight box behind the sign or by phosphorescent or radium paints. Electrically lighted signs should be screened with visors of the proportions indicated above. Side screens are not mandatory. When a sign is inclined forward to reduce the size of the visor, the angle from the vertical should not exceed 3 degrees. (See right hand diagram, above.) Luminous paints and reflector buttons may also be used for blackout signs.

# CAMOUFLAGE



British Combine

Like blackout, camouflage is protective concealment. It is applied almost exclusively to man and man-made objects; nature provides its own blackout at night, its own camouflage by day. As one of Calvert Whiskey's "protective blending" advertisements dramatically shows, a pheasant family in the open (fig. 1) is an easy target for the hunter, but in its natural environment (fig. 2) it is camouflaged almost beyond recognition. Likewise, the lowly "stick" bug (fig. 3).

To conceal himself and his war equipment from his enemies, man has long imitated the protective blending principles of nature. The sniper's mottled brown tunic becomes a part of a tree stump on the rural autumn landscape pictured above, while a white-clad Swiss soldier disappears in the snow scene opposite. With the development of modern war machinery and methods—particularly aerial bombardment—the science of camouflage has increased in importance and application, has become a powerful weapon in behind-the-lines civilian defense as well as on the battlefield. During World War I, camouflage's primary function was to conceal small front-line targets from observers on the ground or in low altitude captive balloons. Today, reconnaissance and

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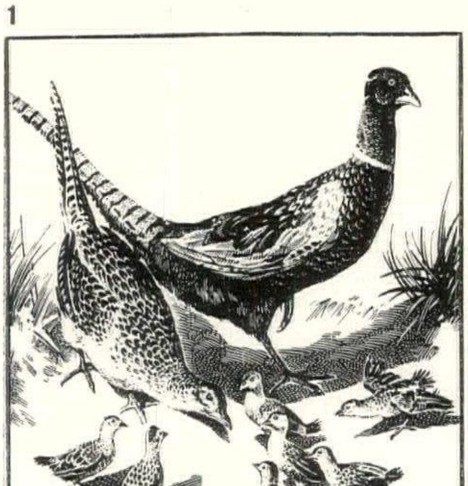

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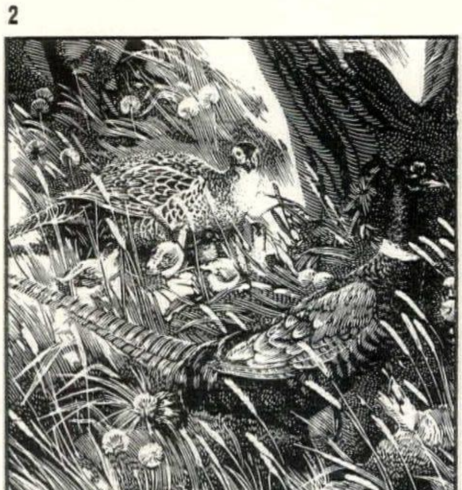

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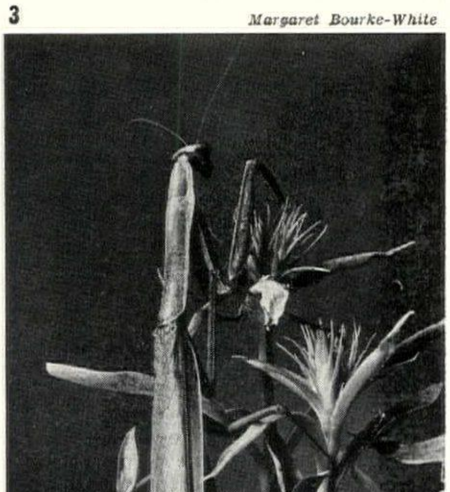
Margaret Bourke-White



bombing planes range thousands of miles inside enemy territory to spot large targets from high above, and camouflage has developed accordingly.

Before considering what should be camouflaged and how, it is well to look at the problem from the enemy's point of view. There are two general types of aerial attack: area bombing and precision bombing. Due to the long distances involved, the Axis Powers will probably not attack the Continental U. S. with the familiar blitzkreig tactics where a large number of planes would lay down aerial barrages on important military and industrial areas. Dive bombing, a form of precision bombing, is also unlikely, because it involves the operation of light, short-range planes. The possibility of level-flight precision bombing is the chief reason for the use of camouflage in U. S. civilian defense.

In this highly skilled operation, the bomber approaches its target on a long straight line, continually checked by reference to prominent landmarks, at an altitude of 18,000 to 30,000 ft. and a speed of 200 to 400 mph. As illustrated by the typical bombing problem presented on page 17, the bombardier—traveling at 30,000 ft. and 200 mph.—must pick up the target at least by the time he is within $4\frac{1}{4}$ miles of it. And, he then has only 35 seconds in which to adjust his bomb sight and drop his bombs.

At least six circumstances may combine to make the bombardier's task a difficult one: his high altitude, his oblique view of the objective (fig. 2, p. 16), his great speed, the short period available for target recognition and actual aiming, the possibility of thick weather and interruptions by anti-aircraft fire. With camouflage, the defender can compound the bombardier's problems by confusing the identity of the target and the landmarks which lead to it. The importance of landmarks cannot be overemphasized; they are not only airplane signposts but, if within one or two miles of the target, they may also be used as direct reference points with the aid of which modern bomb sights will permit the registering of a direct hit upon a completely camouflaged objective. Of course, prior knowledge of the exact relation of the landmark to the target would be necessary.

Observation of both landmarks and targets from the air is facilitated by their large bulks, their unnatural geometric forms, their heavy shadows which accentuate these forms, their surface textures which are clearly recognizable from the air and which control their relative brightness and, lastly, their colors. Therefore, while any degree of camouflage which reduces the visibility of an objective may be worthwhile, complete camouflage must take all five of these recognition factors into account. Least important is color, for at great altitudes small differences in color are lost to sight.

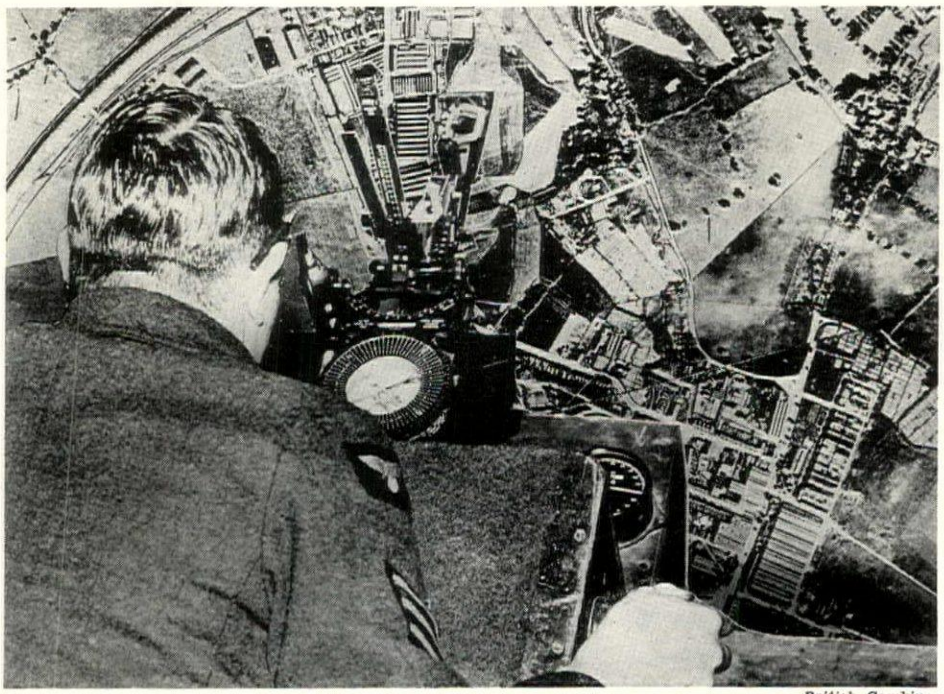
In the construction of new buildings, many of which should now be planned and designed for complete concealment, additional factors must be considered. Thus, if feasible, the new project should be situated remote from prominent landmarks and, preferably, in a rural area where innocence is easy to fake, where low land costs permit dispersion of the buildings and where, if the plant is discovered by enemy airmen, bomb misses will do but little damage. Dispersion facilitates camouflage and reduces the effect of bombardment. The extent to which a new defense plant should be planned for camouflage will depend usually upon the recommendation of military advisors who will study the cost and production delay involved.

*Balkin - Pix*

*British Combine*

1

**Bombardier at school** is trained by the Royal Air Force's "A. M. L. Ground Teacher." The pupil lies on a platform, equipped with compass, bomb sight, air speed indicator and other instruments, over a horizontal screen onto which is projected an image showing, in scale, four miles of moving landscape. The effects of high altitude, speed and drift, which combine to make accurate bombing difficult, are reproduced by intricate mechanism and are partly controlled by a "pilot" who changes the plane's course upon instructions from the bombardier. Note the scale of the "distant" landscape compared with that of the nearby "bombardier."



*British Combine*

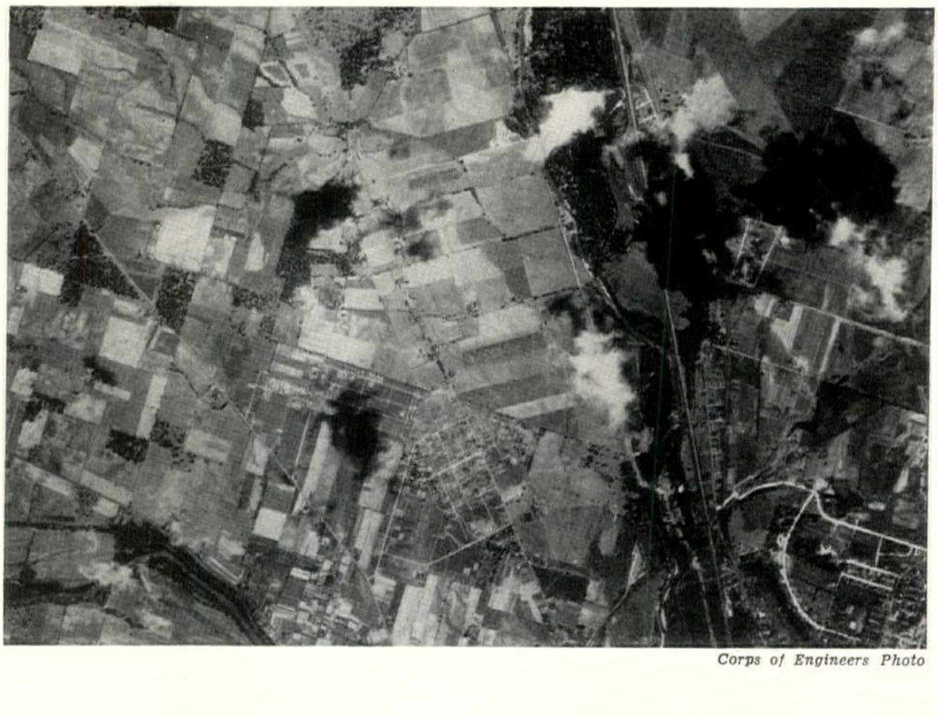
2

**Oblique view** of a metropolitan area as the bombardier would see it with his naked eye from an altitude of about 24,000 ft. While individual buildings are too small for recognition in this reduced photograph, such landmarks as the circular reservoir, kidney-shaped lake and horse-shoe stadium are easily identified. By adjusting his bomb sight to such reference points, the bombardier could hit a nearby target of known location without even seeing it. However, once the general target area is spotted with the naked eye, it is easy for the bombardier to pick up specific objectives through the telescopic bomb sight.

*Corps of Engineers Photo*

3

**Mosaic,** or vertical air view, of a rural landscape taken at an altitude of 32,500 ft. Used primarily in reconnaissance, vertical photographs are of little help to the bombardier who must locate his objective at a 45-50 degree angle (see diagram, opposite). Conspicuous landmarks in this area include rivers, railroads, highways and wooded areas. Note different textures presented by cultivated fields. Black splotches blanketing groups of fields are shadows cast by small clouds.



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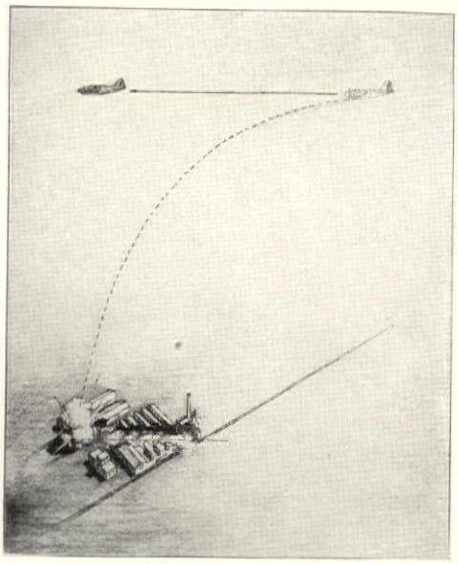

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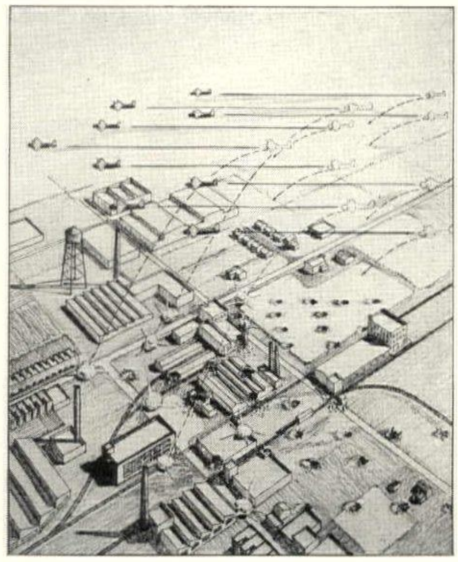

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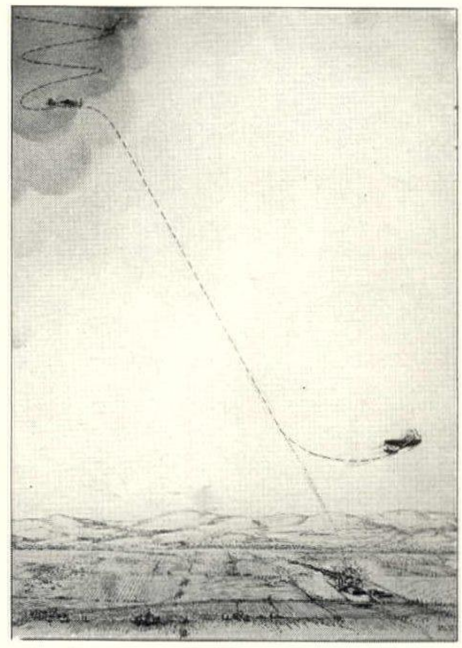
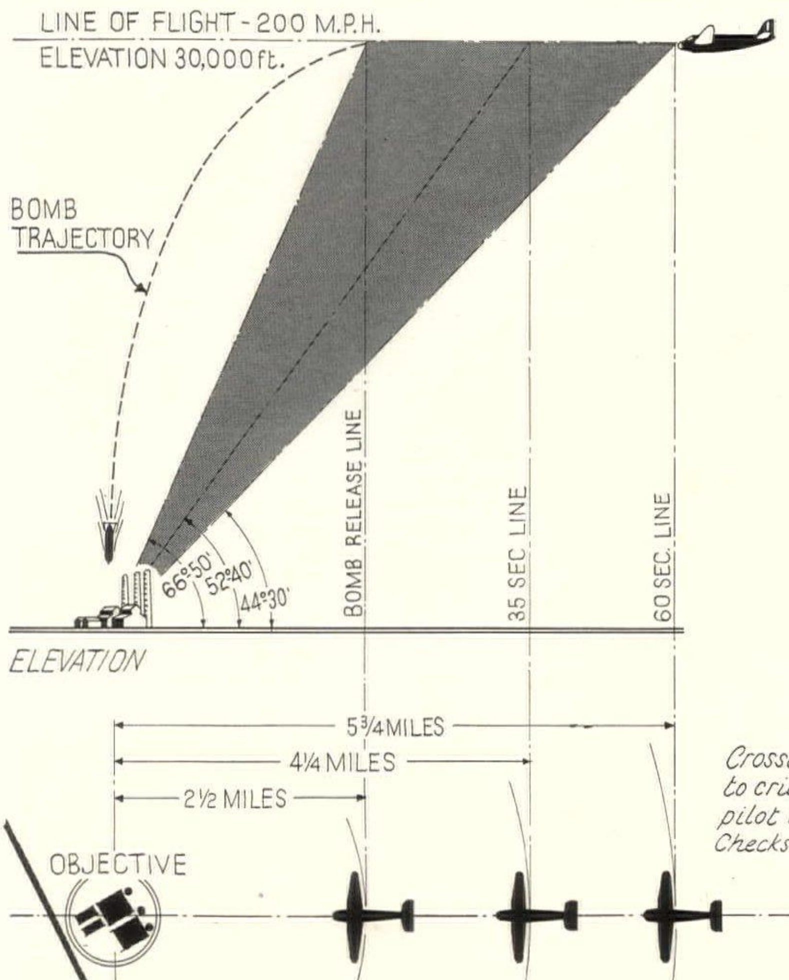
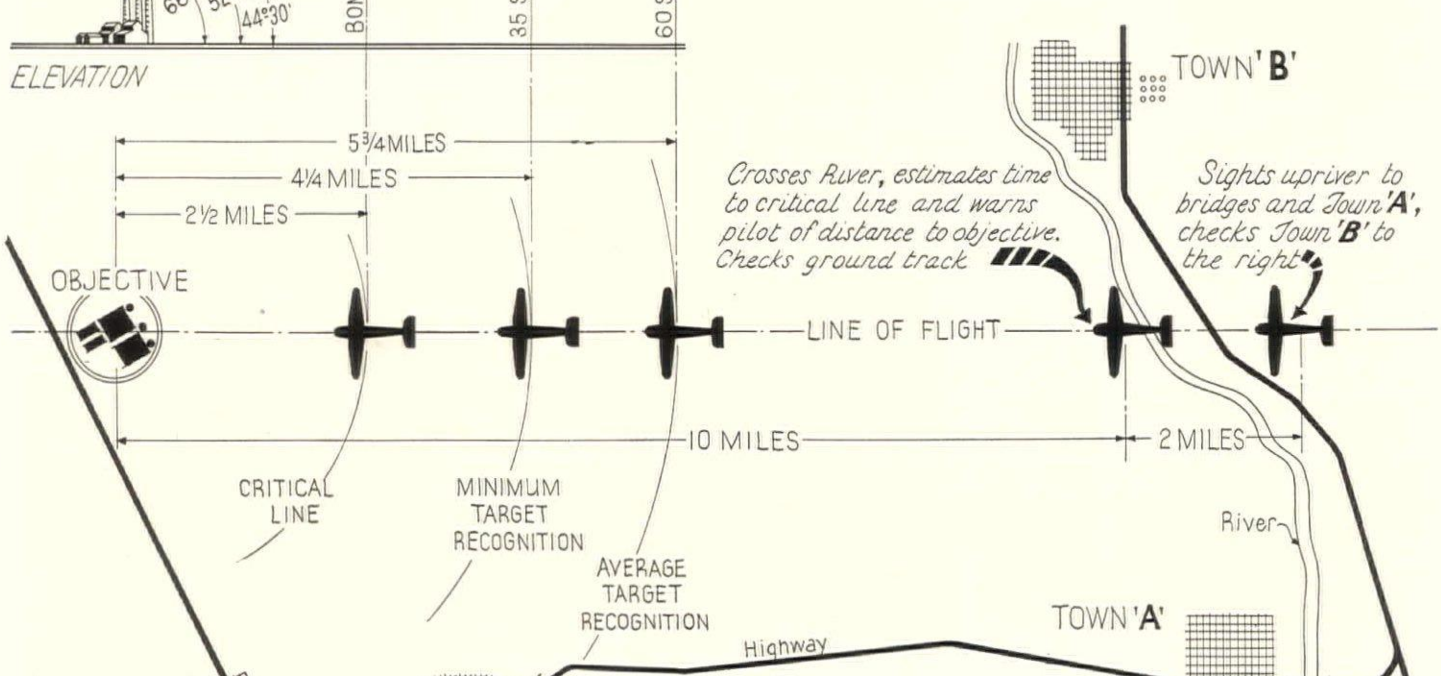


3

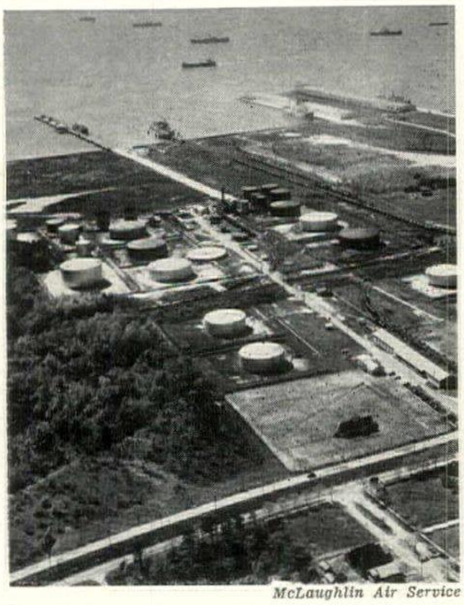
**Types of bombing:** **1** Prescision bombing is most likely to be used against the continental U. S. **2** Area bombing, a blitzkrieg tactic, is least likely. **3** Dive bombing, a variety of precision bombing, is similar to it in many respects. Bomber approaches target at high altitude, maneuvers down to about 5,000 ft., spots target, dives to 1,000 ft., releases bomb and pulls out.



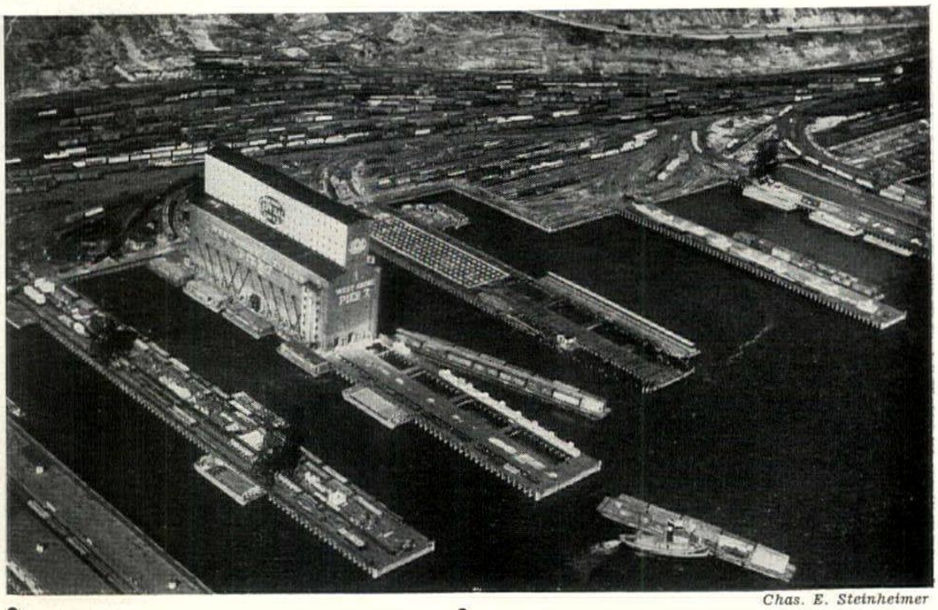

**Precision bombing problem** illustrates use of landmark reference points along line of flight (below) and last minute aiming of bomb sight as plane approaches target (left). Note that the bombardier, on the average, has only 60 seconds during which to pick up the target in his bomb sight, adjust it and release his bombs. These operations cannot be performed in less than 35 seconds at the assumed speed of 200 mph. and altitude of 30,000 ft. The bombardier's job is still more difficult at higher speeds (same altitude) and lower altitudes (same speed). Note that zero second line is at the point of bomb release at the target.



# CAMOUFLAGE—CHARACTERISTIC OBJECTIVES


McLaughlin Air Service

1


Chas. E. Steinheimer

2

### TYPICAL PROBLEMS

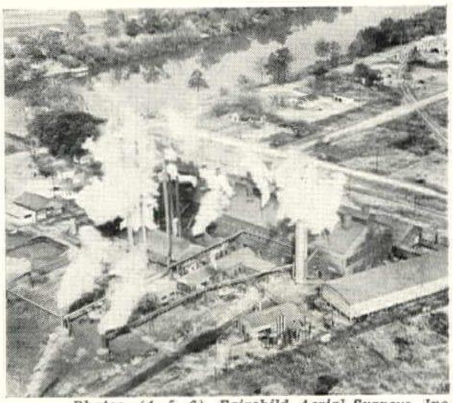
With but few exceptions, no two landmarks or targets appear the same from the air. Each is a camouflage problem in itself, but may have some of the common characteristics illustrated on this page.

**1** A tank farm's regular pattern of circular objects, accentuated by sharp black shadows, is easily seen from 30,000 ft. up. Dead give-aways as to the farm's general location are the flanking river and boulevard, requiring that nearby wharves and cross streets be camouflaged as well as the tanks themselves. Note how the dark painted tanks tend to disappear. **2** An important railroad freight yard is prominently marked by a huge grain elevator which, when viewed obliquely from an approaching bomber, stands out like a sore thumb against the dark river. Difficult to camouflage, this landmark jeopardizes the adjacent freight yard, wharves and barges. **3** A highway intersection in brilliant white concrete serves as a handy reference point for the bomber on its way to more important targets. And, if strategic enough, it might itself be bombed to disrupt traffic. **4** A tell-tale sign of industrial activity, steam cannot be camouflaged, but can be condensed under cover. **5** A light colored industrial plant amid rural surroundings is readily spotted from the sky. But, because of these easily duplicated surroundings it is less difficult to camouflage than **6.** A smoke control expert could probably solve the problem presented by the two chimneys. **6** In a highly industrialized area a plant is more difficult to conceal, due to the many smoke sources, even when its color blends with the surroundings. In this case, the camoufleur with the aid of the wind (if less than 12 mph.) and more smoke from the chimneys and smudge pots might blanket the whole neighborhood with a smoke screen. It would conceal such nearby reference points and targets as the railroad yards beyond and the elevated highway, intersection and two-story building in the foreground.

Other typical landmarks helpful to enemy bombers include easily distinguished coastal features, rivers, lakes and prominent mountains, none of which can be camouflaged. Also, towers, race tracks, canals, easily identified buildings, bridges, blast furnaces, etc. Due to their size, these objects are difficult to camouflage completely, but deception may be enhanced if dummies or decoys are erected some distance from the camouflaged originals.

3


Victor De Palma—B S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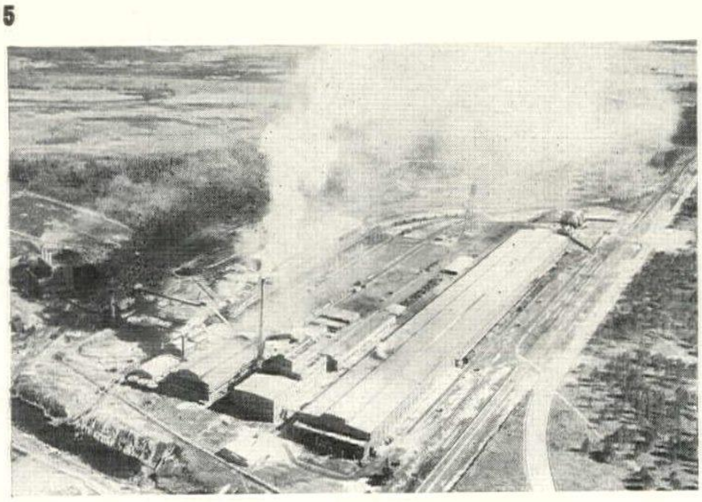
Photos, (4, 5, 6), Fairchild Aerial Surveys, Inc.

5



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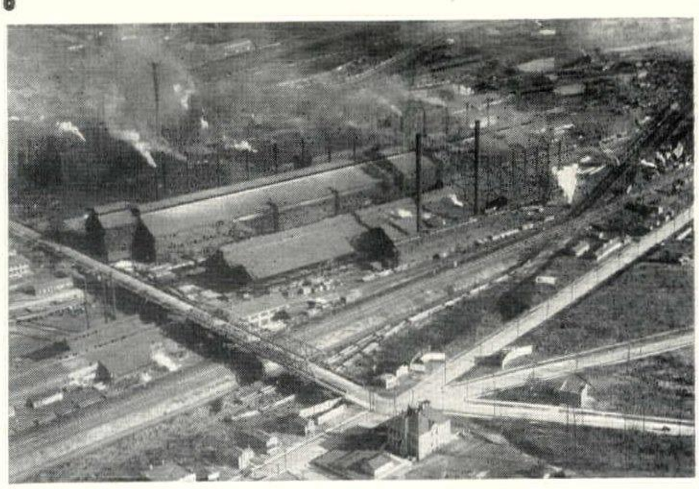


## TECHNIQUE

Before camouflage is begun, it should be decided (on the basis of need, cost and probable success) through how many of four stages the operation should be carried. "Toning down," the first stage usually involves only the use of dull paint to suppress bright colors and sharp contrasts. "Second stage," concealment includes, in addition to toning down, the creation of patterns to resemble the characteristic patterns of the vicinity (figs. 5 & 7, p. 20). More deliberate, the third stage attempts to conceal the outline of buildings, via screening, the introduction of false forms and the roughening of smooth textures. In its fourth and final stage, camouflage technique may be carried to the point where the object is totally concealed by exact duplication of surrounding tones and patterns. This may call for the building of false roofs, decoy buildings and other complex construction, elaborate planting and even burial of the project. Only a target of extreme importance would justify the cost of this all-out camouflage. (See p. 24.)

**Paint** is one of the important camouflage materials. It alone is called for in "first stage" concealment. To be suitable for this purpose, paint should be cheap, easy to apply, do the job with one coat and produce a lusterless finish. While a wide range of colors may be necessary for certain projects, the darker shades—greens, browns, greys and olive drab—will most effectively reduce visibility. Durability of the vehicle, if not the pigment, is of secondary importance, for camouflage must be altered in line with seasonal changes in the natural surroundings. The lusterless olive drab color used on all Army equipment is a compromise or "average" color for year-round use.

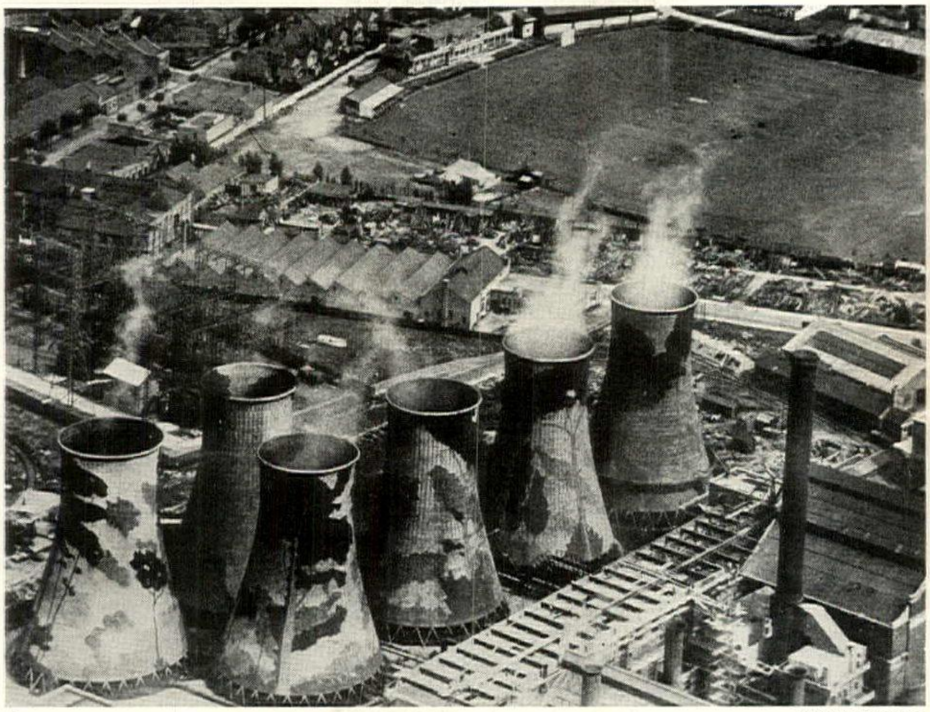
Besides its use in the "toning down" of bright areas and contrasting surfaces, paint may be used to duplicate local natural patterns on surfaces to be concealed. These may be trees, hedges, plowed furrows, streets, house tops, etc. (See p. 20 for bad and good examples.) Unfortunately painted vegetation will not fool enemy aerial photographers if they use an infra-red film. Thus, on an infra-red photograph real trees appear almost white while painted ones show up black. Reason: green leaves contain chlorophyll; green paint does not.

**Adhesives and granules** are recommended for camouflaging concrete surfaces subject to wear—particularly roads and airport runways. The Army suggests an asphalt or bituminous emulsion covered while wet with chopped scrap rubber, dyed sawdust, colored slate granules or asphalt chips. Easy on rubber tires, such surfaces are light-absorbing and are subject to protective coloring. They might well be used in the camouflage of roofs as well as roads and runways. Sand granules are unsatisfactory; a surface of these small particles reflects considerable light.

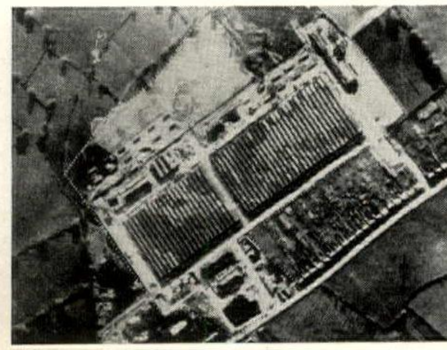
Rudy Arnold—BS

**Urban pattern** presented by upper Manhattan Island is comparable to that seen by German airmen during their daylight raids on English cities. This photograph was taken from a considerably lower altitude than the 18,000 to 30,000 ft. levels usually maintained by bombing planes. But, even in this "close-up," only a few likely targets are recognizable: the gas tank (left, center), the railroad and arterial highway (running along the river bank) and the bridge (upper left). While the gas tank might, itself, be effectively camouflaged to resemble a small city block, it could still be located from the air if the observer had prior knowledge of its relation to such prominent landmarks as the nearby ferry slips, the division of the highway around two monumental buildings and the stadium (right, center).

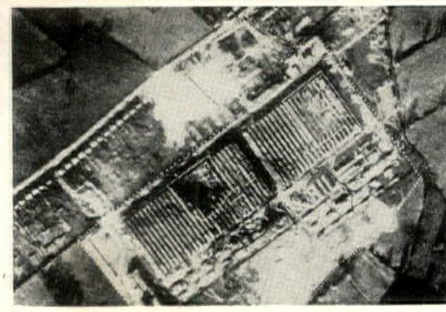
# CAMOUFLAGE—BAD AND GOOD



1 *British Combine*

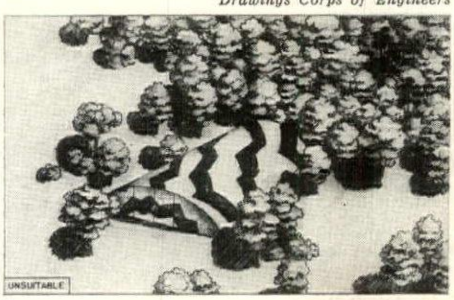


2 *European*



3

*Drawings Corps of Engineers*

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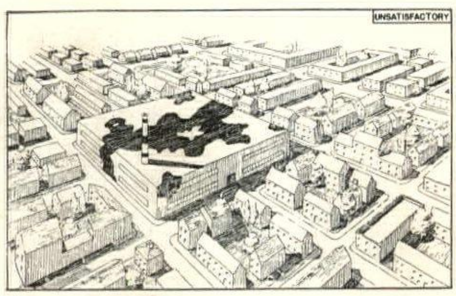


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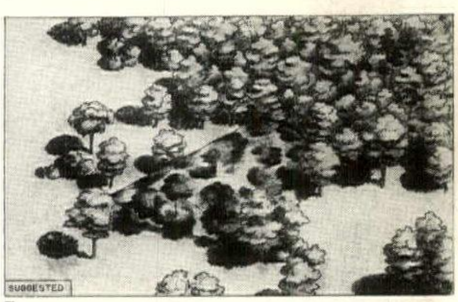


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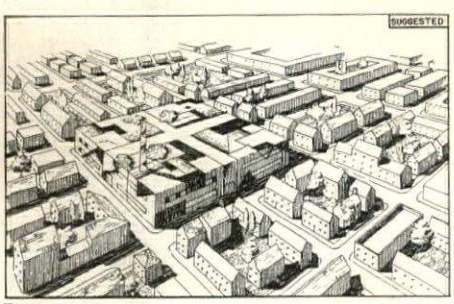
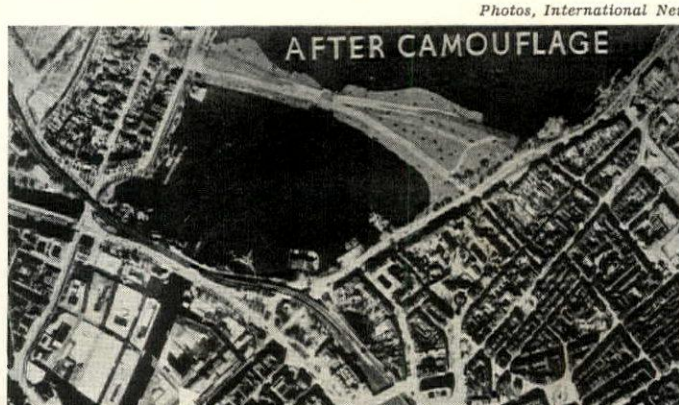



7

**Bad and good camouflage:** **1** The British painted trees on these huge cooling towers despite the fact that there are no trees like them in the immediate vicinity. Then, they released an air view of the job for all—including the enemy—to see. Both actions were mistakes. **2** The sharp outlines of these factory buildings nullified the camouflage painted on the roofs. **3** The result: bomb craters in all three sections of the plant. **4** "Dazzle" camouflage, frequently used in World War I, fails to conceal a hangar in its wooded surroundings as well as **5** painted trees and shadows. **6** The irregular painted blotch on the flat-roofed building does not ape the pattern of its surrounding, is therefore worse than no camouflage at all. **7** Painted house tops and shadows along the faked streets cause the four-block building to blend with its neighborhood.

*Photos, International News*


**8** **Before camouflage,** the important railroad station of Hamburg, Germany, was easily spotted because of its proximity to the Binnen Alster and the railroad causeway. Hence, German camouflage experts made a bold attempt to rearrange the area. Binnen Alster was planked over and painted to resemble blocks of typical buildings; a dummy causeway was built further down

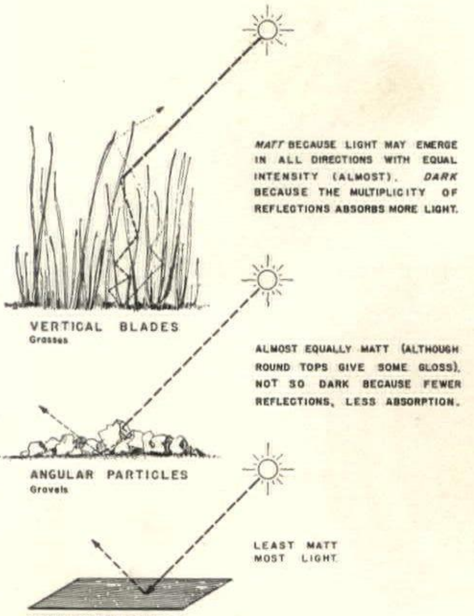
**9** the bay, thus forming a dummy "Binnen Alster;" the station roof was painted with two white stripes which look like extensions of the street pattern; another white "street" was painted across the tracks below the station; finally, a decoy station was produced in line with the decoy causeway, right. Anti-climax: both photographs were taken by the RAF.

*Corps of Engineers Photos*

1


2

**A painted "hedge"** on a turf landing field as it appears from the ground **1** and from the air **2** (arrow A). If several such "hedges" criss-crossed the field, its function would be effectively concealed. Painted trees would complete the illusion, but would require artificial shadows capable of being moved with the sun. Otherwise enemy photographs, revealing the same shadows at different times of day might "give away" the camouflage. Arrow B points to another experiment of the Army's Engineers—imitation of a concrete runway in white paint.



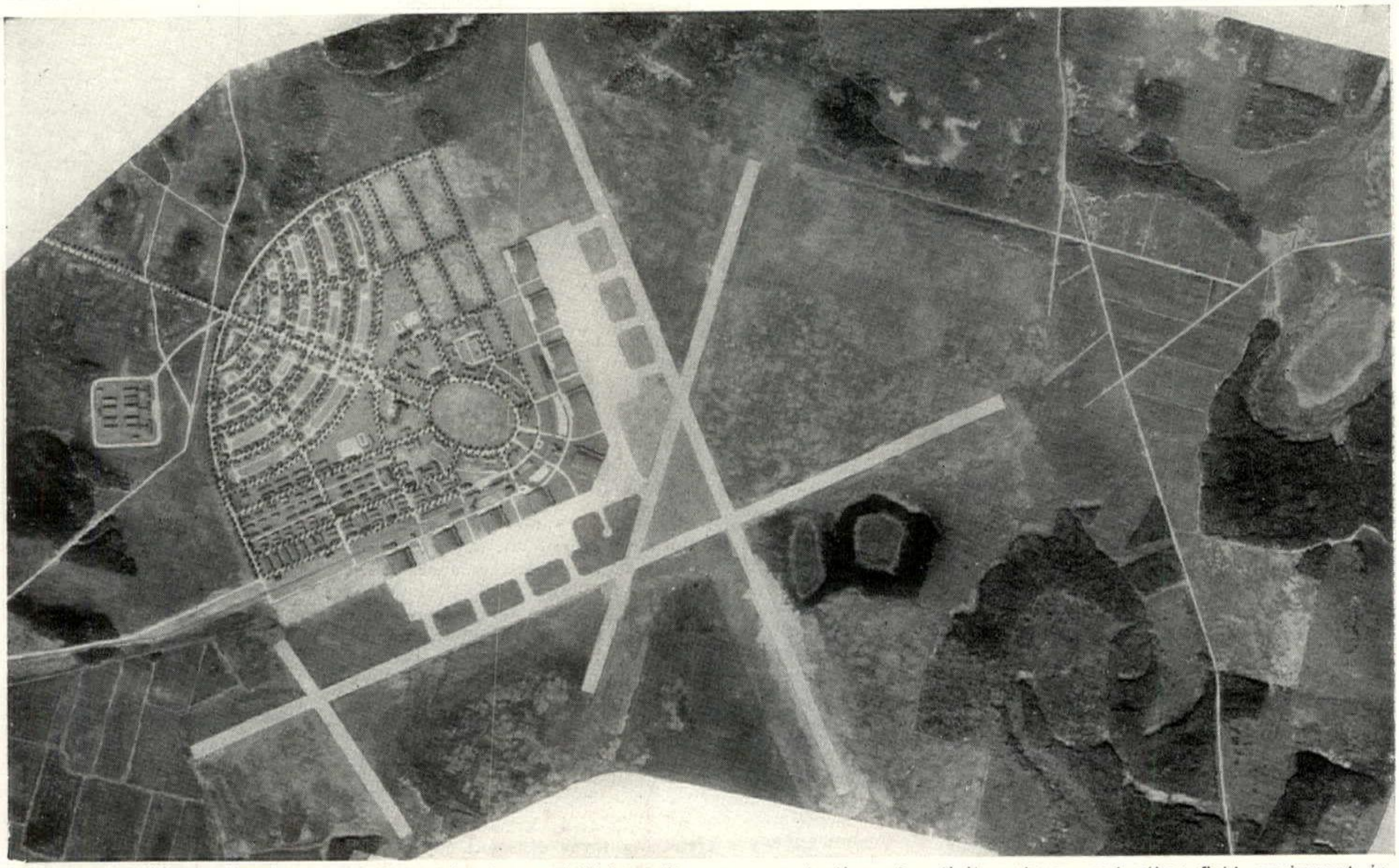

*Corps of Engineers Drawing*

**3 Demonstrating the principle of texture,** these sketches depict the path of the sun's rays when striking three different types of surfaces and the resultant extent of reflection. The principle applies to paint (dull vs. glossy finishes) as well as to more bulky camouflage materials such as granules (chopped rubber, sawdust, asphalt particles, etc.) and garnished nets (see below). Although night camouflage against flare observation is receiving increasing attention in England, the discussion presented on these pages is limited to day camouflage.

**4 This camouflaged barrack building** illustrates several tricks used by the Corps of Engineers: dead branches garnished with strips of fabric become shadow-casting trees growing on the roof; freshly cut real trees further conceal the roof and are "planted" adjacent to the building to cover the cleared yard. The garnished screen is used to conceal parked vehicles. It is important that "transplanted" foliage be erected in its natural position—otherwise it presents a different appearance from the air.

*Corps of Engineers Photo*

Corps of Engineers Photos



**1 Proposed military airport,** presented in model above, might be satisfactory for peace-time purposes, but the formal pattern cut by the white concrete runways and streets and the rows of large dark hangars would make it an easy wartime target. Moreover, the concentration of activity, planes and other field equipment increases the possibility of effective bombardment. The model photograph below shows how the Army's Engineers would layout the same airport for protective concealment.

**2 Innocent in appearance,** this is a model of the same airport. The runways occupy the same positions as shown in the original proposal above, but they are turf or sod (suitable for all but the heaviest traffic, if the subgrade is stable and well drained, and preferred for mechanical reasons by many transport pilots). While the runways are covered with field patterns and painted hedges, the Army's Engineers admit that this phase of the camouflage might have been more effective had more diverse and darker patterns been created. Further to disguise the airport's identity, all buildings have been dispersed—the groups of long barn-like structures conceal the arch trusses of camouflaged hangers, but their regularity might still arouse suspicion.

**Shadows** are frequently more revealing than the objects which cast them and are therefore one of the camoufleur's chief headaches. They may be broken by changing the profiles of the object with irregular silhouettes which will cast rough, rounded shadows more like those of nature. Or, they may be interrupted by planting trees in the shadowed areas. Splotches of dull black paint or cinders will resemble shadows from high altitudes.

**Garnished nets and screens** are frequently used to cover likely targets and to simulate trees (fig. 4, p. 21). While the covering net should be parallel to the surface concealed and extend far beyond it in all directions, for the sake of economy and ease of installation in large projects, its borders are usually sloped to the ground (fig. 3, p. 24). If the angle of slope is less than 10° with the horizontal, the change of plane in the netting will be barely visible from above. To allow for sagging, the net should be stretched 1 to 2 ft. above the object being concealed.

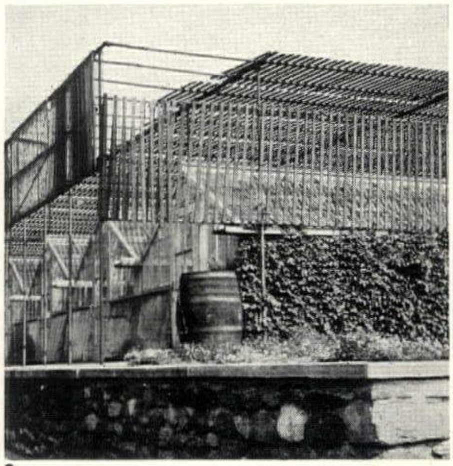
In weaving or tying various colored garnishing strips to the net, any desired pattern may be produced (fig. 5, below). Although any fabric will serve the purpose, camoufleurs now use much osnaburg, a cheap cotton cloth, which is colored to suit local installations and cut into 3 in. x 5 ft. strips. These may either be completely woven into the net (fig. 1, above) or, if additional depth of texture is desired, about a foot of each strip may be dangled from the net (fig. 6, below). If a fireproof or fire retarding paint is not used in coloring the garnish strips, it is suggested that they be treated with 10 per cent solutions of diabasic ammonium phosphate or sodium borate before coloring with casein paint.

More permanent screening installations may be made by using chicken wire or expanded metal for the base and painted, rust-proofed steel wool for the garnish. Mounted on wire mesh, the latter is commercially available specifically for camouflage purposes. Snow fence material

*(Text continued on page 25)*

*Black Star*

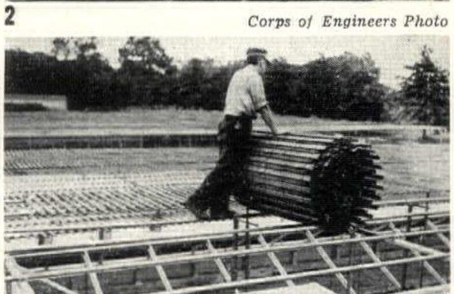
1 *Corps of Engineers Photo*



2 *Corps of Engineers Photo*

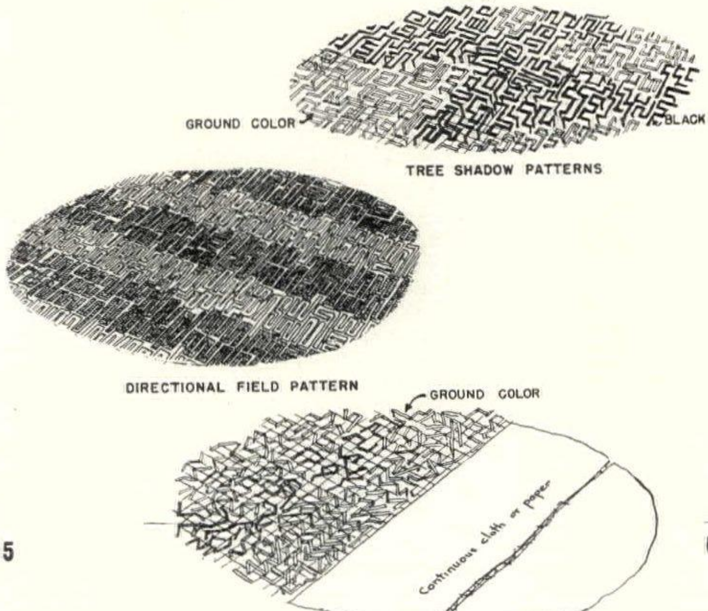
*British Combine*

4



3

**Garnish technique:** 1 Strips of cheap cotton fabric, fireproofed and painted to match local colors, are woven flat into a screen of chicken-wire. 2 & 3 More permanent garnished screens may be built by unrolling snow fences atop pipe scaffolding. 4 A member of the Royal Air Force "mends his nets" which blend effectively with foliage in the background. 5 Imitation of many natural patterns may be accomplished with variously colored strips. 6 In the South, a soldier garnishes chicken-wire with fabric and native Spanish Moss.

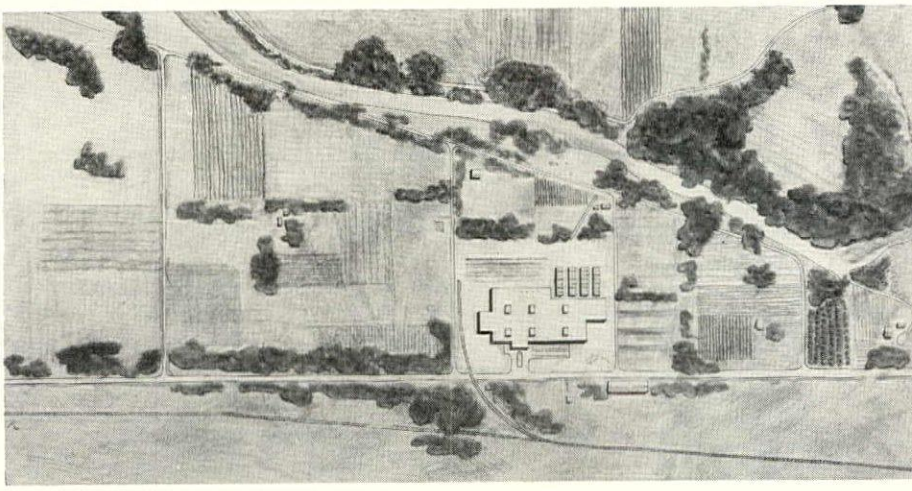



5 *Corps of Engineers Drawing*

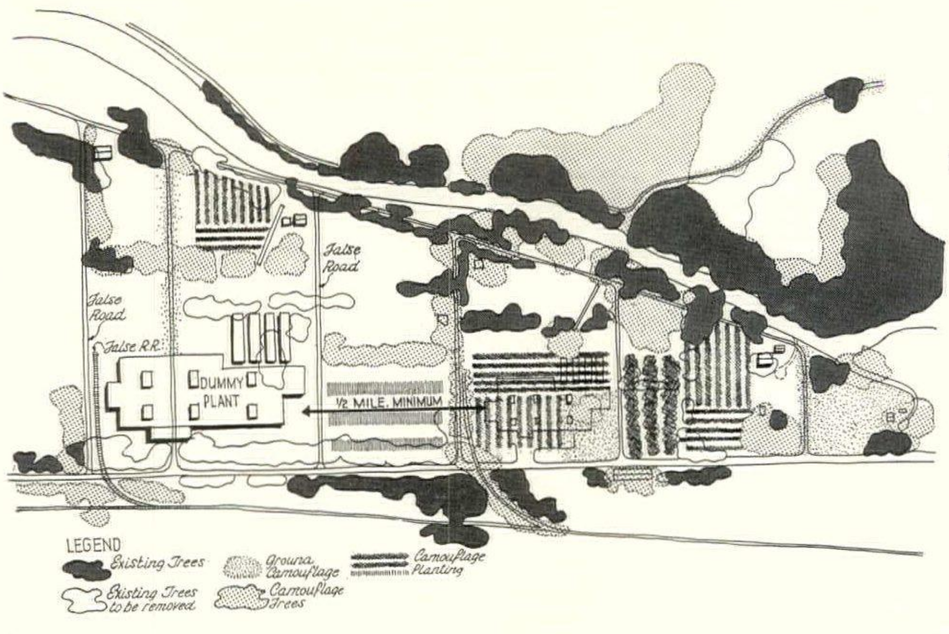
*De Palma—BS*

6

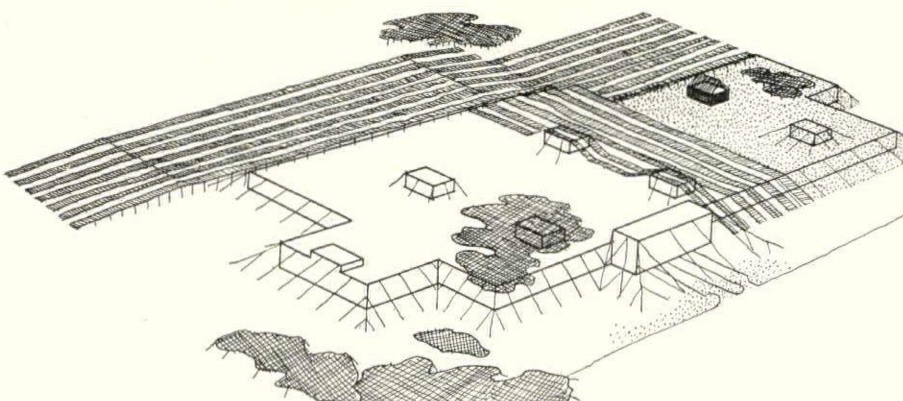
# CAMOUFLAGE—TYPICAL PROJECT



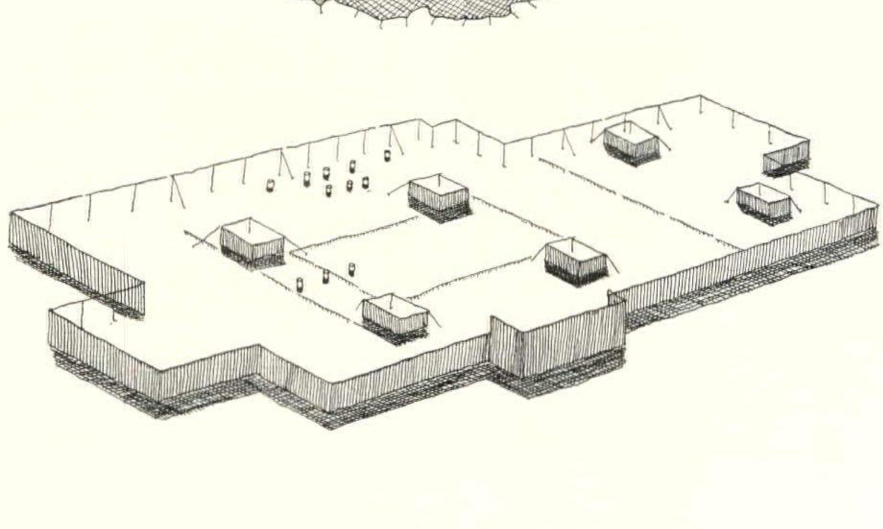
1 **This large factory** in rural surroundings might be completely camouflaged by the methods suggested in the sketches below. Landmarks identifying the general location of the plant from the air are the river and the highway which converge to the right of the plant and the dark U-shaped grove of trees at this point. The specific target is revealed by its geometric shape, the sharp black shadows which it casts and the roads which flank it.




2 **As camouflaged,** the same area covered in figure 1 appears to be an enlarged detail of it. This has been accomplished by enlarging and moving to the left, via various camouflage techniques, all of the ground features seen in figure 1 between the railroad spur and the right-hand limit of the sketch. Thus, the farm at the river bend has been "removed" with ground camouflage resembling an open field; this farm has been duplicated to the left of its actual position at a larger scale by means of fake trees and buildings and garnished screens which give the appearance of the original cultivated fields. In the next block, the actual plant has been screened, as indicated in figure 3, with a camouflage pattern similar to that of the field to its right, and the railroad spur has been hidden by planting. Separated by a half-mile field whose appearance has been doctored to jibe with the pattern immediately to the right of the actual plant in figure 1, a dummy plant about half again as big as the original has been erected by the simple means detailed in figure 4. To complete the illusion, a false railroad siding leads to the dummy and, behind it, appear fake trees, farm buildings and cultivated fields resembling the features of the real plant's backyard. Note, also, that the grove of trees at the bend in the river has been expanded to agree with the scale of the camouflage project, but that it still holds its original U-shape.

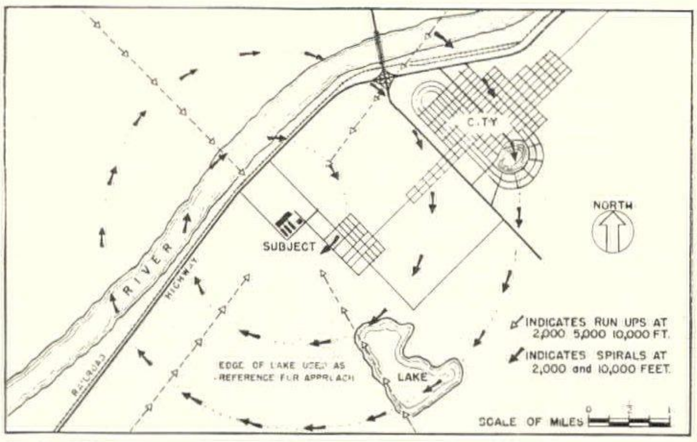


3 **Real plant** is covered with garnished nets held at least 1 ft. off the roof at the point of greatest sag. Colored garnishing materials are woven into the nets in a random pattern to resemble an open field (right) and in regular straight-line pattern to simulate cultivated fields (center). Balance of the building would be similarly covered but is left ungarnished in this sketch to show the method of securing the nets. Angle of guy wires to ground should not exceed 10 degrees; otherwise the break in the net will be visible from the air. Note that one of the factory penthouses has been converted into a farm building and that, to complete the duplicated pattern, two clumps of trees (garnished nets) have been built on the roof. Nets to the rear of the factory conceal parked cars.

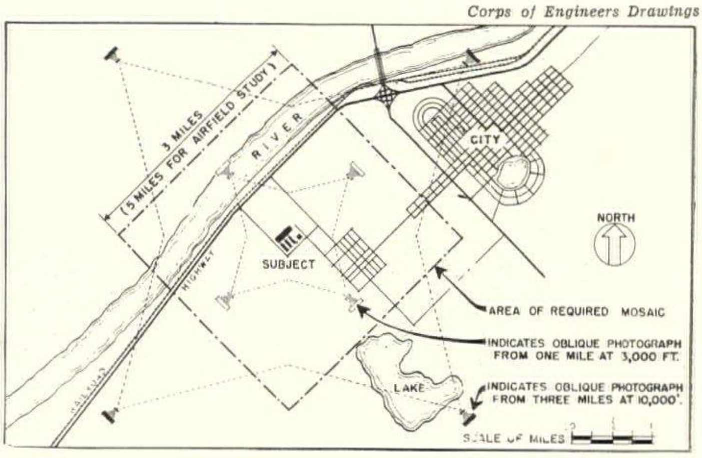


4 **Dummy plant** is comprised of wires strung around the enlarged outline of the original plant from which is hung a light shadow-casting material—building paper mounted on frames, plywood, canvas or similar cheap materials. The shadow-casters would have to be moved at high noon each day to duplicate the changing shadows cast by a real building. And, the earth inside the outline of the dummy would have to be treated to resemble the tone and reflective qualities of the real building's roof. From the air, the oil drums within the dummy's outline would look like the ventilators which are barely visible atop the real plant in figure 1.

*Corps of Engineers Drawings*




**1 Aerial photographs** of the subject should precede all attempts at comprehensive camouflage. These diagrams drawn by the Army's Corps of Engineers indicate to what degree the subject should be covered photographically and the courses of the plane.




**2 Suggested angles** from which the subject to be camouflaged should be photographed. Vertical views, or mosaics, will assist in the study of local patterns. At least one photograph should be taken in color. Note that the mosaic should cover an area of 9 sq. mi.

mounted on pipe scaffolding is another suitable base for permanent screening (figs. 2 & 3, p. 23).

Garnishing materials are not limited to fabrics. Tufts of tall grass may be wired to nails projecting from strips of lumber laid on the screen. Other possibilities include vines growing from suspended containers, live plants and shrubs, cut branches and, in the South, Spanish Moss (fig. 6, p. 23). If cut branches are used —green or dead—they should be installed upright (fig. 4, p. 21); otherwise their brightness and general appearance is unnatural. Growing vines will increase the effectiveness of dummy trees.

**Planting** is another effective means of camouflage, provided the materials used are typical of the immediate areas (fig. 4, p. 21). Regularity should be avoided, unless an orchard pattern is desired. Portable trees and shrubs growing in boxes or tubs may come in handy if the first attempt at camouflage fails to deceive enemy observers.

**Other Techniques.** While most of the important means of camouflage have been discussed in detail above, there are several other tricks-of-the-trade which merit brief note. When imitating buildings of simple design, decoys may be merely painted on the ground and outlined on the shady sides with vertical panels or sheets to cast shadows. Railroad tracks may be at least partially camouflaged by sowing weeds and vines along the green-painted ties and tracks. Roads and railroad sidings leading to camouflaged buildings may be given an innocent appearance by extending them for a considerable distance beyond the site. Railroad yards will be less obvious if planted with trees, if crossed by fake concrete streets (fig. 9, p. 20) and if steam locomotives are replaced with electric or diesel engines. Air fields will be less prominent if located in the country where their turf runways (suitable for all but the heaviest planes) blend with surrounding fields and are criss-crossed with painted hedges (fig. 2, p. 22). Finally, if the camouflage of a project proves ineffective and it is peppered by near misses, false fires may be lighted to convince the bombardier that he has accomplished his mission. They may be touched off in pans atop the target itself—or a safe distance to one side as a decoy for any bombers that may follow up the initial attack.

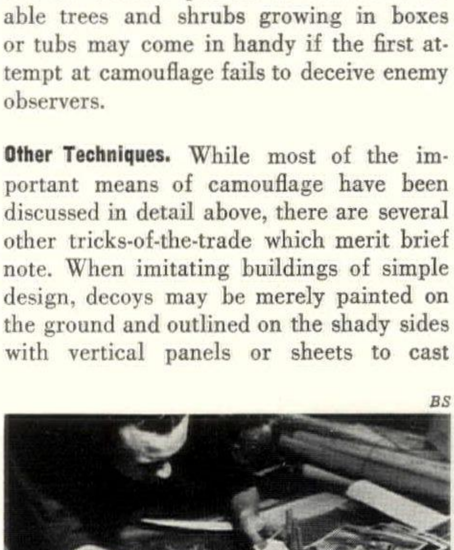
## PROCEDURE

Protective concealment is a science embracing the fields of design, construction, art and engineering. And, even the comparatively simple first and second stages of camouflage (see text p. 19) may not be effectively accomplished without professional advice. Warns the War Department: "No camouflage at all may often be safer than camouflage ill-conceived. . . . No plan should be accepted . . . without advice recognized as competent either by Federal authority or a professional engineering or architectural society."

Even for simple painted camouflage, the projected solution should be studied on paper. More deliberate efforts will require the study of plans and elevations of the object (with rough outside dimensions specified), maps and aerial photographs of the area. These may usually be obtained from local municipal offices or representatives of the Federal Government.

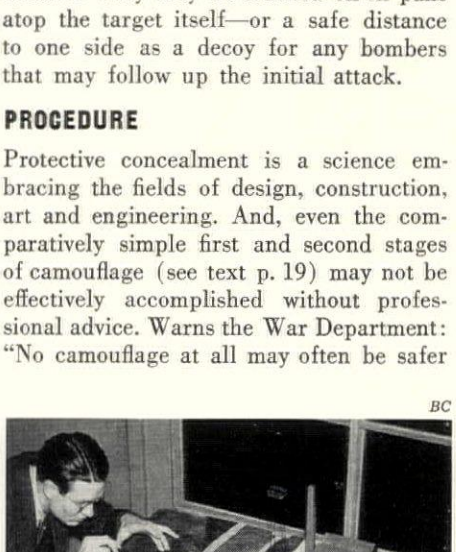
Before a large complex camouflage problem is undertaken, a complete photographic reconnaissance should be made from the air following the pattern suggested by the Corps of Engineers (figs. 1 & 2, above) and producing at least one mosaic from $1\frac{1}{2}$ miles up, four different oblique shots taken at 3,000 ft. and 1 mile away, two vertical stereographic pictures from 3,000 ft.—one in color. Photographs so taken will assist in the subsequent development of rendered drawings and scale models of the proposed camouflage (figs. 1, 2 & 3, below). To permit coordination and control of the various defensive measures being taken in a given area, these preliminary studies should be reviewed by appropriate civil or military authorities before working drawings or actual camouflage is begun.

*BS*

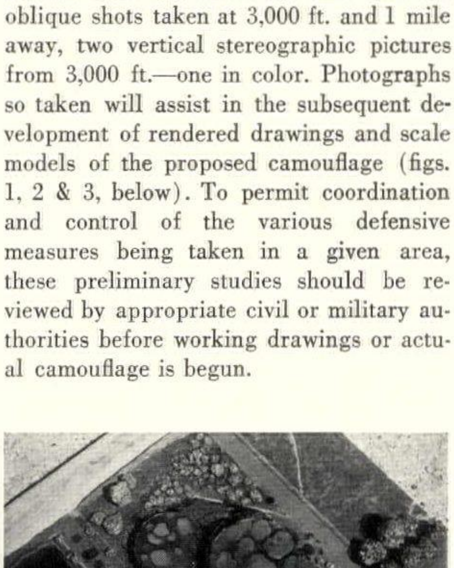


**3 Model building** is an important aid to effective large scale camouflage. Here, an expert ponders the problem presented by a saw-tooth factory roof, studies contour maps and aerial photographs.

*BC*

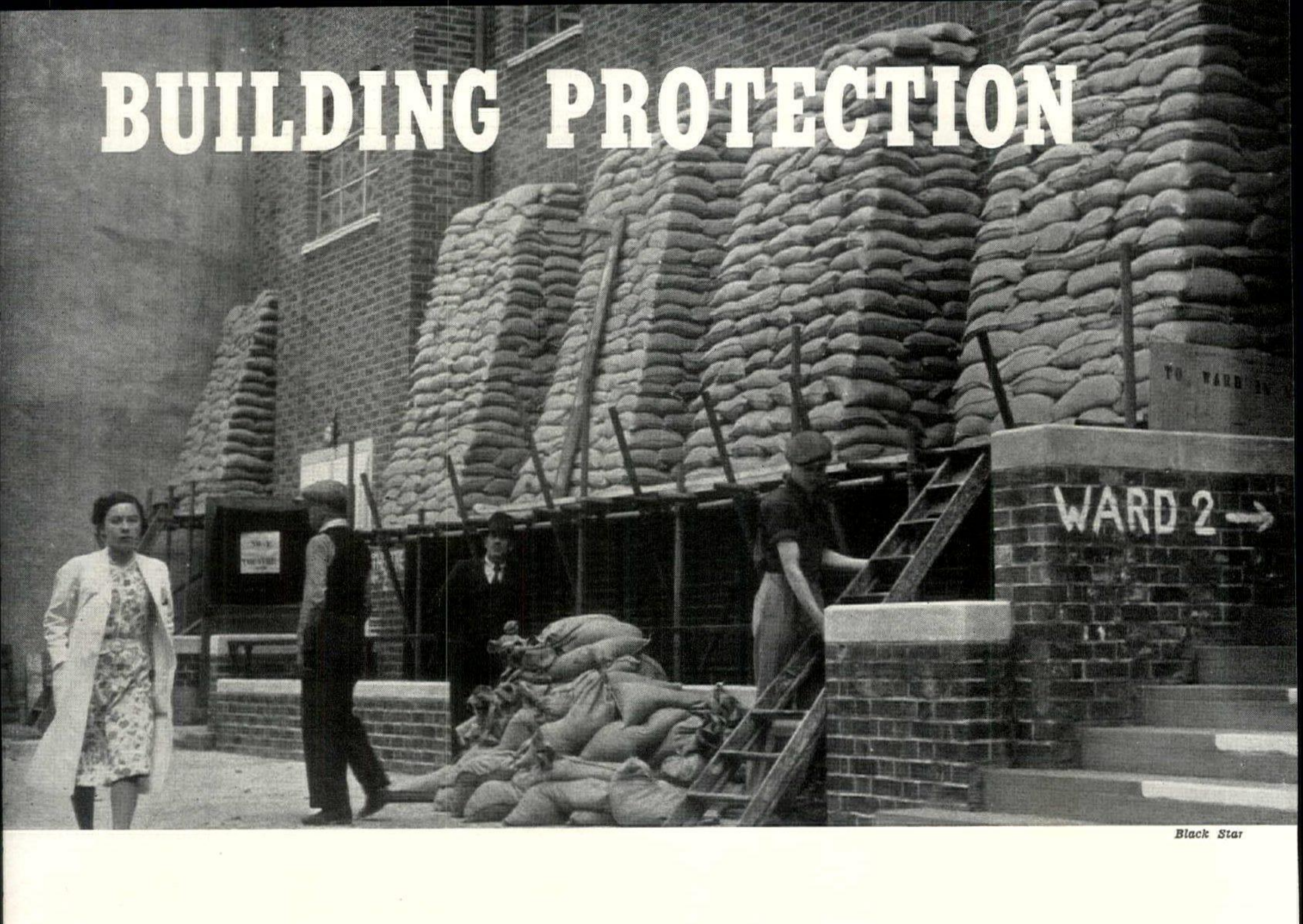


**4 Subterranean camouflage,** modeled above, is difficult, expensive and seldom warranted. The factory has been covered with a farm, but the success of the camouflage is open to question.



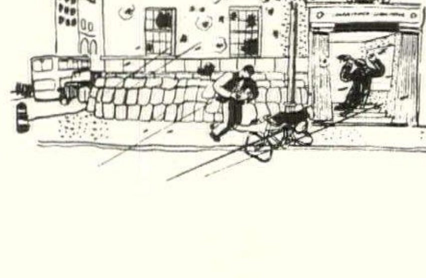
**5 Simple paint camouflage** is benefited by prior study in scale models. Note that while the painted trees conceal the tops of the gas tanks, the shadow problem has not been solved.

# BUILDING PROTECTION




Black Star

In the vastly extended theaters of total war, cities everywhere are objects of air attack. Their safety depends primarily on their active air defense and their distance from hostile air bases, to a smaller degree on their industrial, strategic and political importance, and least of all on their construction and planning. This last is not to say that all cities, regardless of layout and building techniques, are equally vulnerable. The correspondents who returned to Moscow recently and commented on the remarkably slight evidence of raid damage were in some cases inclined to attribute a part of the defenders' success to the broad streets and numerous park areas. But congested London survived a much longer period of concentrated raiding, and in both instances the decisive factors were the defending planes and anti-aircraft batteries. It is important, therefore, for the civilian defense planner to remember that nowhere does the term "passive" defense apply with more force than to the protection of buildings. It is not his job to save the city, for he has no power to make existing buildings immune to the effects of high explosives. It is his function to render certain parts of certain buildings reasonably secure against average bombing risks, and thereby to reduce, by whatever technical means may be feasible, loss of life and damage to vital services. To carry out this work he must understand the organization of community services, such as water, gas, power and transportation; he must know methods of construction and strength of materials; and above all he should be equipped with a liberal amount of common sense.

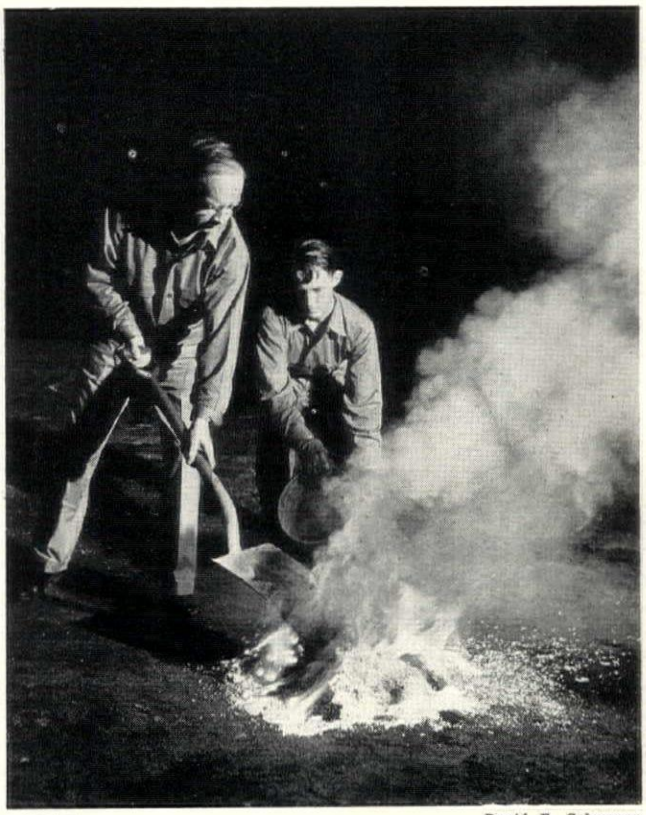


*Sketches from Tecton: Planned ARP*

Air attacks on cities are in essence the same as air attacks on other military objectives. The weapons are high explosives, fire and gas. Against direct hits by the heaviest types of demolition bombs there is no protection except the complete bombproof, a structure which is both slow and costly in the building and, due to the constant development of new bombs, may be obsolete before it is finished. Fortunately the very power of these missiles—which means great weight and high cost—restricts their use to isolated objectives, and it has been found much more effective to have bombers carry larger numbers of lighter bombs, thus increasing the probability of hitting something. Practical methods of dealing with the effects of light and medium bombs are described in this section. A direct hit by any of the common sizes of high explosive bombs will seriously damage, if not completely demolish, the typical urban row house constructed of wood joists on masonry bearing walls. Apartment and office buildings of steel or concrete frame construction will, of course, resist bombing much more effectively. It is one of the responsibilities of the authorities, therefore, to determine which buildings may be reenforced to provide bomb-resistant rooms at the first-floor or basement level and which should be condemned as totally unsafe. In the case of the latter, the occupants must be allocated to shelters in safer buildings, or public shelters in the district may be constructed.

The fire hazard is created by the incendiary bomb which, like the explosive types, has been made as small as practicable, with a consequent increase in the possibility of damage. Such a possibility is very real indeed, for a single big bomber can carry literally thousands of the two-pound incendiaries. And, being lighter than explosive bombs, incendiaries do not readily penetrate buildings, but stop on the roof where they may do the most damage. Protection of buildings against fire bombs, however, is much simpler and far more positive than protection against explosives. Roofs can be made sufficiently strong to resist penetration; and, with enough trained watchers the burning bombs can be extinguished or removed before the fire spreads. If it is not possible in time of war to replace old timber buildings with modern structures that are much more resistant to the effects of high-explosive bombing, it is distinctly possible and desirable to reduce fire risk in congested areas by pulling down the worst of the firetraps. The worst thing that happened in London, according to competent reports, was the rapid spread of fires to the point where whole blocks were consumed. Much of this useless waste could have been prevented, had a previously prepared plan of strategic demolition been carried out promptly by the authorities.

The third important weapon at the disposal of the raider is gas, any discussion of which, however authoritative, must of necessity be theoretical, for to date no city has been subjected to a gas attack. It is quite probable, however, that the horrors of chemical warfare, like those of high explosive and incendiary bombing, have been greatly overstressed. The various kinds of gas and their effects are known, and the methods of combating them are equally well understood. These methods might well change in the light of practice, but preparation and organization are nevertheless important, for it is much less painful to modify an existing system of defense than to start with none at all.



*David E. Scherman*

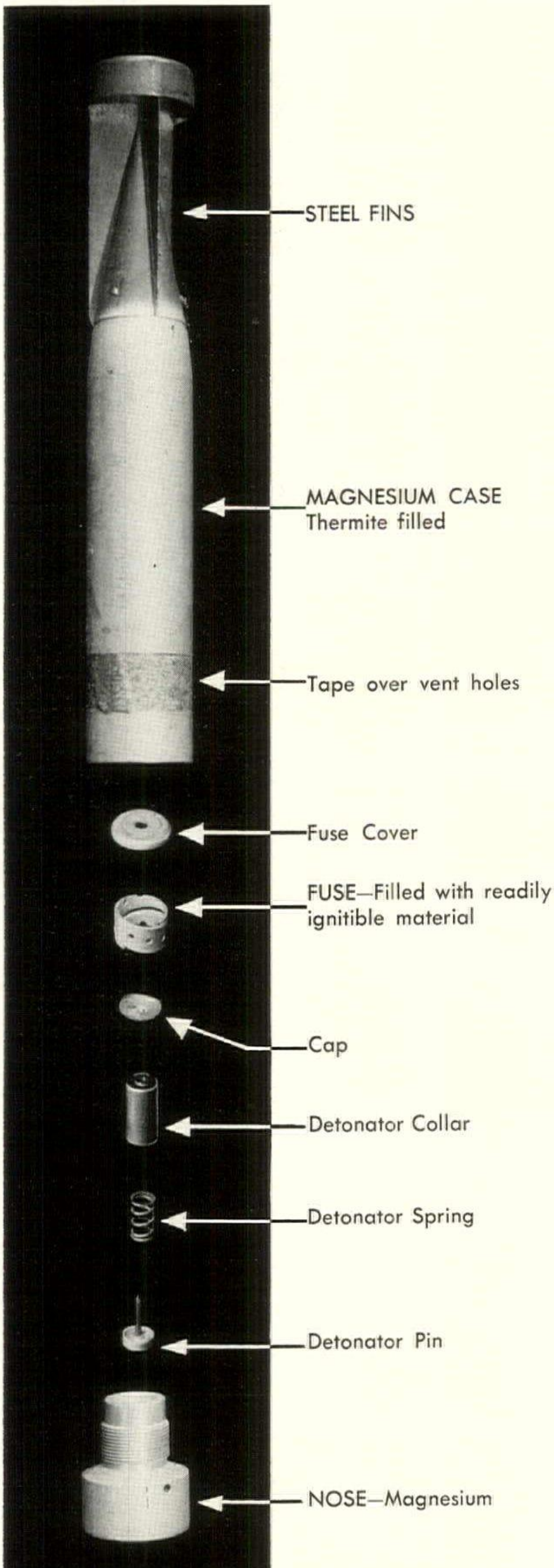
**FIRE**

*European Photos*

**GAS**

**DEMOLITION**

# BUILDING PROTECTION—FIRE



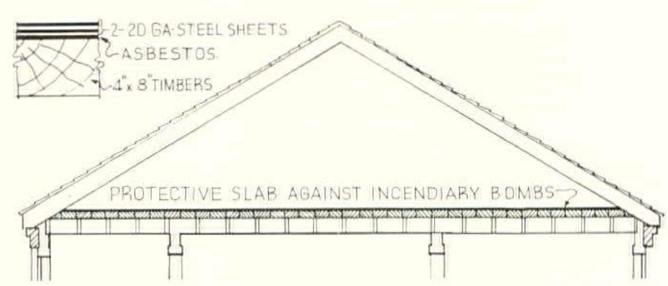

**The standard incendiary** — the so-called "electron" bomb — is shown above. It weighs 2.2 lbs. and is ignited upon impact. Both the magnesium case and thermite filler burn, forming a very efficient destructive unit.

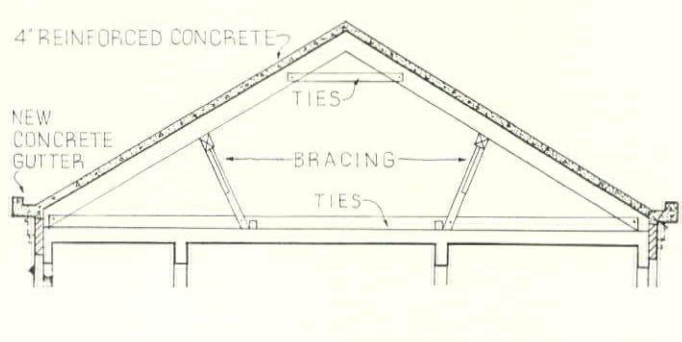
**Alternative types of anti-incendiary roof construction** are shown at the right, involving the use of steel, asbestos, timber and concrete. Although more costly, the methods outlined in the lower drawing offer better protection. Construction must be checked before protective slabs are installed; the average house requires a certain amount of bracing to take the added weight.

Far greater damage can be done by fire than by bombs in congested cities filled with buildings of wood construction, a danger especially real now that scatter bombing is a common practice. Using the light electron bomb or any of the other small incendiaries, a single plane can carry 2,000 or more, starting as many as 200 fires at widely separated points in the city and imposing a staggering load on available fire apparatus. Since there is an ever-present possibility of such fires spreading to raze whole blocks (in London this actually happened) immediate preventative measures include the removal of certain buildings to provide firestops, the protection of roofs and attics, the training of adequate numbers of watchers and a plan for further demolition in case of fire.

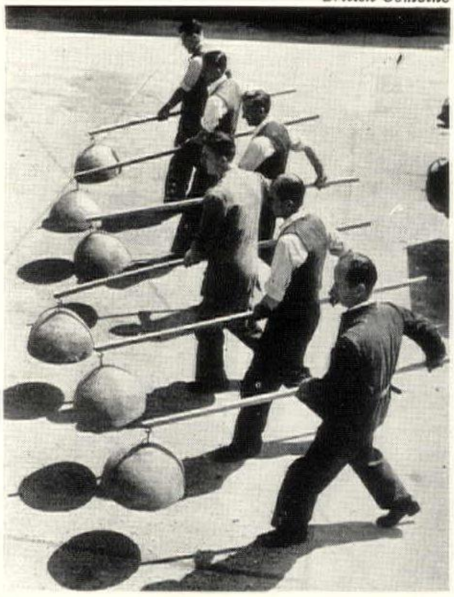
Fortunately the great advantage of the scatter bomb—its light weight—is also its chief weakness. It can be stopped by a light concrete slab, a ¼—½-inch steel sheet continuously supported, or deflected by a steeply sloping roof. Its effect can be localized by means of sand, water and snuffers, and it can be disposed of without difficulty by an experienced person using simple equipment. Common asphalt roofs have been found to resist the action of burning bombs remarkably well, and a number of buildings in London have been covered with solid layers of the material, two or three inches in thickness. The chief danger lies in the old wood house or warehouse, where the bomb may penetrate the roof and set fire to the attic or top floor. It is advisable, therefore, to remove all combustible materials from these spaces, and if possible, to sprinkle a layer of sand on the top floor. Accessibility to attics is also important.

The standard method of combating all incendiaries is smothering with sand or ashes. For the oil bomb, this covering must be dry, as water merely makes matters worse. This type, however, is not used for mass bombing of cities as it is too heavy and hence suitable only for special objectives. The electron bomb (magnesium, aluminum and thermite) will explode on contact with a stream of water, scattering burning fragments; consequently water is used as a fine spray to make the bomb burn out more quickly, and to prevent spreading of the flames. Water or wet sand can be used on phosphorus bombs. In most cases an effort is made to remove the bomb while it is still burning and put it in the street or on the ground outside—to be effective, this must be done within five minutes after the bomb has ignited.



*British Combine*



1.

*INP*

2.

*BC*

3.

*Peter A. Ray—BPS*

4.

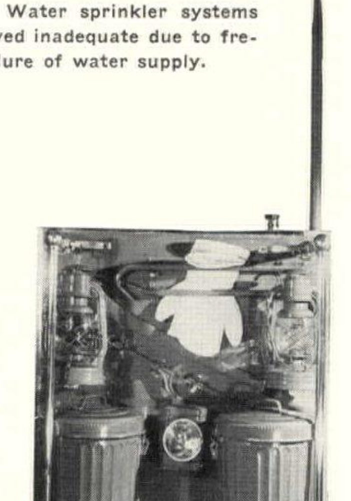
**1.** Snuffer-bowls of asbestos on wire mesh. **2, 3.** Implements for removal of incendiaries. **4, 6.** Reserve supplies of water and sand for fire fighting. **5.** A light mesh alarm device. If an incendiary bomb drops through the roof into the mesh an alarm is automatically sounded. **7.** Mobile fire apparatus installed in Mutual Life Insurance Building, New York. There are extinguishers on the other side of the panel. **8.** Demonstration of proper method of spraying a burning bomb. The stirrup pump and buckets are invaluable in reducing dependence on fixed water connections. Water sprinkler systems have proved inadequate due to frequent failure of water supply.

*BC*

5.

*BC*

6.



7.

*BC*

8.

# BUILDING PROTECTION—GAS*

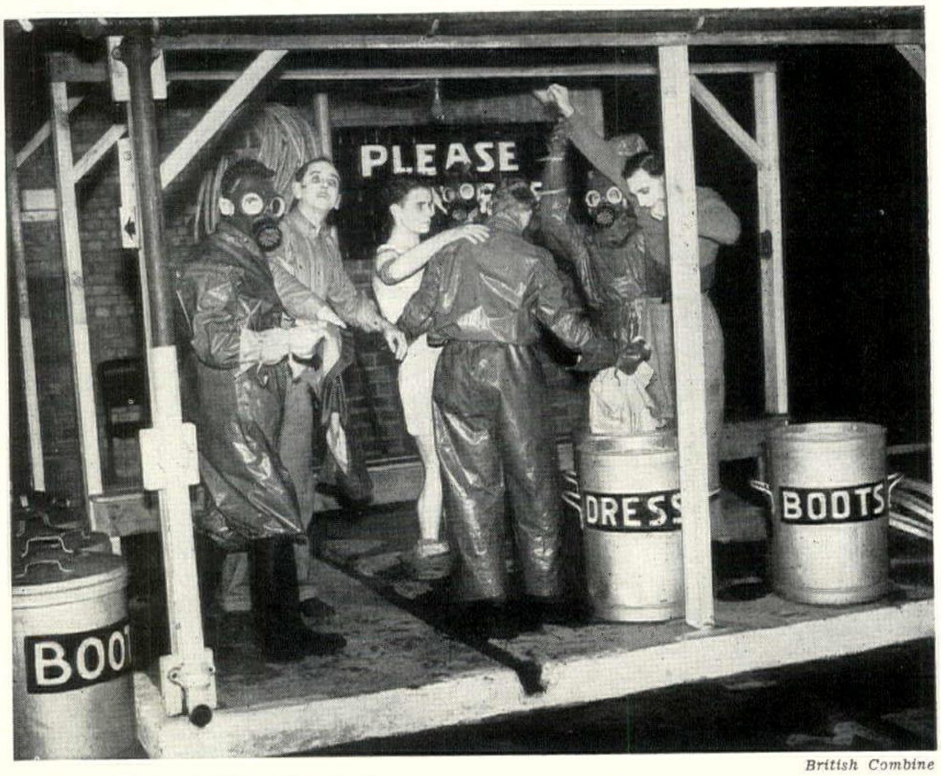
Protection against gas attack is the one phase of civilian defense which has not received the full-scale test of actual experience, and for this reason, perhaps, there has been far too much speculation in print on the effects of chemical warfare. The fact is that gas is an expensive (in terms of results) way of winning a war, and none too effective at that. About eight tons of mustard gas were used for every gas fatality in the last war, and it might very reasonably be assumed that if the Nazis had any more efficient means of eliminating civilians than explosive and incendiary bombs, they would not have hesitated to use them except, perhaps, in fear of retaliation.

The prime purpose of gas attack, however, is not fatality, but injury, and it requires complete surprise to be effective. Thus, had Germany gassed England in the early days of the war before everyone had been supplied with masks and had been taught counter measures, the resultant panic, demoralization, widespread injuries and overtaxing of medical and hospital facilities might have been decisive factors in the course of the war. But, once the people were prepared for it, the gas attack would have small value. For this reason, the U. S. should now acquaint itself with at least the fundamentals of protection against gas. Not until the Government deems it wise to issue civilian masks—the basic means of gas protection—need the public concern itself with actual protective installations.

Phosgene and mustard were the two most widely used gases during World War I. A lung irritant known technically as CG, the former is a non-persistent gas which dissipates in about ten minutes under normal weather conditions and smells like mushy hay. It accumulates in low places—cellars, areaways, ravines, etc.—and concentrations of it may cause death. On the other hand, mustard gas (HS) is a blistering skin irritant and is highly persistent. It may contaminate an area for days or even weeks and must be attacked by special squads equipped with protective clothing and counter-chemicals. Mustard gas smells like horseradish, onions or garlic.

Other war gases include: 1) Adamsite—a non-persistent nose and throat irritant or sneeze gas which is produced by burning. 2) Lewisite—like mustard gas but more volatile. 3) Tear gas—a non-persistent eye irritant. 4) Chlorine—another lung irritant. 5) Arsenical smoke.

Weather conditions greatly affect the behavior of gases, and the likelihood of gas attacks is somewhat dependent upon them.




British Combine

DECONTAMINATION STATION

Photos, European

1

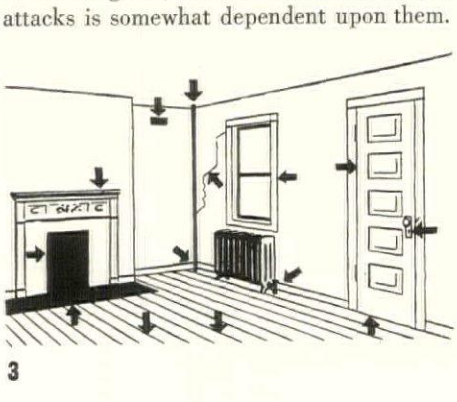
2

1. Gas fighters in English drill scrub a sidewalk "contaminated" with persistent mustard gas, are themselves protected against its blistering effect with masks and nonporous clothes.

2. Gas-tight door in German shelter is bolted shut.

3. Arrows are reminders of possible gas inlets.

4. A damped blanket is a satisfactory emergency gas stop. Here one corner is not battened down to permit entrance and egress.



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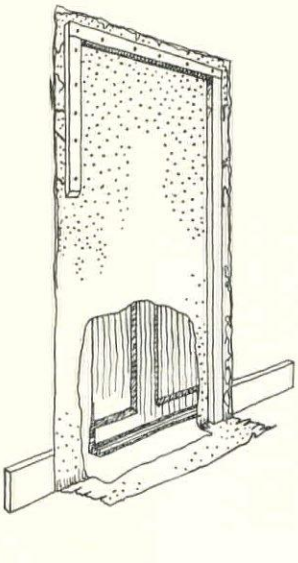


4

*When this went to press the OCD and other civilian defense officials had yet to formulate their policy concerning protection against gas attack. Hence, only a brief, general discussion of the subject is presented on these pages.

All gases tend to hug the ground. A wind of more than 10 mph. will dissipate most of them quickly. Since rising air currents generated by sunshine rid the atmosphere of pollution, gas attacks are most likely to occur at night. Rain is another ally of the defender; it destroys phosgene chemically and renders most other types harmless. (Mist, fog and clouds, however, do not have the same effect).

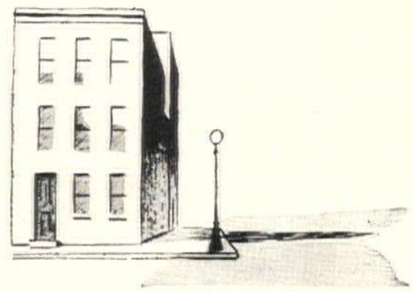
The warmer the temperature, the quicker most gases are dissipated. For this reason, gases are usually used during cool, cloudy weather. Exception: warm weather accelerates the evaporation of mustard gas, thus producing higher vapor concentration and increasing its effectiveness. This gas springs from a liquid which will freeze and be inert at a temperature slightly above the freezing point of water.

In general, there are two types of gas shelters: non-ventilated and ventilated. Suitable for short periods, the former may be a sealed room on the first or basement floor of a building chosen for its resistance to other forms of bombardment. (If gas bombs were the only ones to be guarded against, a refuge on upper floors would better serve the purpose.) It should be equipped with two air-lock exits and all openings should be sealed with oil cloth, coated fabrics or other non-porous materials. Damped blankets will serve the purpose in an emergency. All cracks in the walls should be sealed with gummed tape or putty; chimney openings should be tightly closed and fires extinguished. Comfort of an unventilated shelter is increased by the provision of an electric fan and cotton bags filled with activated charcoal and soda lime.

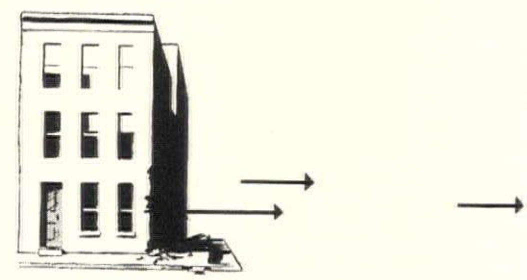
If a new non-ventilated gas proof shelter is to be built, it should contain 20 sq. ft. of floor space for each person. Concrete construction at least 12 in. thick is recommended. The room should not be lined with steel or waterproofed, for these materials will prevent the absorption of carbon dioxide from the air. Even then, the maximum of 2 per cent carbon dioxide may be reached in ten hours if the shelter is occupied by adults. (Steel lining or waterproofing would cut the time to five or six hours.) In climates where the temperature may run higher than 70 degrees, more space per person must be provided.

In ventilated shelters outside air is drawn in through a gas-mask-like canister or filter which removes the gas. It is recommended that this system supply at least 33 cu. ft. of air per hour per person and have a peak capacity of about 90 cu. ft. English experiments have proved most satisfactory when the outside air is heated to 60 degrees and blown into the shelter via nozzles to insure proper mixing. Unless artificial cooling is also provided, it is suggested that uninsulated wall areas should not be less than 25 sq. ft. per person if the shelter is underground and 50 sq. ft. if above ground. An air-cooled shelter need have only 6 sq. ft. of floor space per person. Slatted wooden floors will facilitate cooling.

All gas shelters should be supplied with decontamination materials. Most universally useful is chloride of lime, a bleaching powder kept in airtight containers and mixed with water before use. Although water will destroy Lewisite, it has little effect upon mustard gas (heavier than water) but may be used to drain it off. Wetted earth, sand, ashes and sawdust if spread to a depth of 3 in. will serve as temporary protection. One per cent of sodium sulphide in water will approach chloride of lime in effectiveness, particularly if the water is hot.

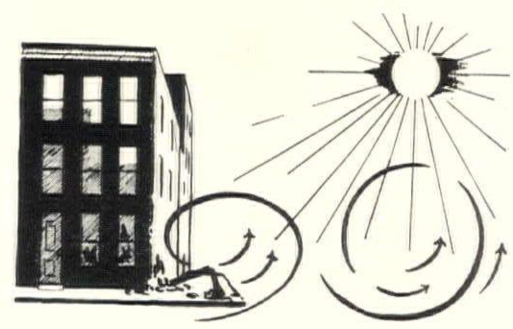


**1.** Dissipation of gas is hastened. . . .

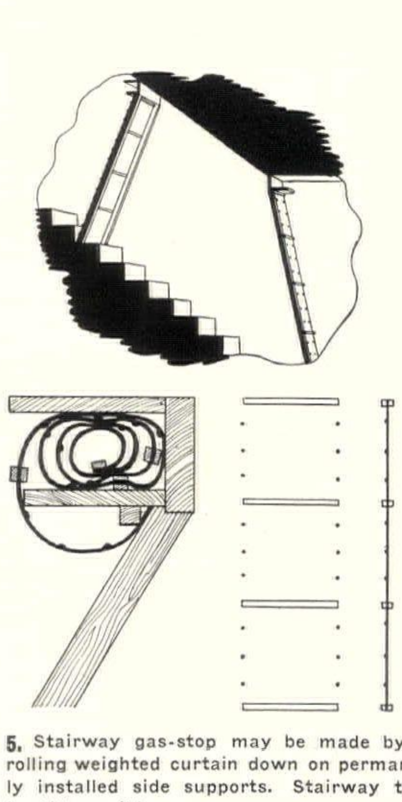


**2.** by wind in excess of 10 mph. . . .

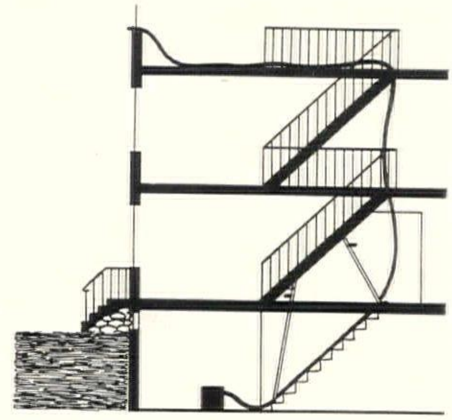
**3.** by rain which washes it away. . . .



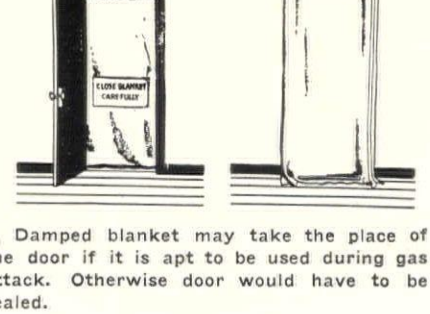
**4.** and by air currents generated by sun.



**5.** Stairway gas-stop may be made by unrolling weighted curtain down on permanently installed side supports. Stairway traffic is still possible.

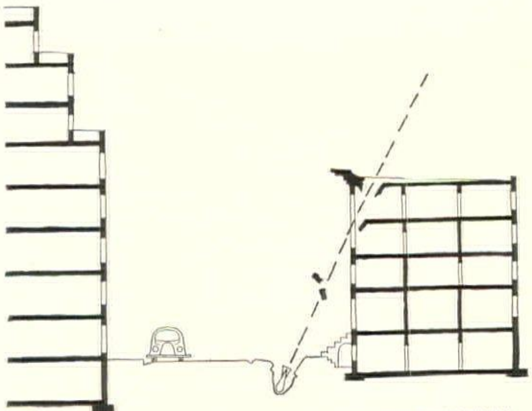


**6.** Ventilation of basement gas shelters may be accomplished via an air hose from second floor window.

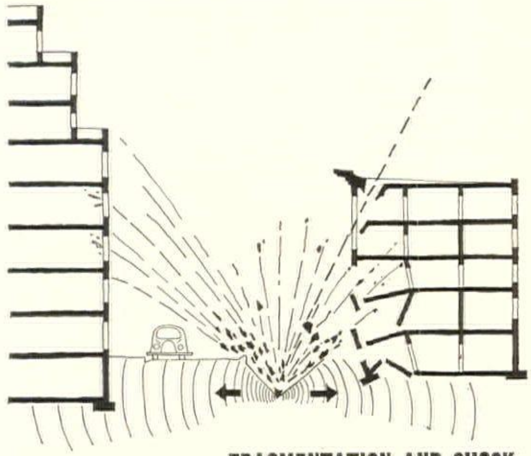


**7.** Damped blanket may take the place of the door if it is apt to be used during gas attack. Otherwise door would have to be sealed.

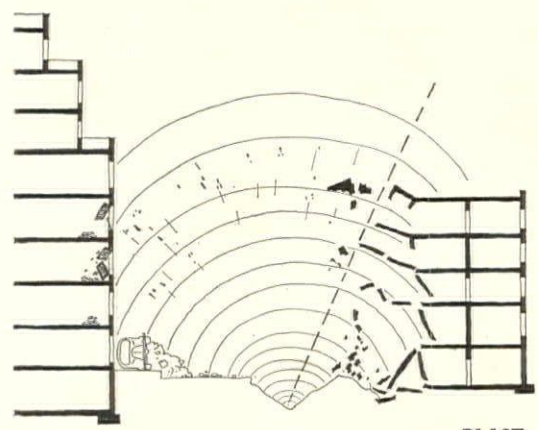
# BUILDING PROTECTION—DEMOLITION



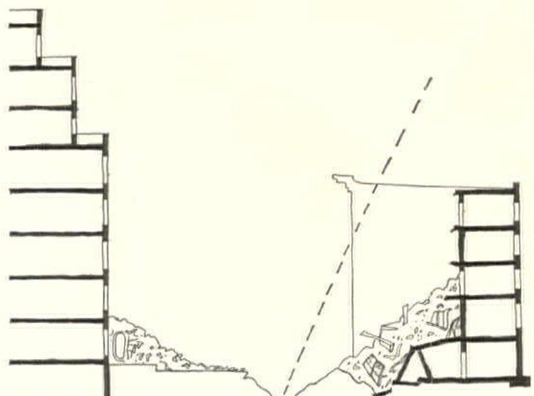
PENETRATION



FRAGMENTATION AND SHOCK



BLAST

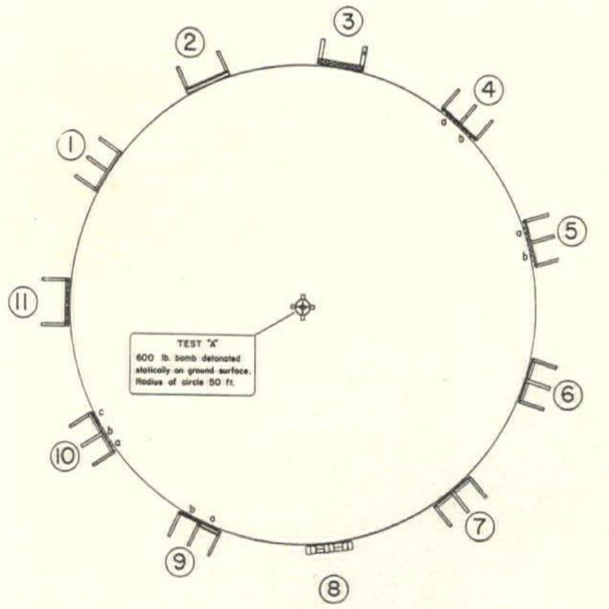


COLLAPSE

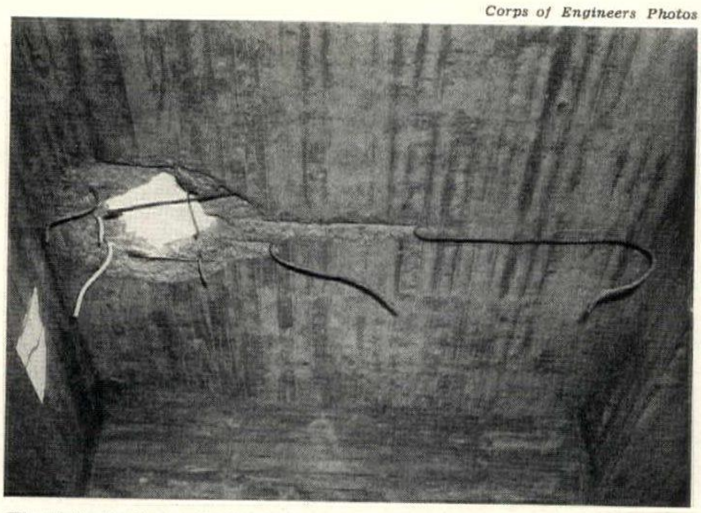
Big cities are peculiarly vulnerable to demolition bombing because they are badly built and badly planned—a condition quite as true of New York and San Francisco as of London and Warsaw. Their buildings are largely of wood on masonry bearing walls, a type of construction readily destroyed by bombs of moderate explosive power. The congested nature of most big-city building is equally serious, as it makes direct hits frequent and devastating. If a city were planned with streets adequate for motor traffic, and with buildings spaced to assure all inhabitants good light, air and adequate recreation areas, it would provide a vastly more difficult target. If, moreover, all its buildings were of modern frame construction in steel and concrete, it is unlikely that demolition bombing would be seriously attempted by hostile air fleets unless the city had no active air defense whatever.

Unfortunately these conditions—ideal from the viewpoints of both peacetime use and passive defense—do not exist, and it is necessary to consider what happens in the average city when demolition bombs do begin to fall, and what can be done to minimize their effect. The four illustrations on this page demonstrate the various effects produced by a bomb dropped into a street which has a modern frame building on one side and a wood and masonry structure on the other.

The bomb lands at an angle, possibly striking a building in its course. The explosion produces a crater in the street and throws steel splinters and debris for a distance depending on the bomb's explosive power. The destructive effect within a short radius is more than can be withstood by any type of building save a bombproof shelter. Following the explosion a terrific pressure is built up, quickly followed by a suction wave. Both the blast and suction have an enormous destructive effect, and particularly if the space is confined, will blow out windows and rip out walls. Simultaneously, the explosion sets up ground waves which produce a type of stress not provided for in anything save earthquake-proof construction, and the strength of these waves may be sufficient to bring down nearby buildings. In the non-frame structures much of the damage may be produced by the collapse of the upper floors, which then overload the lower floors and wreck the entire building. The great advantage of the frame building is that it forms an integral whole, with sufficient strength and flexibility to resist blast and earth shock with only minor damage to walls, windows and partitions. Had the bomb in the illustrations dropped closer to the frame building, one or two supporting columns might have been blown out, but the structure would have otherwise remained intact.




*Corps of Engineers Photos*

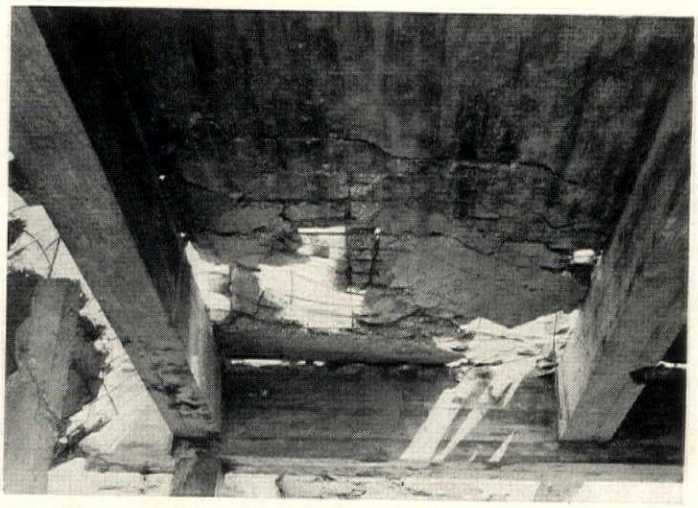


The hole in the concrete slab was made by a 500-pound demolition bomb, sand-filled and dropped from a height of 8,000 feet. A number of such tests were made to study resistance to penetration without the complicating factors introduced by the explosion.

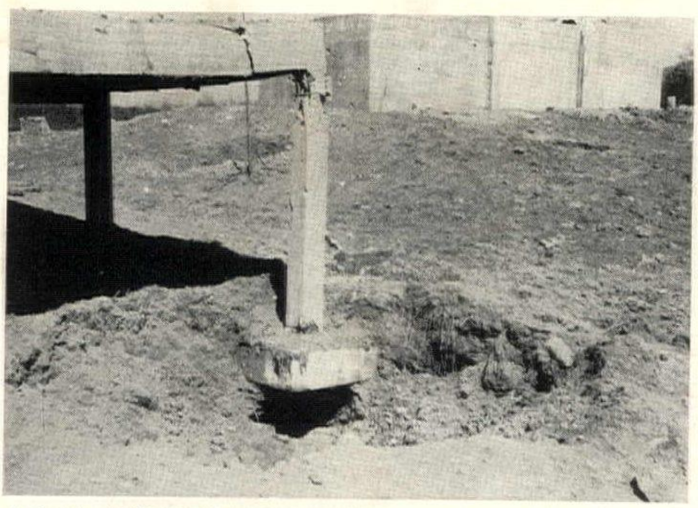
**PANEL TEST "A"**

**600 POUND DEMOLITION BOMB DETONATED AT 50 FEET**

| Description of Panel | | | Number of Perforations | Number of Penetrations | Maximum Depth of Penetrations | Remarks |
|---|---|---|---|---|---|---|
| 1 | | WOOD WALL $\frac{11}{16}$" Siding on $\frac{7}{8}$" sheathing | 15 | 4 | $1\frac{1}{8}$" | Panel remained standing |
| 2 | | BRICK VENEER 4" Brick on $\frac{7}{8}$" sheathing | 2 | 23 | $1\frac{3}{4}$" | Wall was cracked in several places |
| 3 | | 12" BRICK WALL Standard masonry | None | 20 | 2" | Panel damaged very little |
| 4 | a | CORRUGATED IRON 10 Gage | 12 | 6 | $\frac{1}{4}$" | Panel moved slightly by blast and sheets were warped slightly. No other damage |
| | b | CORRUGATED IRON 12 Gage | 18 | 5 | $\frac{1}{4}$" | |
| 5 | a | CORRUGATED IRON 3 Gage | 3 | 11 | $\frac{1}{2}$" | Panel not otherwise damaged |
| | b | CORRUGATED IRON 8 Gage | 5 | 16 | $\frac{3}{16}$" | |
| 6 | | STRUCTURAL STEEL $\frac{1}{2}$" Plate | 2 | 27 | $\frac{9}{16}$" | No. other damage |
| 7 | | STRUCTURAL STEEL 1" Plate | None | 28 | $\frac{1}{2}$" | No other damage |
| 8 | | SANDBAGS 30" Wall | None | 31 | $5\frac{1}{2}$" | Two courses at end were blown over |
| 9 | a | PLYWOOD - 2 LAYERS $\frac{3}{4}$" on 2" x 4" studs | 9 | 5 | $\frac{3}{4}$" | Panel remained in place |
| | b | PLYWOOD - 2 LAYERS $\frac{3}{4}$" nailed together | 8 | 3 | 1" | Panel dislodged and fell 10 ft. closer to explosion |
| 10 | a | ASBESTOS CEMENT $\frac{3}{8}$" Corrugated | – | – | – | Panel completely disintegrated |
| | b | ASBESTOS CEMENT 1" Flat sheet | 5 | 3 | $\frac{3}{8}$" | Panel remained in place |
| | c | ASBESTOS CEMENT 2" Flat sheet | 4 | 2 | $\frac{3}{4}$" | Panel remained in place |
| 11 | | CINDER BLOCK 8" Wall - hollow core | 2 | 13 | $1\frac{1}{2}$" | Panel not otherwise damaged |



The damage produced here was caused by a 100-pound high explosive demolition bomb with delay action fuse, dropped from 5,000 feet. Note that the frame is intact despite the partial destruction of the slab.



A bomb similar to the one used above was dropped from the same height, hitting the ground very close to the corner of the structure. Here, as in the test above, the frame is still standing despite the uprooting of the corner column footing.

Tests made by the War Department provide a great deal of valuable data on construction methods and materials. The diagram shows one of a series of tests of wall panels for resistance to splinters and blast, with the data tabulated above. Three of the panels, it will be noted, stopped all splinters which struck them.

The three photographs to the right show results of actual bombing of structures.

# BUILDING PROTECTION—DEMOLITION

Wall scarred by bomb fragments. Note radial pattern.

Effect of blast extends 3 stories above roof. Note that panels are blown in between framing members; framing is intact.

**BOMB EXPLODED HERE** upon striking roof of 4-story wall bearing structure.

Note blasted-in side wall of framed building above and below roof of wall-bearing building. Note also that framing in immediate vicinity of explosion is intact.

Wall partially blown in by blast.

Floor destroyed by blast and collapse of party bearing-walls.

Floor destroyed by blast and collapse of structure above.

Reinforcement of structure here might have prevented injury to occupants of first floor.


Tapsell—BS

**In this remarkable photograph** are compressed many of the most important lessons on the protection of the common wall-bearing building. The bomb used here was apparently fairly light (perhaps 100 lbs.) and exploded on contact. Since this type is used a great deal in the bombing of cities, the best possible protection for the occupants (except for construction of a complete bombproof) would be reinforcement of the first floor or basement, as the greatest danger is from the collapse of the superstructure.

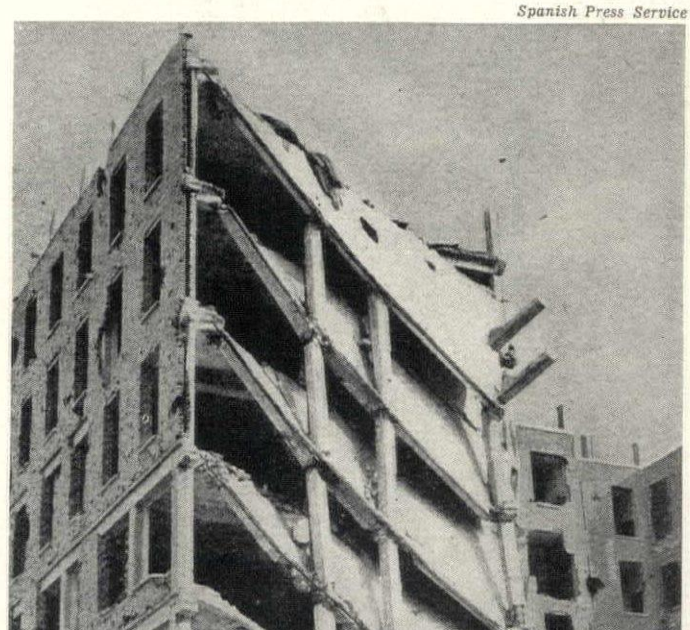
Black Star

Sovfoto

Oswald Wild

BS

Spanish Press Service



The repeated observations in English technical papers on the localized effects of the bombing of buildings are well illustrated by the examples on these two pages. The facing illustration, for instance, shows two structures destroyed, with those adjoining left practically intact. A similar effect is visible in the two photographs directly above. Both buildings were of the wall-bearing type, and the greater part of the damage done was caused by the destruction of bearing walls with the resulting collapse of the wood floors. The apartment house (above, right) minus its front wall was apparently untouched by the bomb, but was stripped of its non-bearing (and therefore almost unattached) sidewall by the explosion. In the case of steel or reenforced concrete frame buildings all of these forms of damage are minimized, a good case in point being the modern apartment house (middle, right) where a bomb penetrated the roof, blew out a part of the wall, and did little other apparent damage beyond breaking some windows. Given sufficiently intensive bombing, even heavy frame buildings will collapse. The photograph at the right was taken in Madrid, and shows how the floor slabs gave way after the columns were destroyed. It should be pointed out, however, that this damage resulted from protracted shelling; a comparable effect produced by bombing would require a concentration of effort which is of necessity restricted to objectives of first-rate military importance.

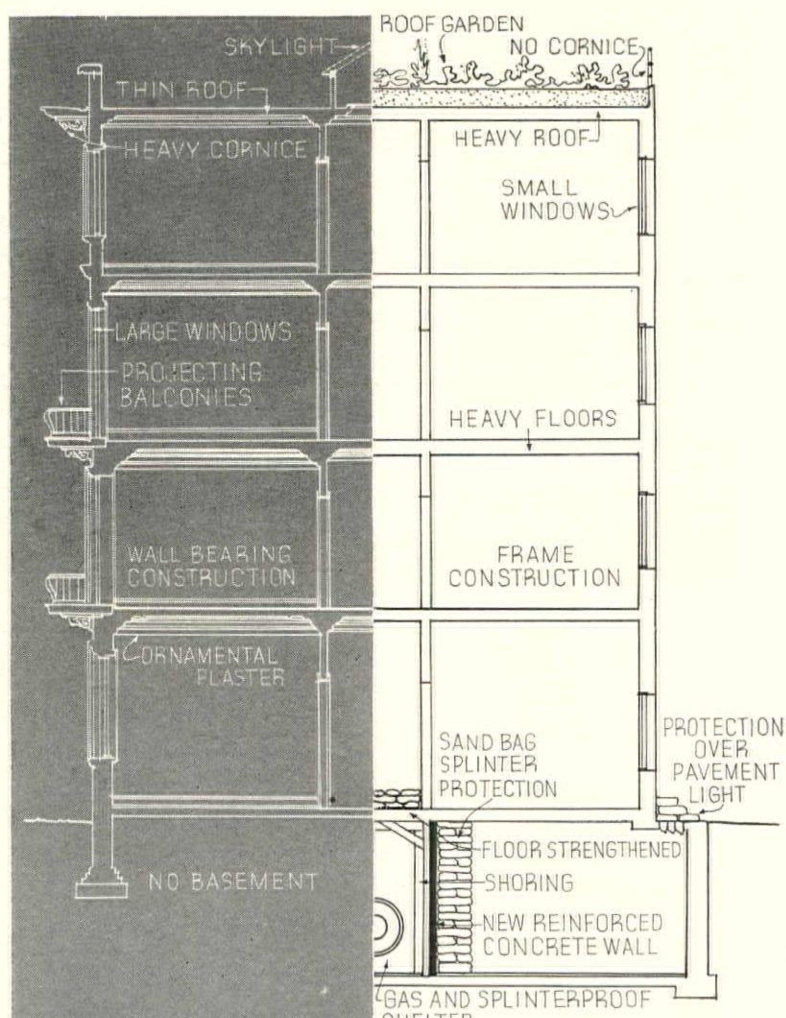
# BUILDING PROTECTION—DESIGN FEATURES

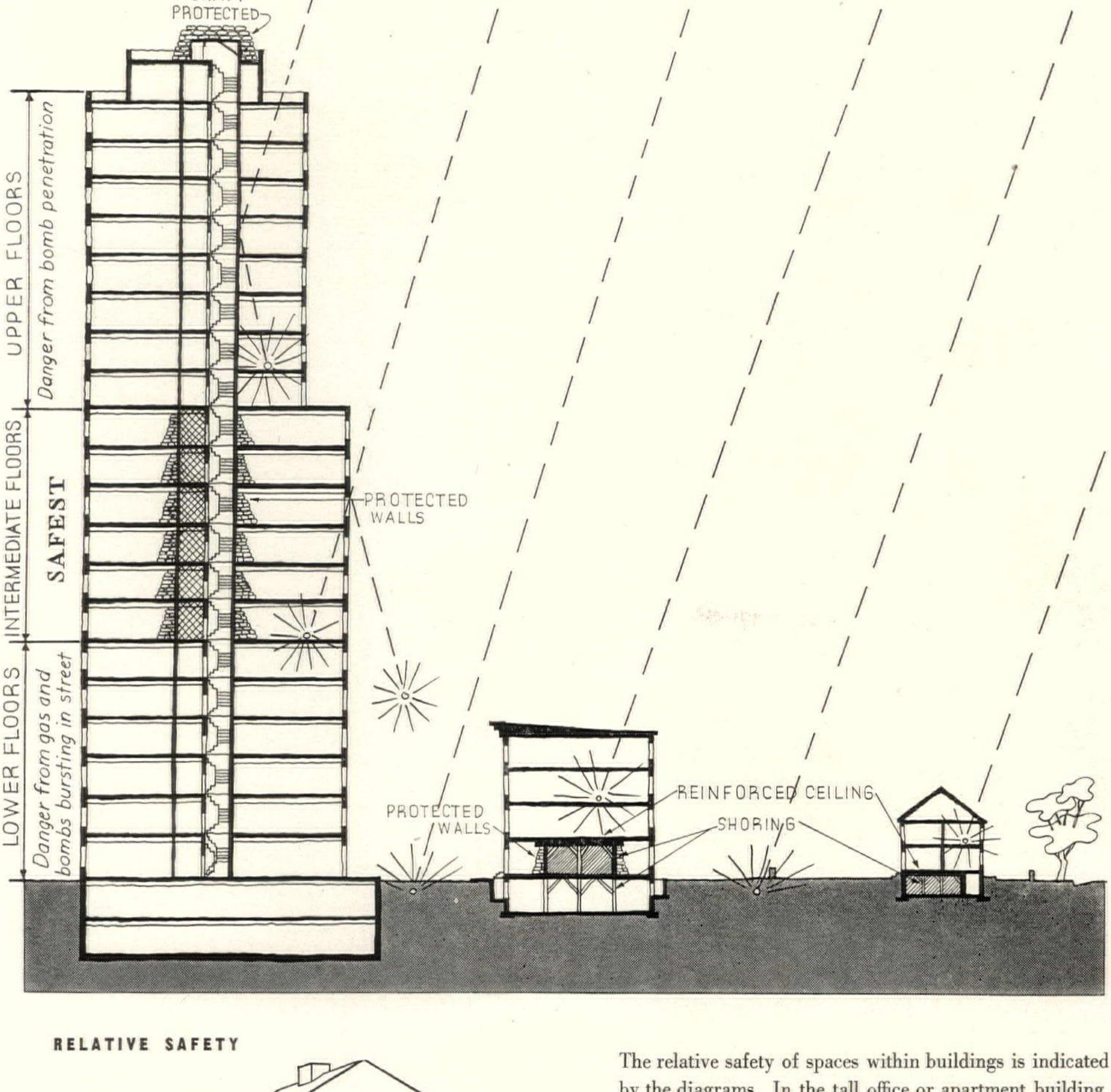
*Black Star*

The correctness of many of the theories of modern architecture has received striking and unexpected confirmation during the air raids of the past few years. (Notable exception is the use of large glass areas.) Skeleton construction and flush surfaces have proved their greater safety time and again. The collapsed building (middle, left) which apparently did not even get a direct hit, would still be standing had it been of frame construction. The debris in the top illustration is almost entirely made up of pieces of cornice, the masonry balcony and doorway pediment. During an air raid these structurally meaningless elements might constitute as serious a danger to life and limb as the bombs themselves. A similar example from inside the house is the heavy ornamental plaster ceiling shown at the bottom. The drawing compares the most common of the safe and unsafe features of construction and design, and illustrates in addition some of the measures to be taken for the creation of a reasonably adequate basement shelter. It might also be noted that the roof garden, so enthusiastically developed by modern architects, serves admirably as a protection against incendiary bombs.

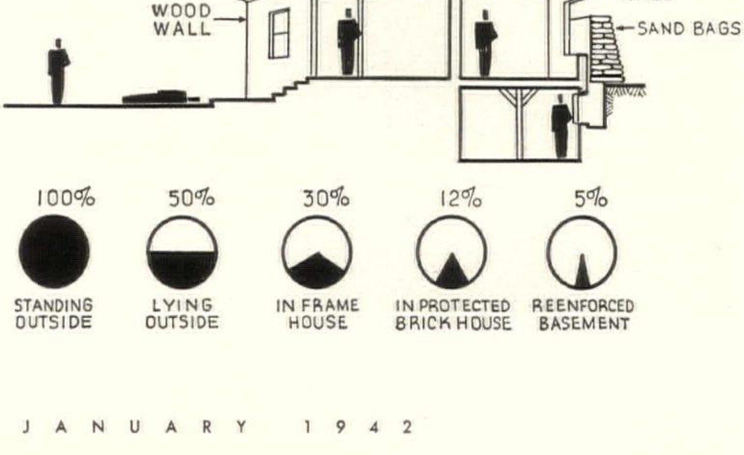
*BS*

*Pix Publishing Co.*






**RELATIVE SAFETY**




The relative safety of spaces within buildings is indicated by the diagrams. In the tall office or apartment building, obviously, the degree of safety per occupant is considerable. Nevertheless precautions against direct hits at the sides or top must be taken, and also against blast and splinters from bombs landing in the street. In practice this suggests the removal of occupants to the middle stories, with sandbags used as shown for protection of interior spaces. In smaller wall-bearing buildings and private houses, floors over the basement or first floor must be expertly strengthened with additional beams and columns, and sandbags should be used where there is danger from bomb splinters.

1. *European*

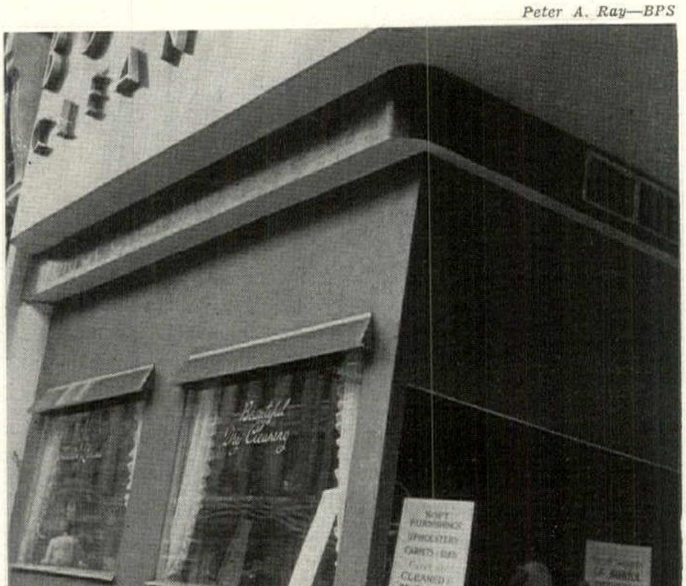
2. *B S*


3. *Pix*

*Wide World*

4.

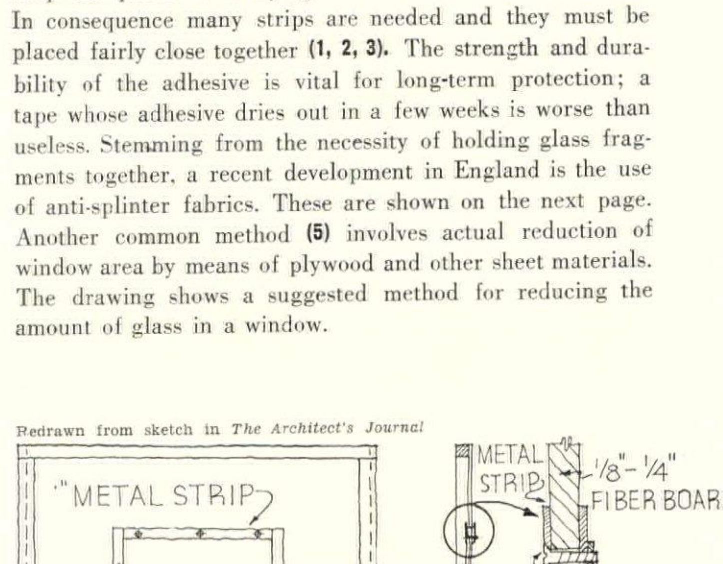
*Peter A. Ray—BPS*



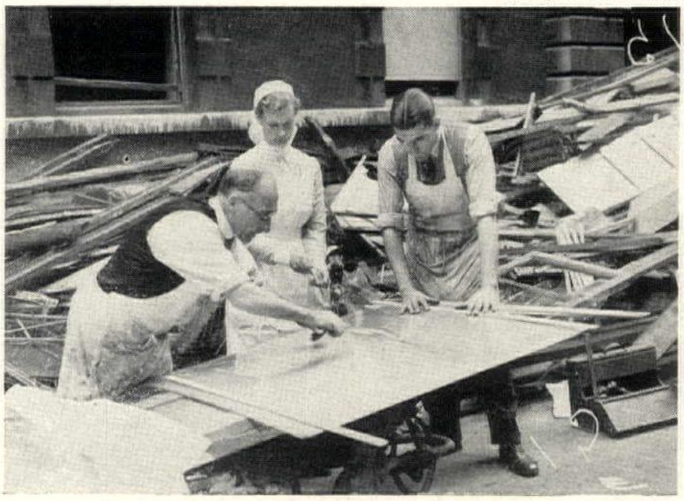
5.

Probably no glass will remain unbroken if a 500-pound high explosive bomb goes off within 50 yards; some may break 500 yards away. Moreover, there is no protective device known (beyond walling up the opening) that will increase the resistance of glass against breakage. While leaving windows open will tend to reduce the effort of the pressure and suction following a blast, it is necessary to eliminate the danger from flying glass, using one or another of the methods shown on this and the following page. A common and satisfactory method involves the use of tape—adhesive tape, friction tape or cloth-backed passepartout. While there have been a number of extremely elaborate installations, such as figure **3,** these are effective only to the extent that the glass is divided up into small areas. There is an apparently widespread notion, expressed in a recent American example **(4),** that the tape somehow reinforces the glass and that a few diagonal strips are enough to do the job. The purpose of the tape is not to keep the glass from shattering, but merely to keep the pieces from flying around after it has shattered. In consequence many strips are needed and they must be placed fairly close together **(1, 2, 3).** The strength and durability of the adhesive is vital for long-term protection; a tape whose adhesive dries out in a few weeks is worse than useless. Stemming from the necessity of holding glass fragments together, a recent development in England is the use of anti-splinter fabrics. These are shown on the next page. Another common method **(5)** involves actual reduction of window area by means of plywood and other sheet materials. The drawing shows a suggested method for reducing the amount of glass in a window.

Redrawn from sketch in *The Architect's Journal*



Photos, British Combine



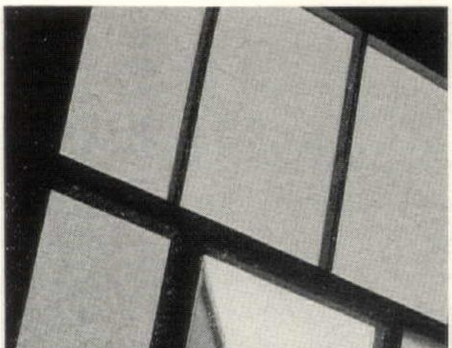
Any number of variations, obviously, is possible and their adoption depends chiefly on the means available for this type of protection. One advantage of replacing glass with hardboard is that the blackout problem is simplified at the same time. Trussing the glass, a common protection against commercial blasting, has proved to be useless against bombing. In developing a whole series of techniques to deal with glass fragments, it was soon realized that if tapes, closely spaced, were effective in this regard, fabric netting might do the job even better. Various sizes of wire mesh have also been used, ranging from chicken wire down to fly screens. When applied to a light framework inside the window these grilles have the further advantage of serving as a temporary base for protection against weather in case the glass is broken. With the increasing scarcity of metals in England—a situation now being duplicated here—experimenters turned to textiles with very satisfactory results.

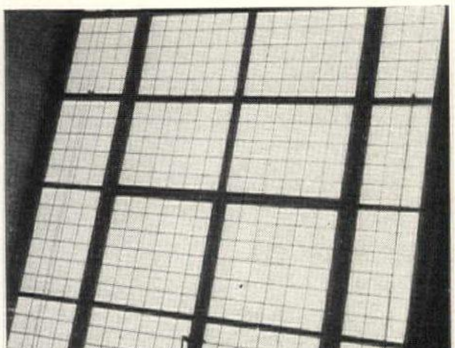
Any fabric selected should, of course, admit as much light as possible. It must be affixed to the glass with a convenient strong adhesive, such as cold water paste, flour paste or gum. If the window is exposed to hot sunshine, the admixture of five per cent of glycerine will keep the adhesive from drying out too fast. The strength of the fabric can be further increased by reinforcing the edges with adhesive tape, by tacking them to the window frames, and by varnishing the surface. Cellulose and cellulose acetate films have also been satisfactory under test. Their advantage is that light transmission and visibility are better than with fabrics. These transparent sheets may be put on the glass with an adhesive, or they may be purchased with an adhesive coating. In some instances, it may be advisable to remove the glass entirely and use the films alone (see photograph). Cellulose film, being affected by moisture, should be given a waterproofing coat of varnish or lacquer after it has been applied to the glass.

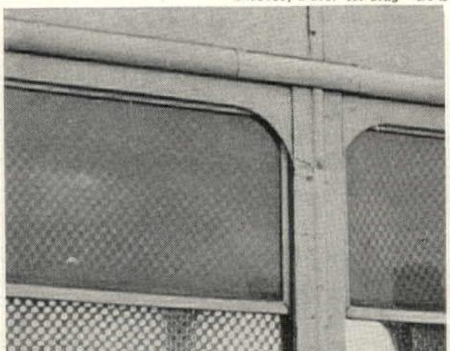
A number of liquid coatings have been placed on the market in England, with latex or synthetic resins as a base. To date none of those tested have been satisfactory, as the coatings either lack the necessary strength when fresh, or quickly dry out and become ineffective.

**In some English buildings,** notably hospitals, glass has been replaced with flexible, transparent sheets of cellulose acetate.

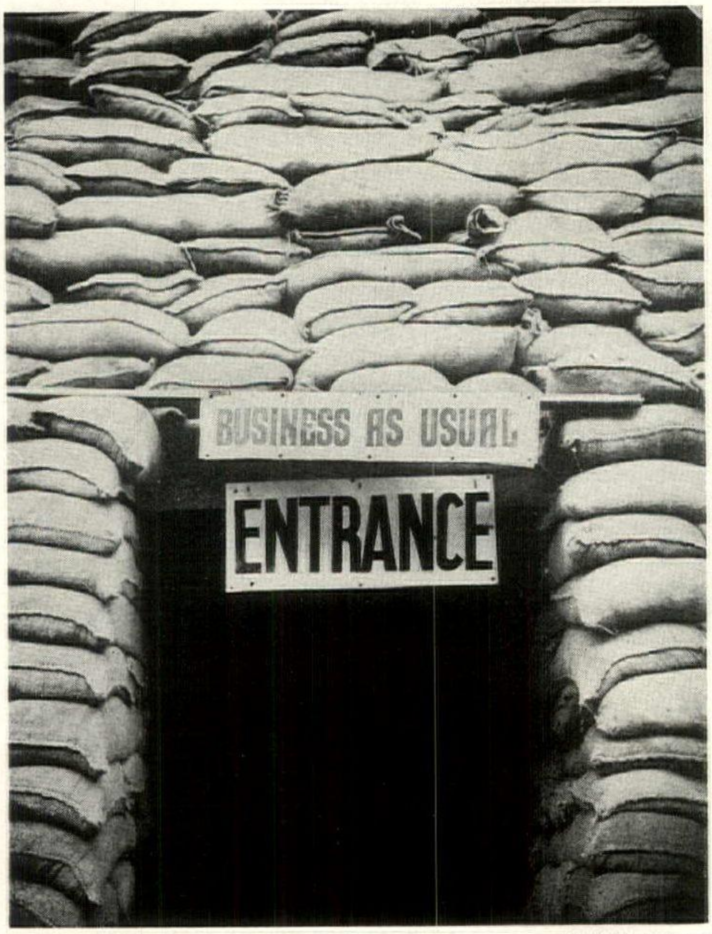
Photos, Peter A. Ray—BPS





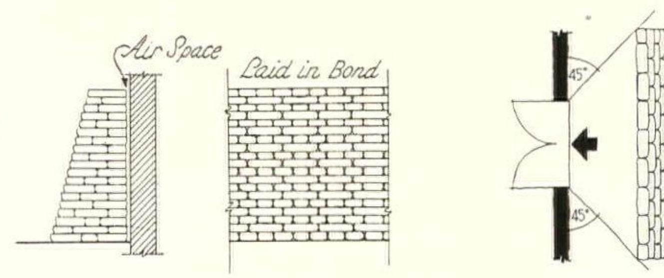


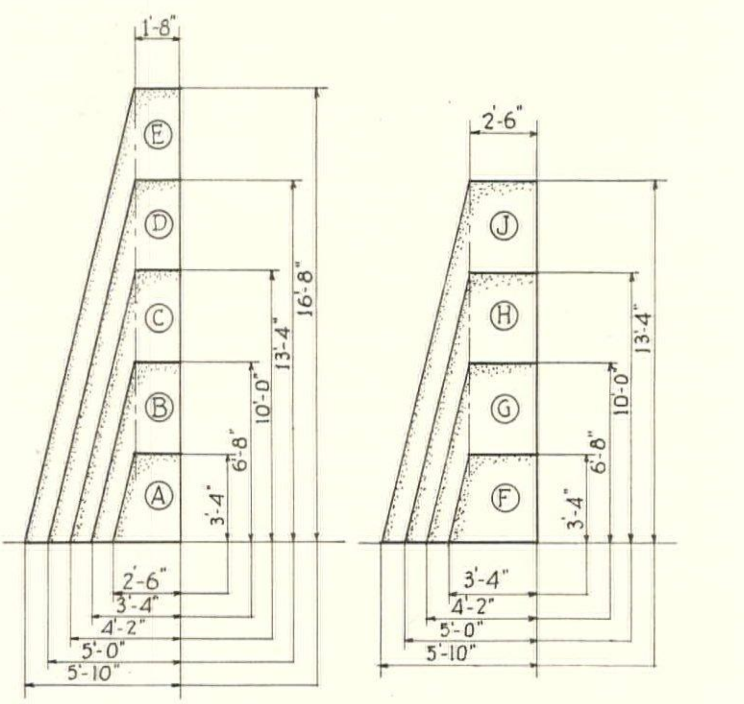
**USE OF ANTI-GLASS-FRAGMENT FABRICS**




Pix Publishing Co.

Metcalf—BS




**APPROXIMATE NUMBER OF SANDBAGS REQUIRED AND WEIGHT PER FOOT RUN OF SANDBAG REVETMENTS**

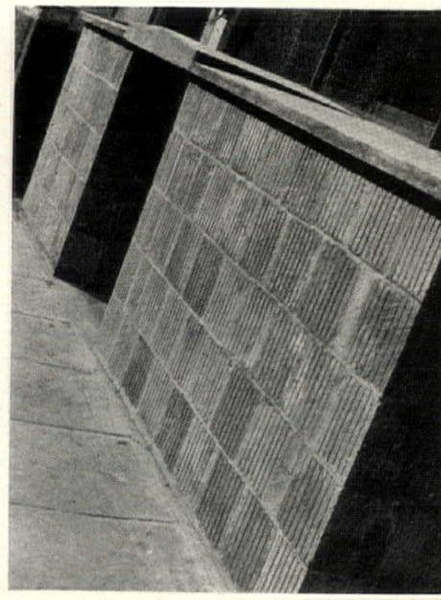
| | Thickness of Wall At Base | Thickness of Wall At Top | Height of Wall | No. of Bags Per Ft. Run | Wt. of bags Per Ft. Run-Tons |
|---|---|---|---|---|---|
| A | 2' 6" or 1½ bags | 1' 8" or 1 bags | 3' 4" | 12 | .30 |
| B | 3' 4" " 2 " | 1' 8" " 1 " | 6' 8" | 29 | .75 |
| C | 4' 2" " 2½ " | 1' 8" " 1 " | 10' 0" | 50 | 1.25 |
| D | 5' 0" " 3 " | 1' 8" " 1 " | 13' 4" | 77 | 1.95 |
| E | 5' 10" " 3½ " | 1' 8" " 1 " | 16' 8" | 108 | 2.70 |
| F | 3' 4" " 2 " | 2' 6" " 1½ " | 3' 4" | 17 | .40 |
| G | 4' 2" " 2½ " | 2' 6" " 1½ " | 6' 8" | 38 | .95 |
| H | 5' 0" " 3 " | 2' 6" " 1½ " | 10' 0" | 65 | 1.65 |
| J | 5' 10" " 3½ " | 2' 6" " 1½ " | 13' 4" | 96 | 2.40 |

For the protection of windows, entrances and other vulnerable parts of buildings, sandbags have been used more often than all other methods taken together. The reasons are obvious: materials needed are easily obtained, revetments of sandbags can be put up quickly by unskilled labor, and they can be taken down after the danger is over without damage to the structure. Nevertheless, the method has serious disadvantages which should be clearly understood. Chief of these drawbacks is the temporary nature of sandbag protection; both fabric and seams tend to rot out very quickly, requiring frequent and expensive replacements. If disintegration takes place at the bottom, which happens most often, there is a danger of sudden collapse with injury to bystanders. Stacked against a building, the bags will collect moisture, possibly damaging the interior of the building. They also form a good breeding place for vermin.

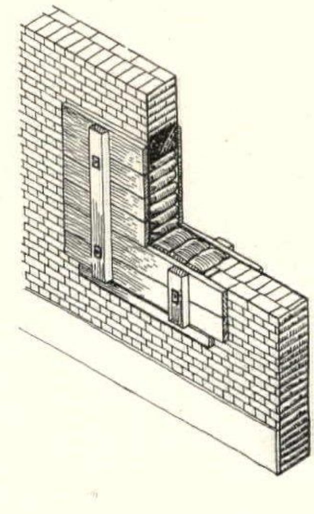
Methods of overcoming these difficulties have been developed. An air space (see diagram above) between the building, the ground and the sandbags is provided for better ventilation and drainage. In some cases preservatives are sprayed on every few months. Bags may also be protected by a tarpaulin or a sprayed cement coat, using chicken wire as reinforcing. Any covering that keeps rain and snow off the bags is a help. All of these devices, however, increase the cost of a type of protection that is not cheap to begin with. Brickwork offers more promise.

Photos, Peter A. Ray—B P S

1



2

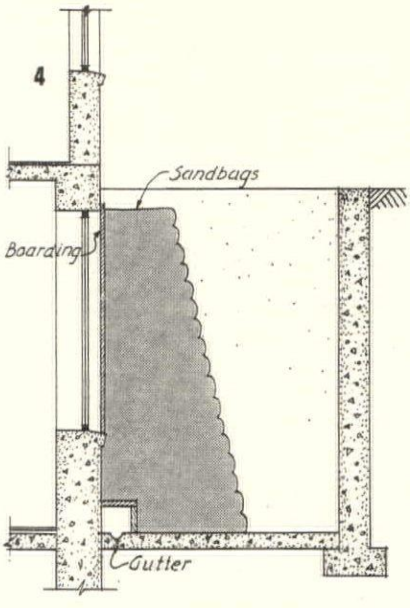


3

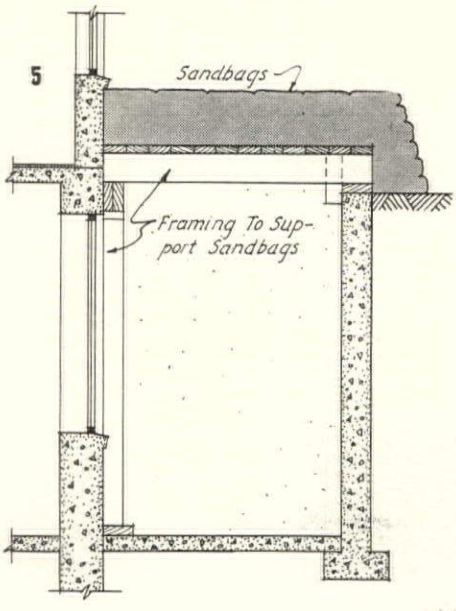
Methods of protection more permanent than sandbags include use of brick (1) and sand-filled hollow tile (2). Figure 3 shows an official British suggestion for closing a window opening with sandbags, the latter being held in place by board covers. An advantage here is the minimum of damage to the building. Drawings 4, 5 and 6 illustrate recommended British methods of protecting basement windows and roof lights. Note the drainage opening in 5 and the airspaces beneath the sandbags in the other two drawings.

Where materials and labor are available, it is advisable to consider revetments of more permanent character. Sand-filled concrete block, hollow tile (also sand-filled) and brick are materials that have stood up well under actual raid conditions. To facilitate their removal in the future, weak mortar, metal clips and a certain number of dry joints are used. Where masonry is used to close up windows, or to reduce the size of openings, it should overlap the windows by a foot on each side if possible; otherwise there is the chance that a blast will blow the masonry filler through the window and increase rather than reduce the damage. Usually employed for ground floor protection only, these masonry screens are frequently shorter than the windows, leaving an opening of about 1 ft. at the top for light and ventilation.

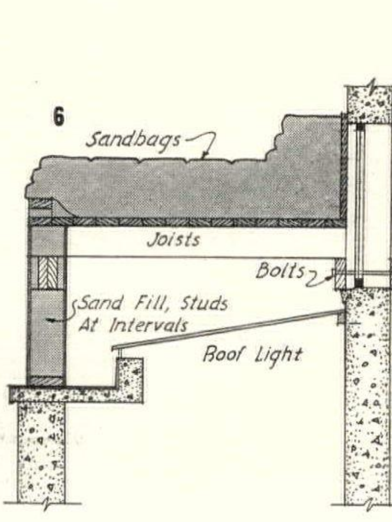
4



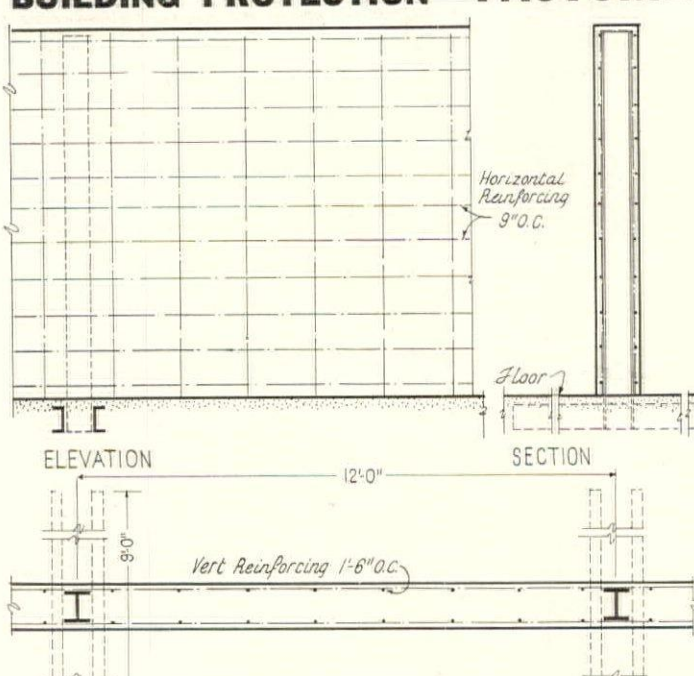

5

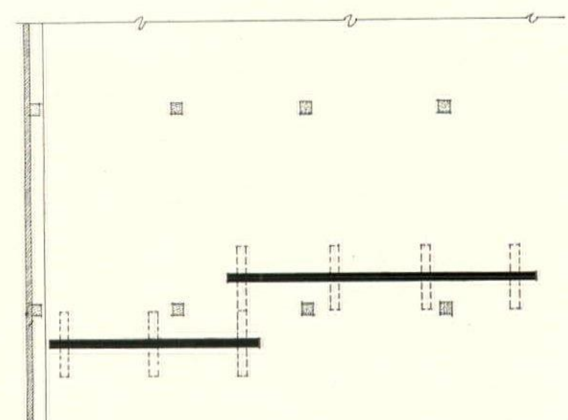



6

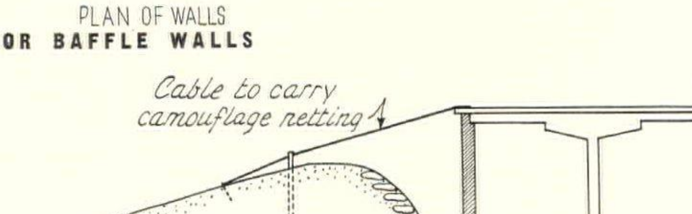


# BUILDING PROTECTION—FACTORIES

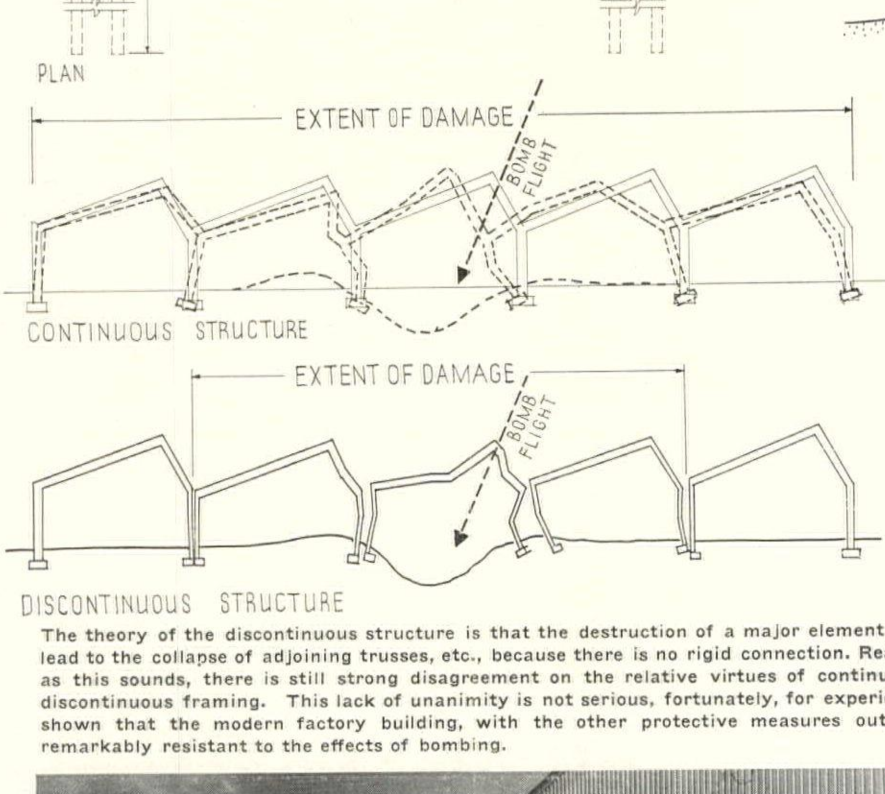



**INTERIOR BAFFLE WALLS**

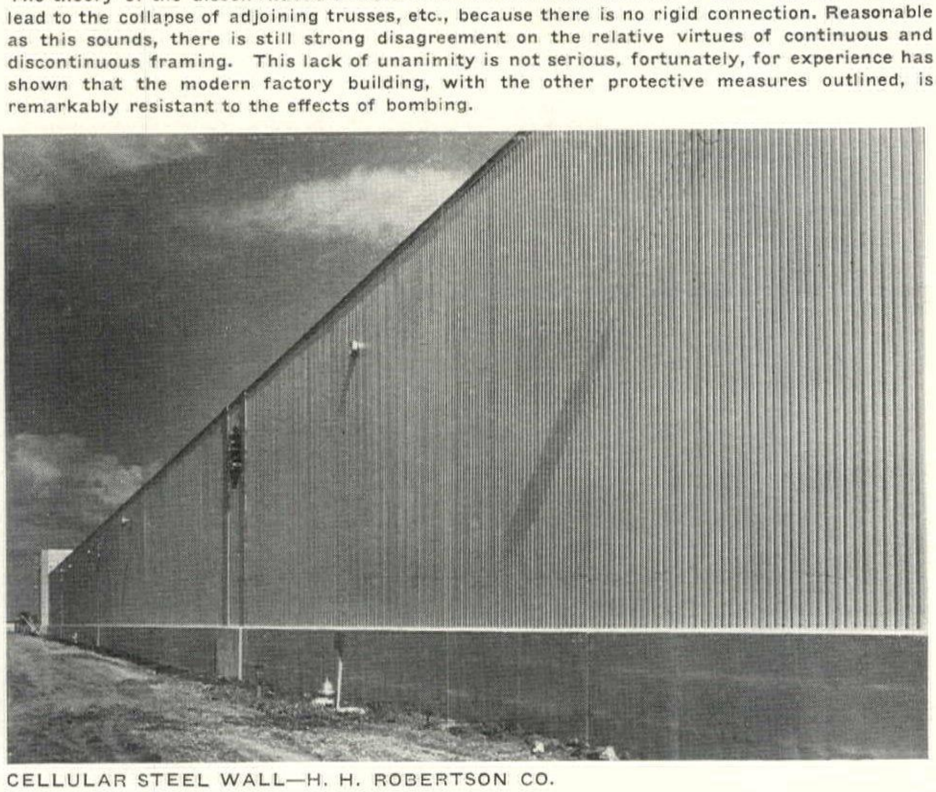



**PROTECTIVE VOID AGAINST EARTH SHOCK**

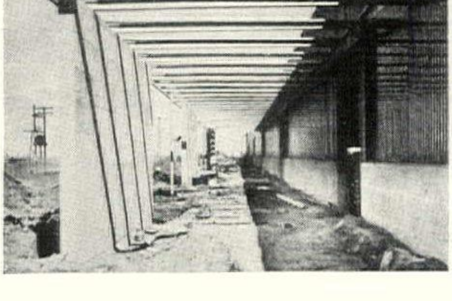



The theory of the discontinuous structure is that the destruction of a major element will not lead to the collapse of adjoining trusses, etc., because there is no rigid connection. Reasonable as this sounds, there is still strong disagreement on the relative virtues of continuous and discontinuous framing. This lack of unanimity is not serious, fortunately, for experience has shown that the modern factory building, with the other protective measures outlined, is remarkably resistant to the effects of bombing.

Protection for the factory, while it makes demands that are occasionally contradictory, is focused entirely on keeping up the flow of production. A factory must have walls capable of resisting blast and splinters, but at the same time it must have sections that blow out easily to avoid the consequences of a confined blast. Line production demands huge, uninterrupted spaces, but interior protective walls must be erected to minimize damage to men and machines. A few of the solutions for these diverse requirements are shown here. The baffle wall at the top is anchored in the floor slab to prevent overturning; it has been found that a great many of these units can be erected without impeding production. The drawing of the earth embankment shows a practical device for avoiding the worst effects of blast, splinters and earth shock; this scheme also materially simplifies the problem of camouflage. The photographs illustrate a "combination" scheme that has worked very well in practice: the concrete wall is high enough to protect men and machines from explosions outside, while the unit steel wall panels are light enough to blow out after a direct hit without pulling down the structural framework. Blast walls protect each entrance to the plant.



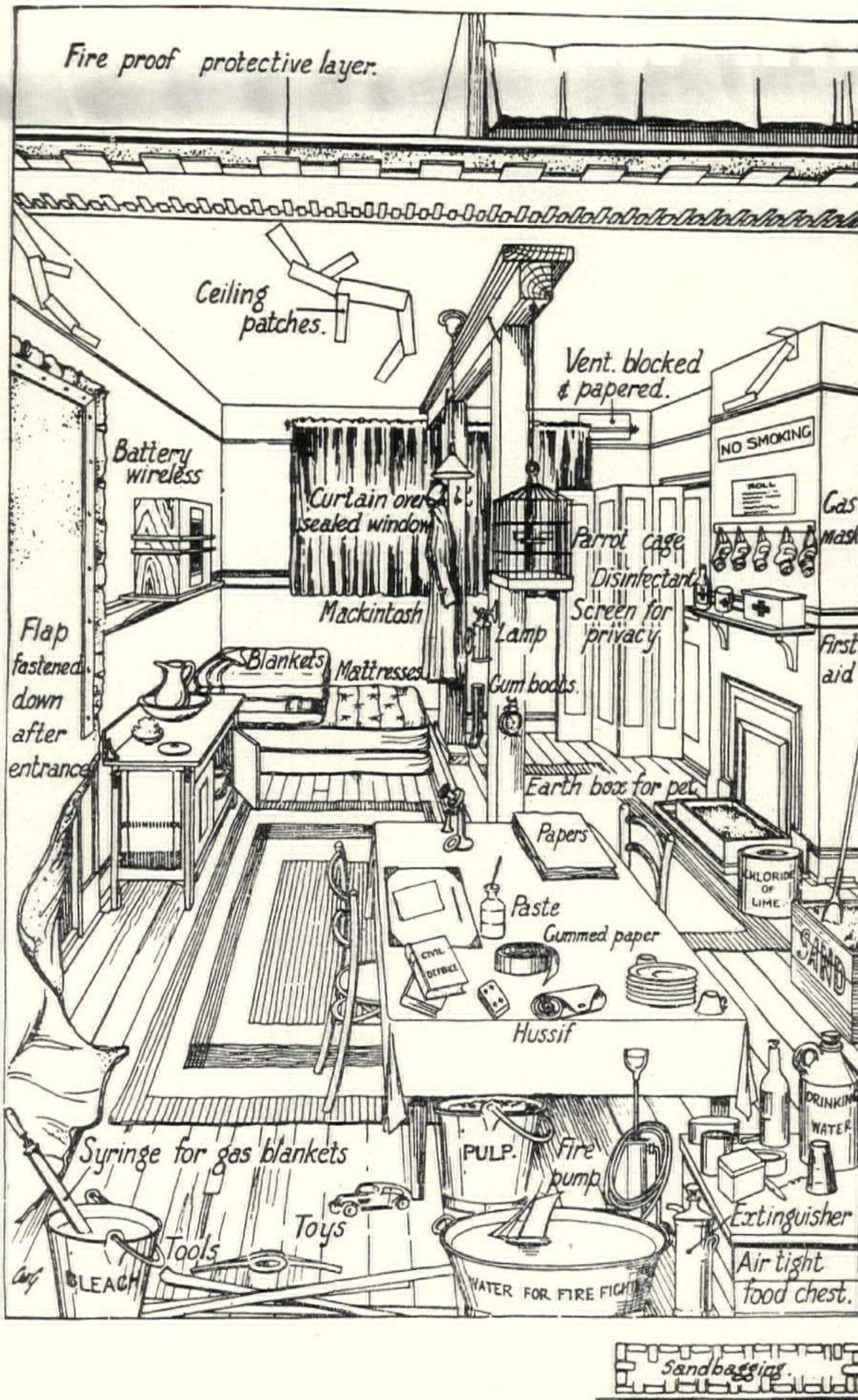
CELLULAR STEEL WALL—H. H. ROBERTSON CO.

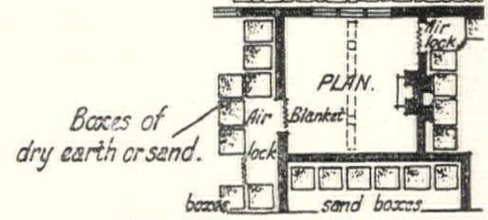


It took very few air raids before the one glaring inadequacy of the Anderson shelter became apparent to its users in England. Conceived as protection against short-time raids, this bent sheet of corrugated iron, while safe enough from blast and splinters when properly covered with earth or sandbags, offered nothing better than sleeping quarters half underground, damp and chilly in good weather and uninhabitable when it rained. While his experience led to increased demands for better public shelters, it simultaneously developed techniques for the creation of shelters inside homes, at least as safe as the Anderson and far more comfortable.

The English drawing, cartoon-like in its comprehensive coverage of the subject, shows a composite of the most common protective measures. The room (see plan) is surrounded with sandbags or boxes of dry earth, and has been made safe from gas by an air lock, sealed door and windows, and ceiling patches. A half-hearted effort has been made to shore up the ceiling. There is water and sand for fire fighting, an air tight food chest, a supply of chemicals for gas, pulp and gummed paper for sealing cracks, etc. As a design for staying alive it may still look strange to us, but it is a far from exaggerated picture of an ordinary family shelter in England.

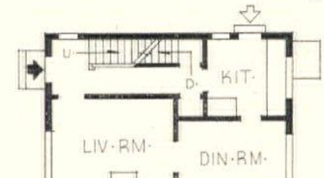
The drawings below present a possible solution for an average small house. Here a portion of the basement has been converted with a heavily reenforced ceiling, shoring, and an air lock. There is a new fireproof slab on the attic floor. As in all shelters, the emergency exit is mandatory. To accomplish its purpose, shoring must be designed and built with skill. More Britishers have been killed by the collapse of poorly strutted basements than by any other single type of shelter failure.





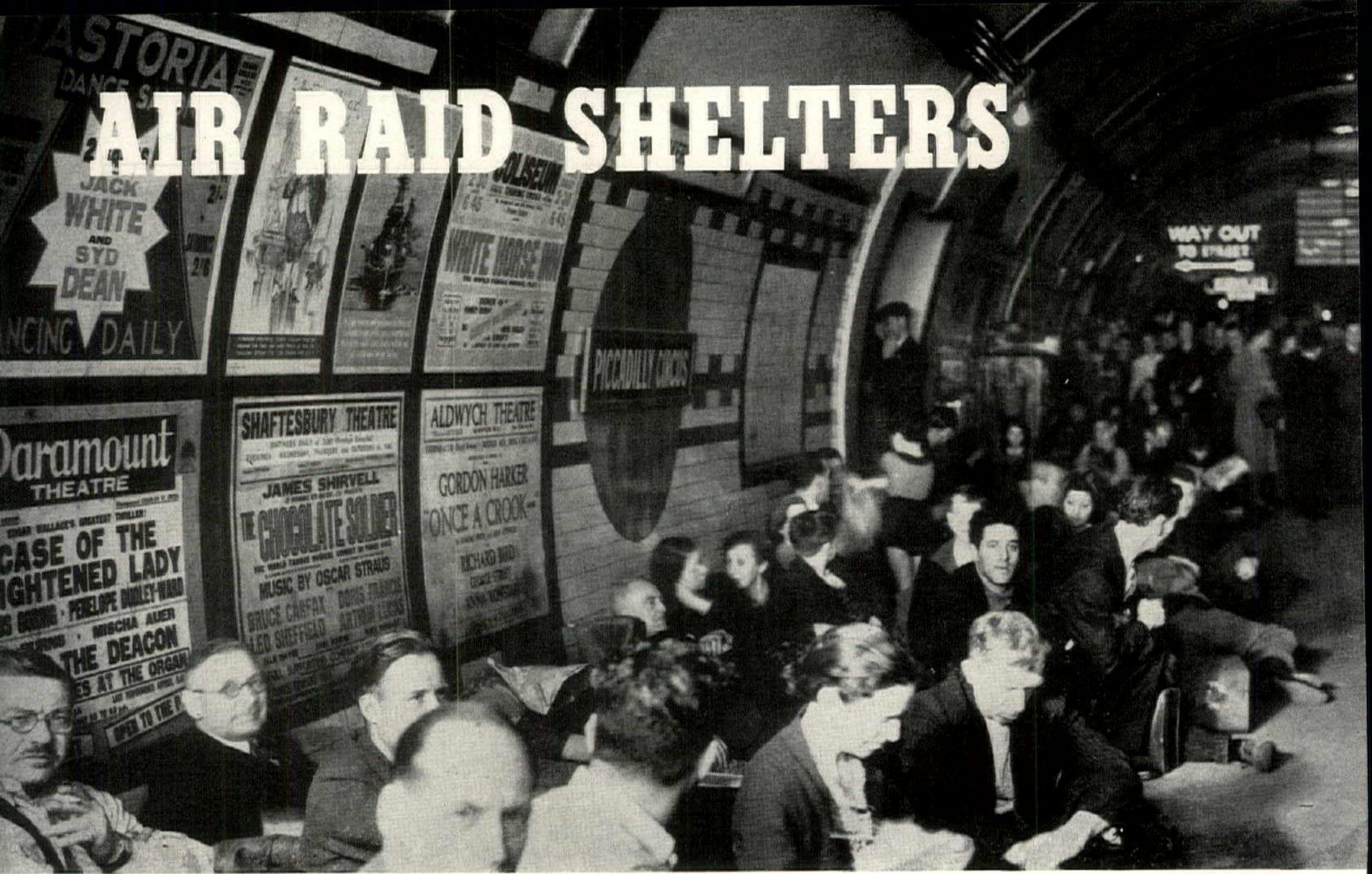
SECTION A-A




FIRST FLOOR

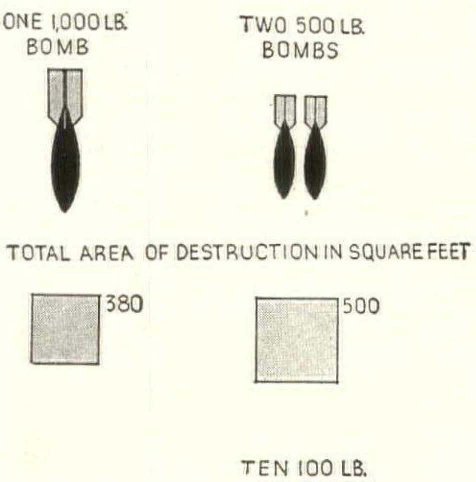

BASEMENT

# AIR RAID SHELTERS




LONDON SUBWAY, SEPTEMBER 1940

*British Combine*




**Relative "inefficiency"** of large-size bombs renders their use unlikely except against targets of first-rate military importance. Area-bombardment, prime danger to civil population, usually involves medium-weight and light bombs.

First reaction to the prospect of aerial bombardment, real or imagined, is a desire for shelter—protective cover from the death that rains from the sky. Natural enough, this instinct is also a sound one. Protection even so rudimentary as that afforded by the masonry jambs of a building entrance can reduce the probability of injury from scattered bombs by 60 percent as compared with complete exposure. Inside most masonry buildings the danger is still less, while some man-made and natural structures reduce it to the vanishing point. Technically, it is quite feasible to create shelters that are proof against the heaviest bomb an airplane can conceivably carry: a room contained in a concrete box with walls 20 ft. thick would probably meet this specification, as might any habitable space 100 ft. or more underground. To provide protection against direct hits by most bombs now in use, a reenforced concrete structure with walls and roof 5 or 6 ft. thick, or a tunnel, cave, or mine at least 60 ft. below ground is sufficient.

The target of aerial bombardment, however—even bombardment directed against the civil population—is not the individual; it is the community. The aim is not so much to kill off the civil population as it is to disrupt civilian life, hamper production of war materials, and dampen morale—with the ultimate object of weakening the armed forces. Since an ill-advised, time-taking program of extensive shelter construction might accomplish these objectives more surely than enemy bombs, the question of passive air raid protection is not so much what is technically possible as what is desirable from a social and military point of view. What is required is not maximum protection for the individual citizen (who remains relatively safe in any event), but maximum protection for the *functioning community;* not a "holing-up" that brings civil life to a standstill, but a policy which insures maximum production of war materials and maintenance of civilian morale at the highest possible level.

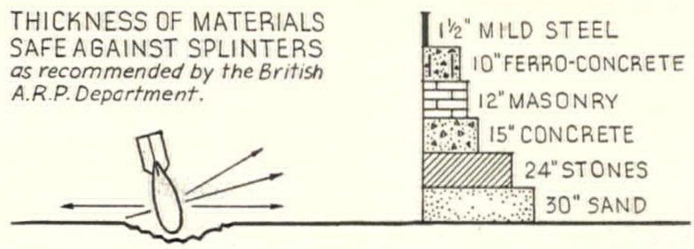
British experience at the height of the blitz has shown that the incidence of civilian casualties due to air raids is not high. Fatalities peaked at about 1.5 per hundred population in the extremely intensive raids on Coventry, while the total to date among Britain's 46 million largely-urban inhabitants has not equaled U. S. fatalities due to automobile accidents during the same period. In view of these figures, the tremendous effort which would have been necessary to house the entire urban population in completely bombproof shelters, as was sometimes proposed, was obviously not so warranted as the expenditure of an equivalent amount of time and money on anti-aircraft, pursuit planes and bombers to carry the war into enemy territory. Indeed, there is much to be said for the argument that the best possible air raid shelter is the so-called "steel ceiling" of intense anti-aircraft fire.

Nevertheless, passive protection against bombing has an important place in civilian defense, and building professionals, and the building industry generally, an important part in providing it. In the event of actual raids on the continental U. S., mass psychology, if nothing else, will compel the construction of shelters in one form or another. Point is, that the *degree* and *extent* of protection to be provided for the civilian at home, at work, and in the streets may best be determined by governmental and military authorities; the designer and builder will have his hands full and will perform an essential function if he concentrates on seeing that whatever plans are adopted are properly carried out.

Despite controversies over bombproof versus splinterproof shelters and communal versus individual types, the big lesson of British experience lies not in the answers to these questions but in the importance of convenience and comfort in shelters of all types. The British public, in its overwhelming majority, has shown itself willing to risk direct hits in shelters that offer reasonable protection against blast and splinters, but unprepared to risk colds in the head from nights spent in shelters with several inches of water on the floor. Shelter designs based on the assumption of occasional use for short periods proved woefully inadequate for repeated overnight occupancy: by and large, they kept out the bombs, but failed to keep out the weather. Leaky roofs, bad air, and lack of sanitary facilities became a more serious menace than high explosives. Epidemics were narrowly averted. Sheltering, according to the ARP chief of Birmingham, became "a case of bombs versus germs," with the germs the greater danger.

The U. S. shelter problem, should any arise, will obviously not parallel Britain's in every respect. Shelter design depends upon a complex of factors, including the length of the warning period before a raid, the density of population, the intensity of bombardment, available building materials, and so on, all of which vary considerably between the two countries. It is doubtful whether any country not almost conquered will ever again be subjected to the type of raids which England withstood in the winter of 1940-41, since the democracies are now better prepared for active resistance to aerial attack and will certainly remain so as long as the threat of attack exists. Other factors, such as the size of the U. S., its distance from the nearest possible land bases for enemy planes, and its probable immunity from successful invasion render the possibility of frequent and prolonged bombardment extremely remote. U. S. shelters, if any are found necessary, may be used only for brief periods and at long intervals—a fact which would certainly influence their design. British experience constitutes a valuable basis for an approach to the shelter problem, but it should never be assumed that all of the difficulties encountered abroad will automatically arise here; our problem, if indeed we are to have one, should be somewhat easier to solve.

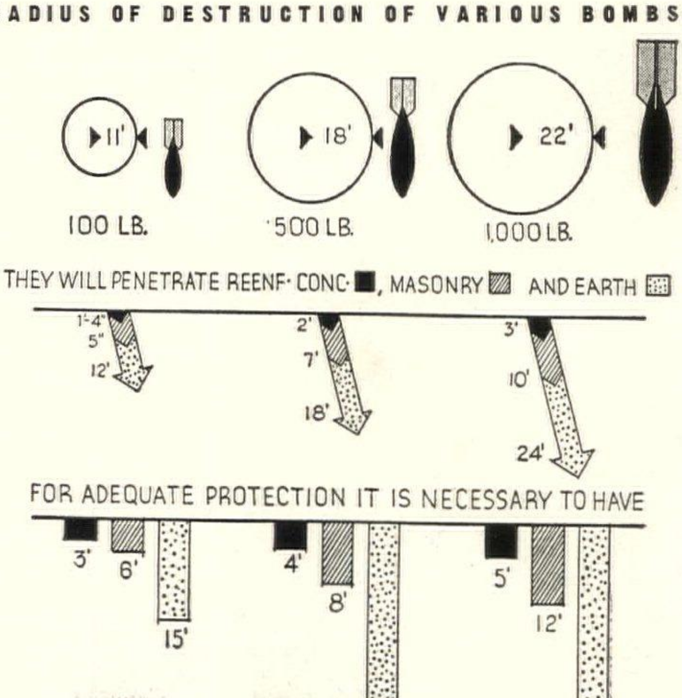
Based on thorough investigation and research of all data available, there have been evolved two shelters which appear to provide the most economical and feasible means for the protection of the U. S. civilian population. The first is an indoor table shelter designed for home use in a protected "refuge room" to withstand debris loads and to be home-made at a cost of about $50 (see p. 51). The second is an outdoor group shelter for 24 persons—a reenforced concrete box which may be erected on contract for about $1,800 (see p. 53).




**With reference to the chart above, 12 in. of ordinary reenforced concrete or 13½ in. of reenforced brickwork are generally recommended for U. S. use.**

**While the penetration data presented below are authoritative, all statistics of this type are subject to constant revision. Before using them, reference should be made to OCD's Technical Committee for the latest information.**

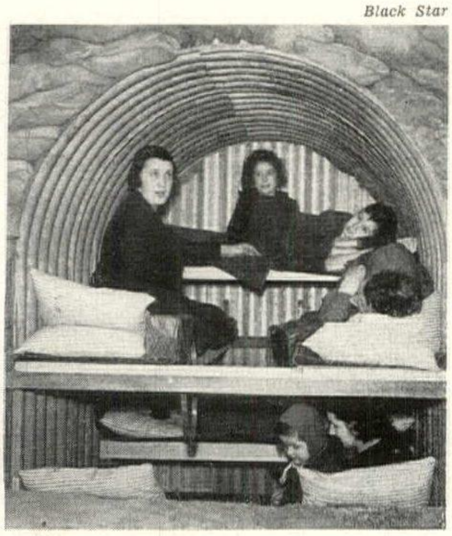
**RADIUS OF DESTRUCTION OF VARIOUS BOMBS**



# AIR RAID SHELTERS—FAMILY TYPE

*British Combine*

*Black Star*



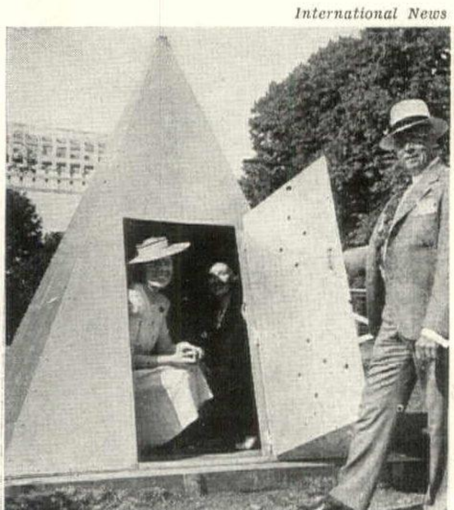
**Anderson, metal and earth shelters,** designed to resist splinters, blast and earth shock, withstood the blitz but not the weather. Intended for sitting purposes, they were ill-adapted for sleeping because of their small size and arched roofs, although the demonstration set-up (left) proved that they would accommodate 6 sleepers on various levels.

Backbone of British shelter policy has been the individual family shelter. By January, 1941, Greater London had almost 600,000 Anderson shelters (above and left), with a theoretical capacity of more than 3 million and an actual "population" of 1¼ million users, as compared with the 368 thousand then using public shelters and an equal number in tube stations and private group shelters. Big arguments for the family-type shelter are its immediate accessibility and the fact that it keeps the bulk of the population at home, off the streets, and dispersed (an advantage both from the standpoint of danger from bombs and of danger from epidemics). Still another claim is its low cost, but this is countered by advocates of group shelter with the argument that properly equipped unit shelters cost as much, if not more, than the communal type. The Anderson has been criticised from all sides, not because it fails to keep out bomb splinters and protect against blast and earth shock—which it does remarkably well—but because it is damp, cramped, and badly shaped for sleeping purposes. Designed in the expectation of brief, occasional raids rather than continuous, night-after-night bombardment, it has no provision for drainage, gasproofing, or ventilation. Shelters were half-buried and covered with earth, doorways protected against blast by embankments or building walls.

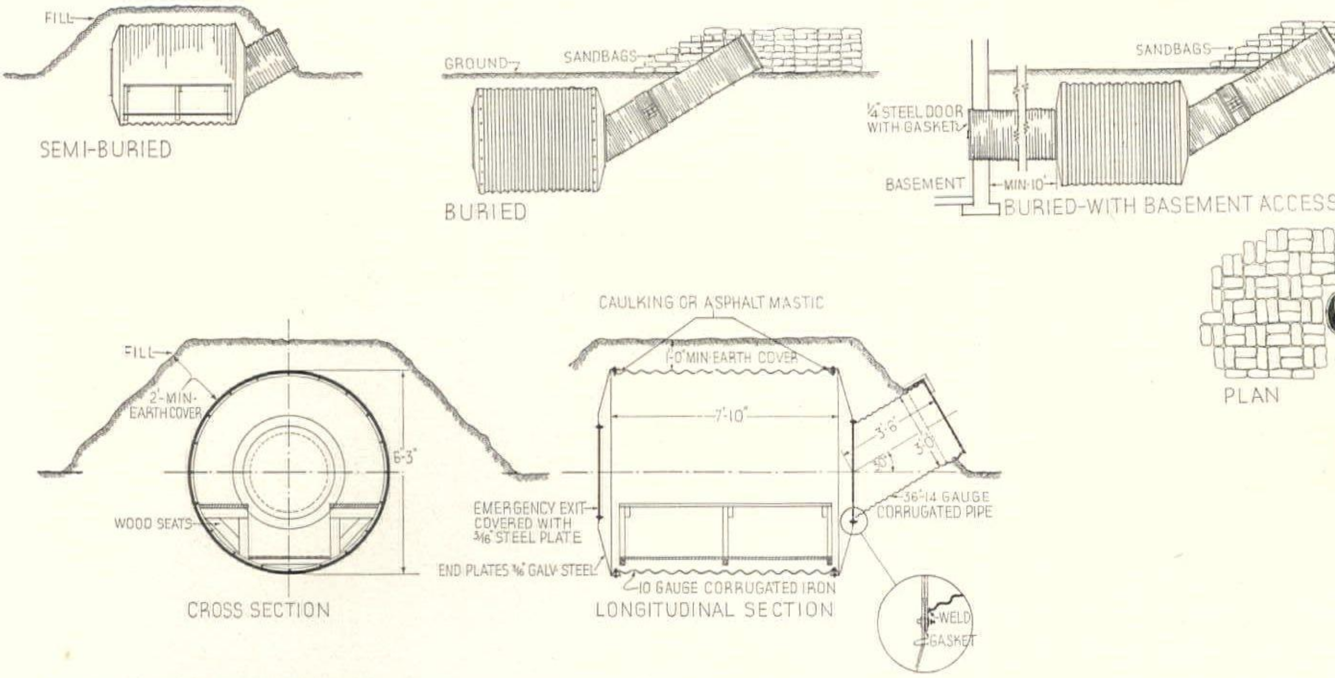
Surface type family shelters were also constructed in brick and reenforced concrete where soil conditions rendered the Anderson type unsuitable. Such shelters were not as safe against blast as the semi-buried type, unless built with heavy walls.

Shelters have progressed through three development stages in England: 1) at first neither their roofs nor walls were tied down, and parted when subjected to near-by explosion; 2) performance improved when the roof was secured to the walls and the walls to the earth; 3) still better results were obtained when the shelter was built as a reenforced brick or concrete box with all faces bonded together but not anchored to the earth. Thus was developed a reenforced masonry shelter that boasts the flexibility of the Anderson type and will be shifted, not destroyed, by a near miss.

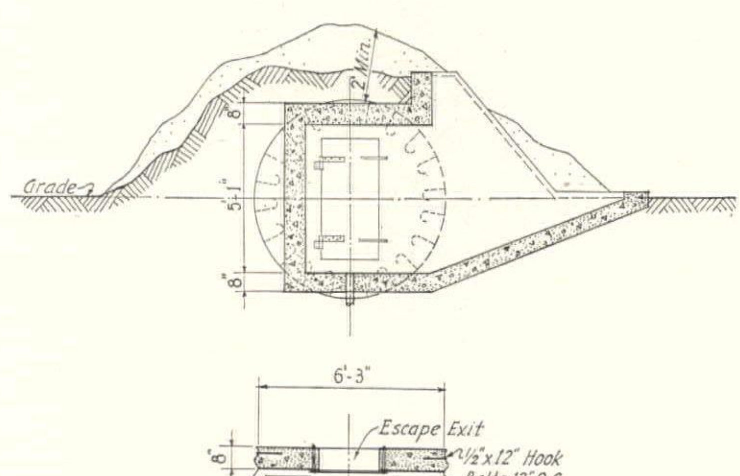
*International News*



**American version of the metal shelter** (left) has most of the disadvantages of the Anderson and none of its virtues. Rigid, triangular shape is not only awkward, it would not "give" when subjected to shock; metal walls would need to be 1½ in. thick if not protected by earth cover, metal door might become a lethal missile if subjected to blast.




**Tested by the Corps of Engineers,** U. S. Army, this type of corrugated iron, 6-person shelter is stronger than the Anderson, and considerably more watertight. While somewhat difficult to get in and out of, it does afford considerable protection against blast, earth shock and splinters at very low cost (approx. $250). Semi-buried type would probably provide greatest protection and be easiest to build, should have embankment or sandbagging to protect entrance. Underground installations are not recommended. Drainage and ventilation would be desirable additions.

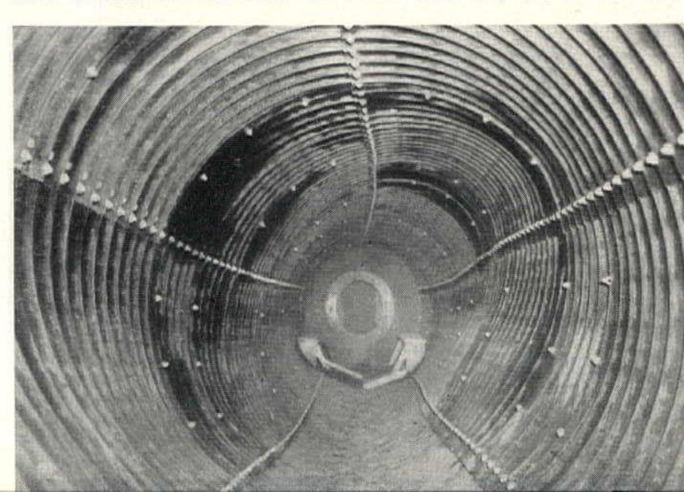



**More costly ($400) version** of the corrugated iron shelter shown above has concrete ends and entrance ramp. Note that emergency exits are provided in all cases. Pictures at right show results of test of a similar, 50-person shelter where a 600 lb. bomb exploded at 15 ft. Although earth cover was blown away (2) and corrugated tube was distorted (3) occupants would probably have sustained no injury other than minor bruises. Greatest advantage of this type of shelter is its flexibility, which enables it to withstand earth shocks which might destroy more rigid structures.

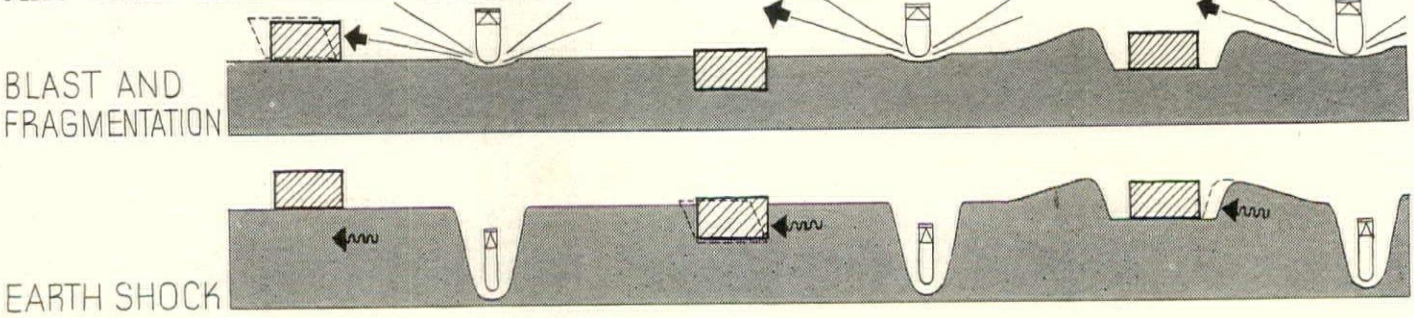
1

2

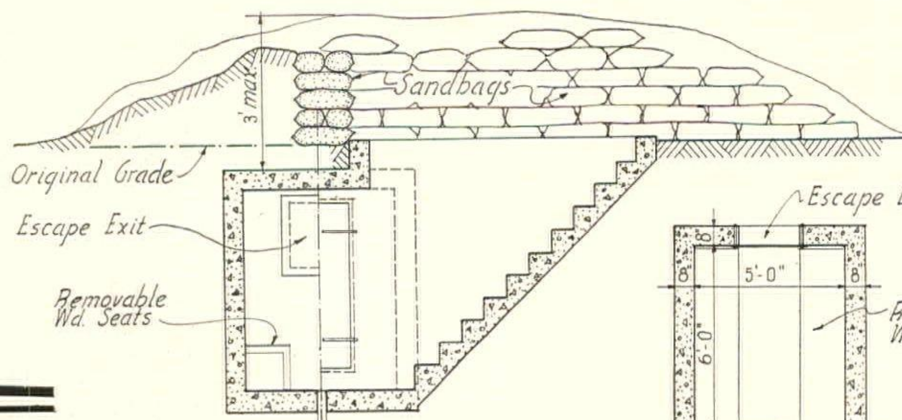
3

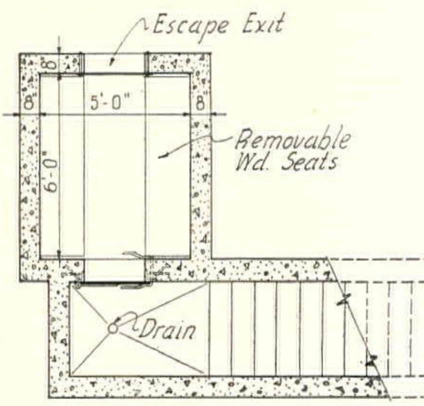


# AIR RAID SHELTERS—FAMILY TYPE

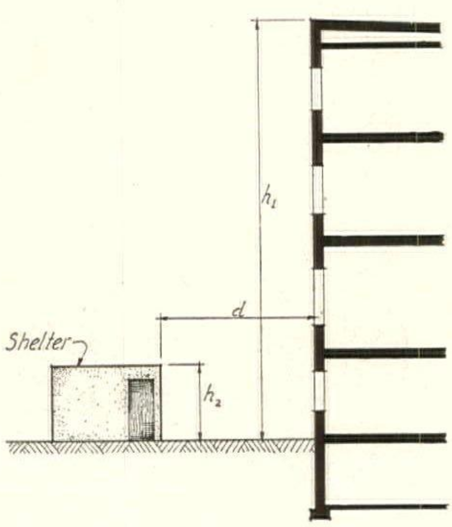



**Advantages and disadvantages** of surface, buried and semi-buried shelters (above). Semi-buried type with surrounding "moat" is shown to provide the most economical resistance to bombs, since it is vulnerable neither to blast or splinters, as is the surface shelter, nor to earth shock like the buried type. Main factor in shelter location, however, is shown by British experience to be natural drainage, difficult in both buried and semi-buried types.

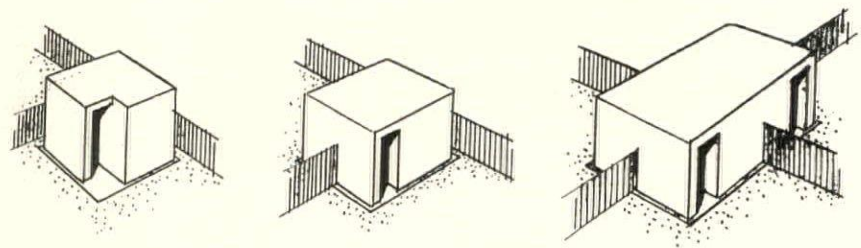


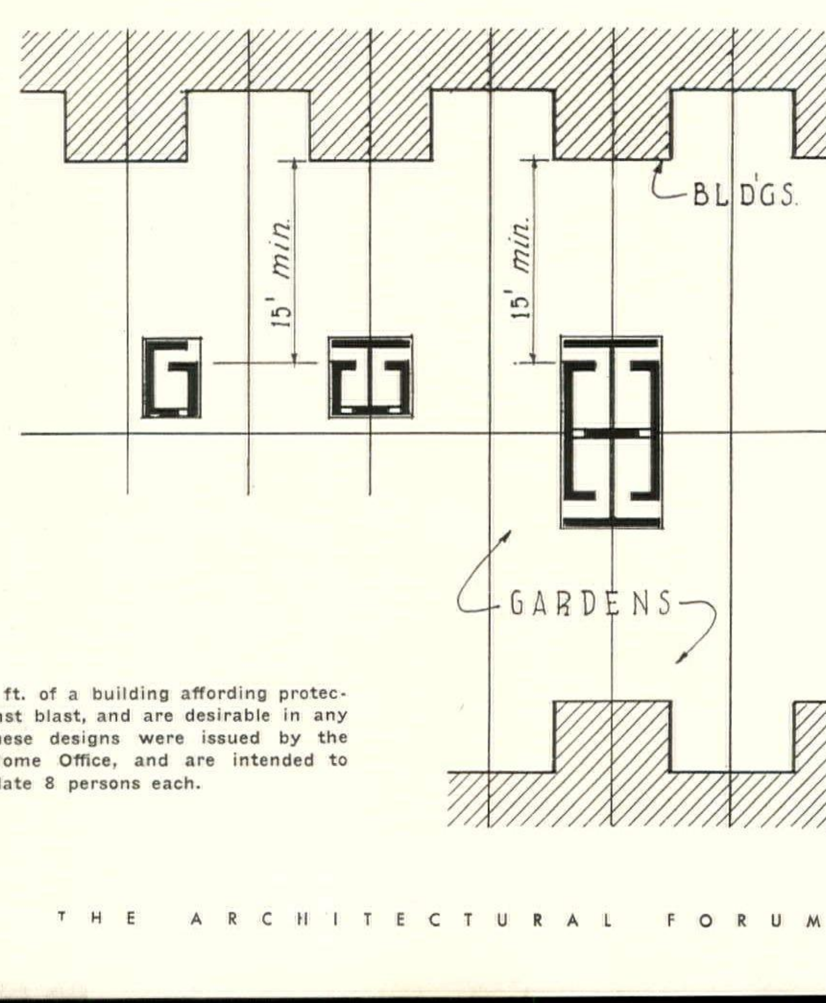



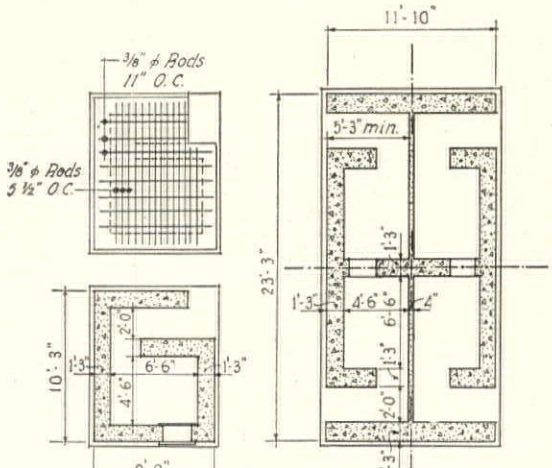

**Buried, 6-person splinterproof shelter** in concrete was tested by the U. S. Corps of Engineers; approximate cost $750. Access by concrete stairway, with emergency opening at opposite end. This shelter successfully withstood a test explosion of a 300 lb. bomb at 10 ft. from the shelter.




**Surface shelters** should be placed at least as far from the building as the distance "d" given by the formula (diagram above): $d = .465\ (h_1 - h_2)$.

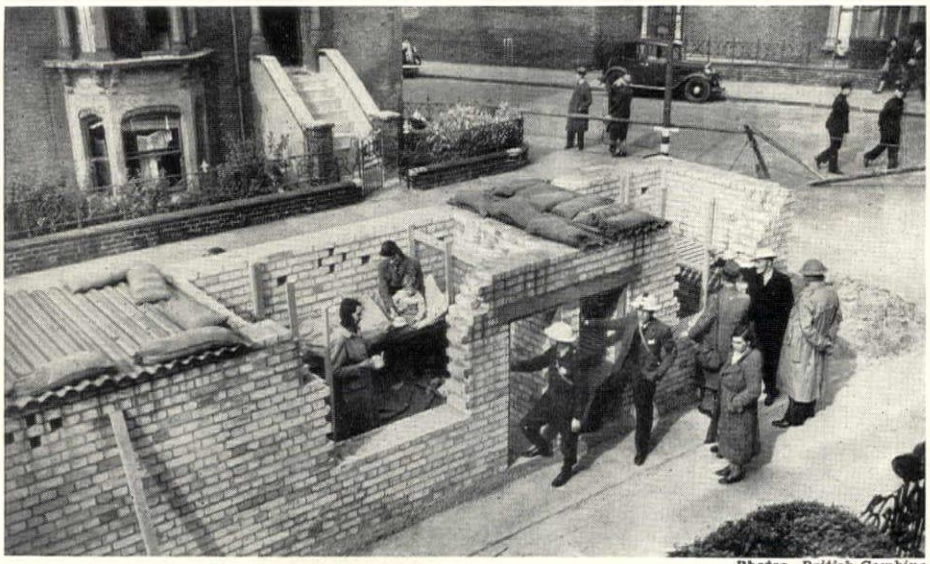


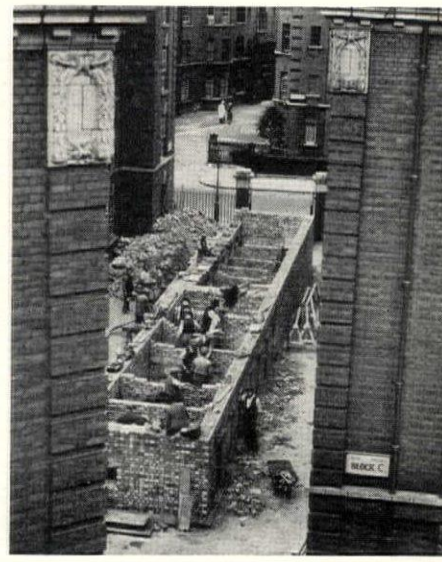



**British, surface-type splinterproof** shelters in reenforced concrete, for 1, 2, and 4 families. Surface shelters have the advantage of easier access, and can more readily be kept dry and comfortable. Baffle walls are required in front of the entrance unless the shelter is within 15 ft. of a building affording protection against blast, and are desirable in any event. These designs were issued by the British Home Office, and are intended to accommodate 8 persons each.

# STREET SHELTERS

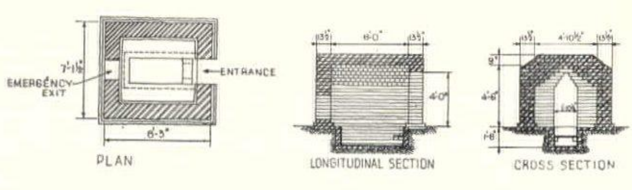


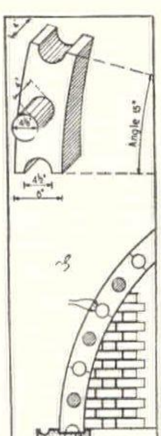


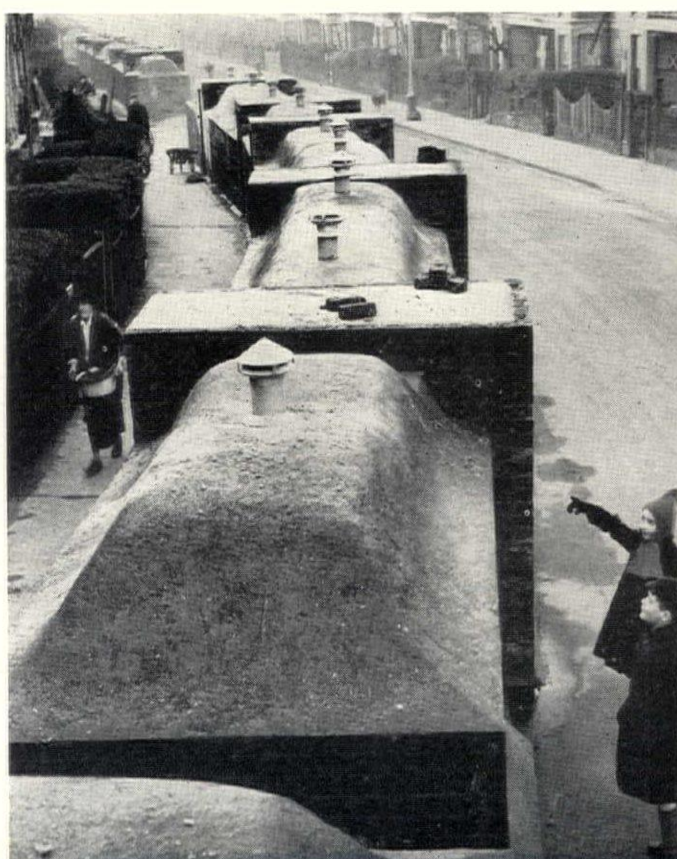
*Photos, British Combine*

Following a flurry of construction of strutted and earth-covered trench shelters in the parks, a practice abandoned along with Chamberlain's "peace in our time", a considerable number of public shelters were built in the streets of London's congested districts. Intended only for sitting, their all-night use proved dangerously insanitary, and the structures themselves leaky and damp. Later street shelters took the form of those on this page, which are divided into cubicles for individual family use, and bear about the same relation to the backyard type as the row house bears to its freestanding counterpart. As such, they save space, are cheaper to build, and should be easier to heat and light than unit shelters. Favored material is now reenforced brick, which seems to have greater resistance to blast and splinters than concrete, and saves metal. Because they require little or no reenforcement, self-centering concrete arch units have been used to conserve strategic materials. However, they should not be used in the manner shown in the shelter below, which is much too large and flimsy to provide much protection against blast.

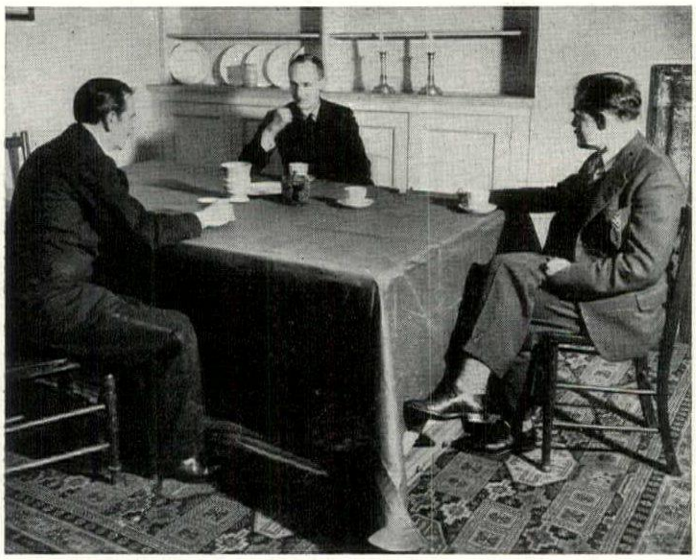
**Row-type, family shelters** in brick are built on the streets in congested districts to save space and reduce cost. Their construction also entails less fuss than the backyard type, and does not destroy garden space. Some of these early shelters, fitted with ventilating flues (below), employed corbelled brick roofs covered with cement to conserve strategic materials. Shelter above withstood shock of debris from nearby hit. Later, more successful shelters were built of reenforced brick or concrete.



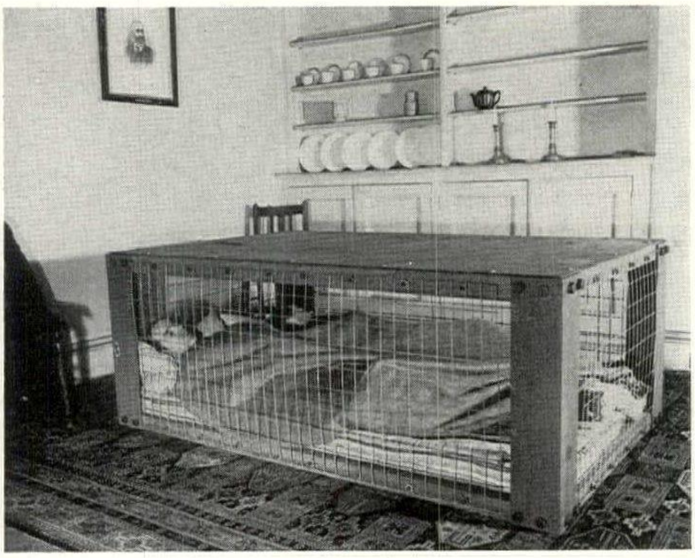





# AIR RAID SHELTERS—INDOOR TYPE

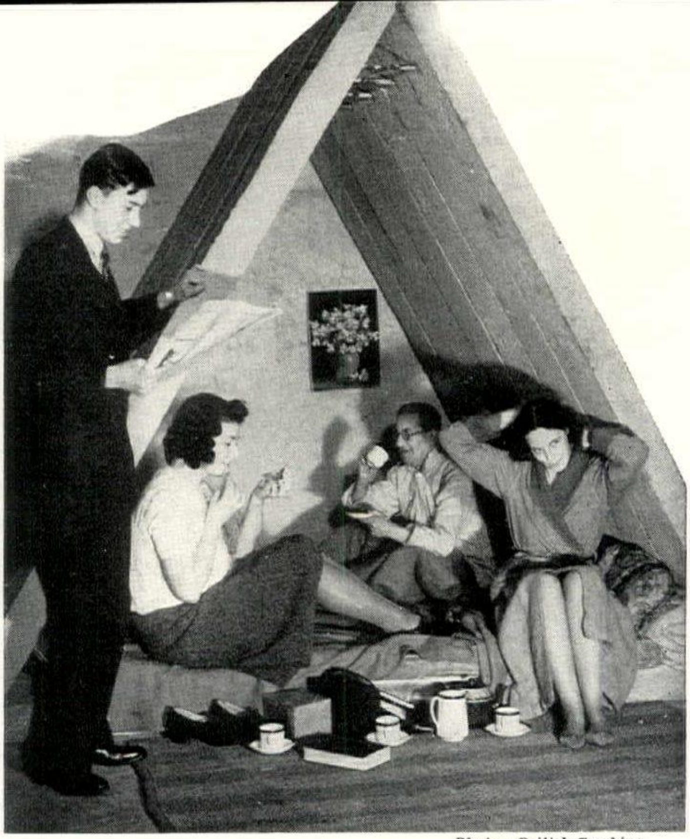


**All steel, Morrison shelter** named for Herbert Morrison, who replaced Sir John Anderson as Minister of Home Security, is designed to resist falling debris in a sandbagged "refuge room." Termed a "table shelter" by courtesy, it measures about 4 by 7 ft.

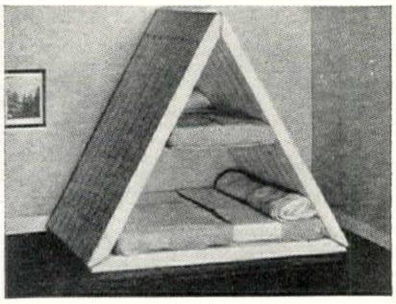


**At night,** the shelter accommodates 2 adults and 1 child. Mesh screens exclude falling debris; heavy objects which might be thrown about violently by blast should not be kept in the room in which the shelter is placed, and heavy furniture should be removed from the floor above.

**Morrison shelter after collapse** of surrounding construction (debris has been cleared away to show condition of shelter). Shelters are designed to support the weight of one or two stories of overhead construction, should never be set on wood joist floors like that in the photograph unless supported by expertly designed shoring.



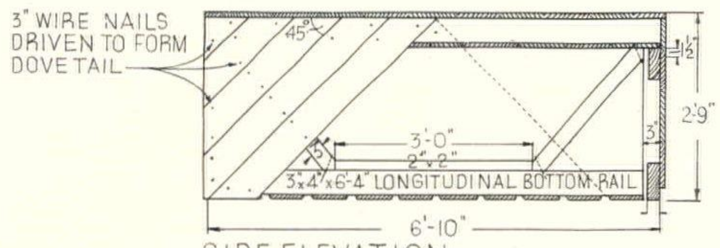
*Photos, British Combine*



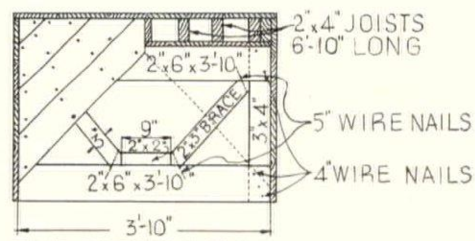
**Concrete version** of the indoor shelter, prefabricated in sections. Somewhat larger than the Morrison, it provides sleeping space for 2 adults and 2 children. Side strips are bolted together at corners; one end may be bricked-up for blast protection, other end faced to blast-proof wall, such as masonry party wall. (It is not known to have received official blessing.)

After a winter spent in the backyard, British civilians have shown themselves more than ready to accept the idea of indoor shelter, or "shelter at home," now being pushed by the Ministry of Home Security. Indoor shelters escape the discomforts of outdoor shelters by combining the resources of the dwelling and a special device; the dwelling furnishes the protection against blast and splinters, but since these may bring the dwelling itself down on the occupants, the table is needed to protect against debris. To be a safe combination, the walls of the dwelling between the table and the outside must be splinter proof; also there must be no hollow spaces, such as cellars, beneath the table into which it may fall; the level of the table must be below window sills, it must stand in the middle of a room so that the full impact of a wall will not be forced on it; the total debris load must be at most only that accumulated by two conventional stories, and should not be increased by heavy furniture above. The device is less adaptable for American dwellings for at least two reasons: 1) the low penetration resistance of wood-frame walls 2) the ubiquitous American cellar. In most houses the table shelter must therefore be located in the cellar where the splinter resistance will be high, but where the debris load and the difficulties of digging out are increased. None-the-less the table shelter may well prove the most practical device for the suburban householder.

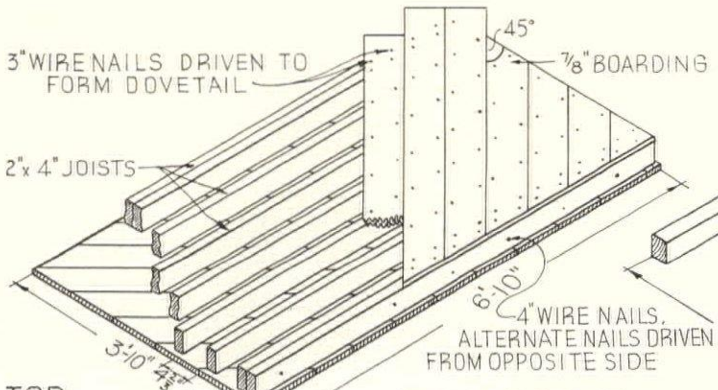
# TABLE SHELTER



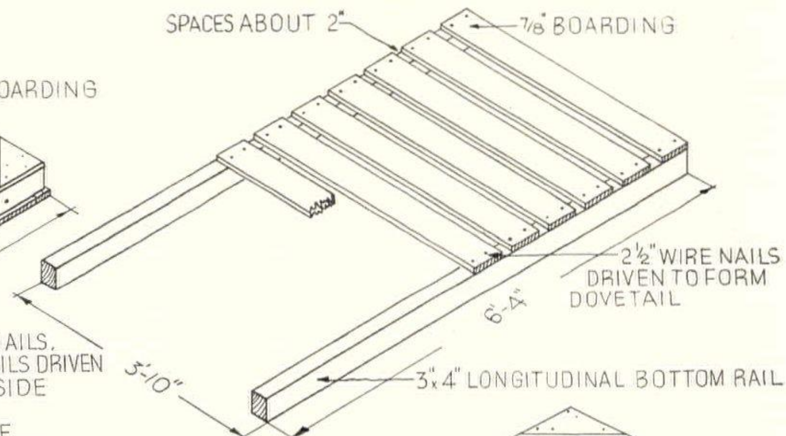
SIDE ELEVATION



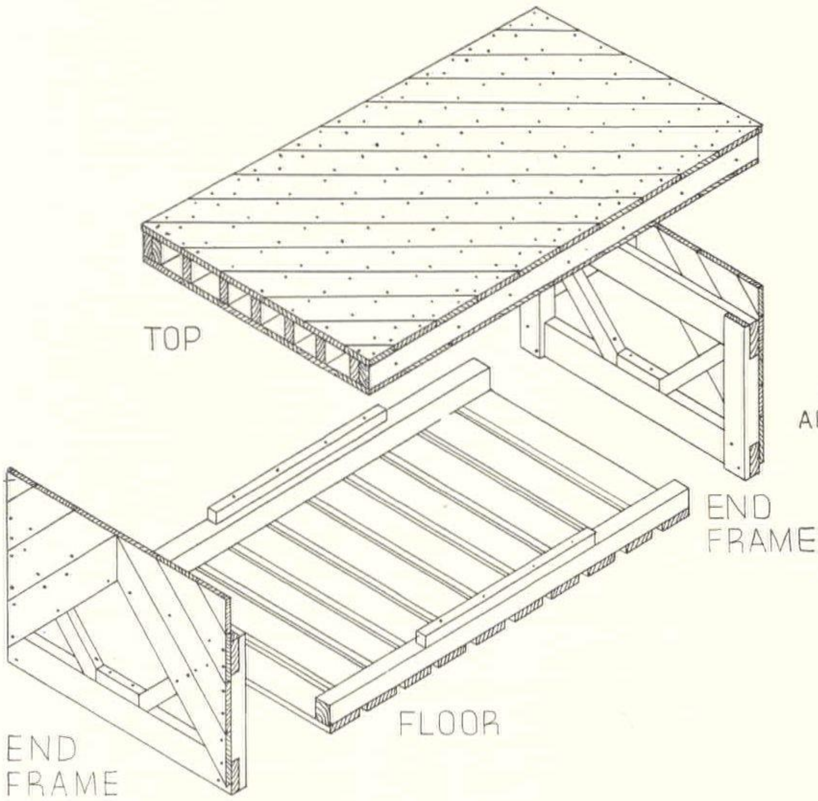
END ELEVATION

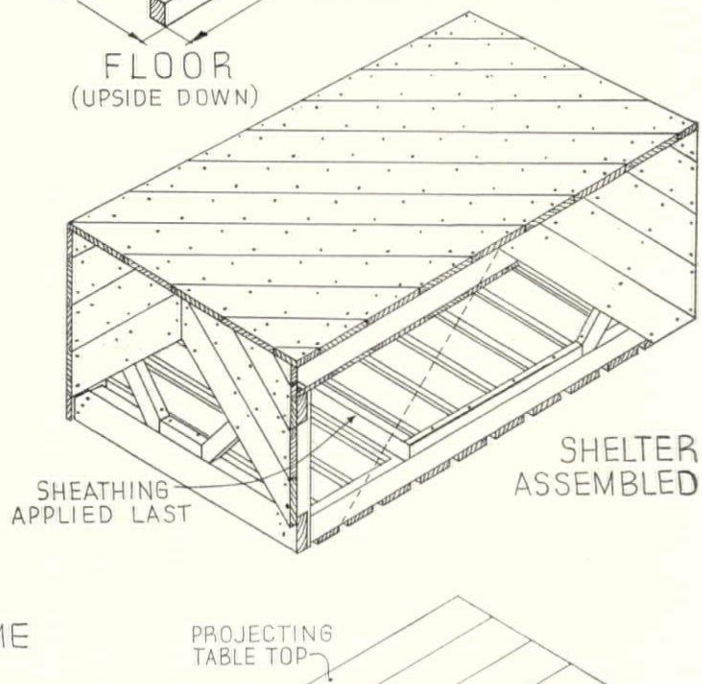


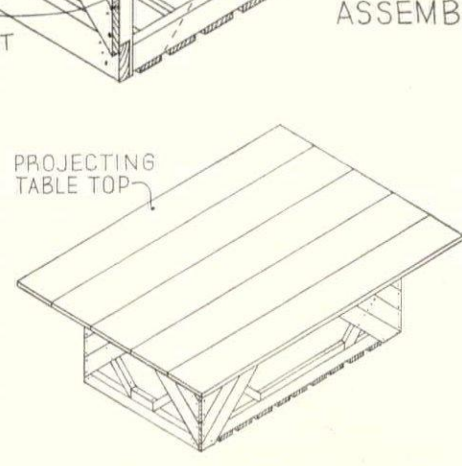
TOP (UPSIDE DOWN)



FLOOR (UPSIDE DOWN)



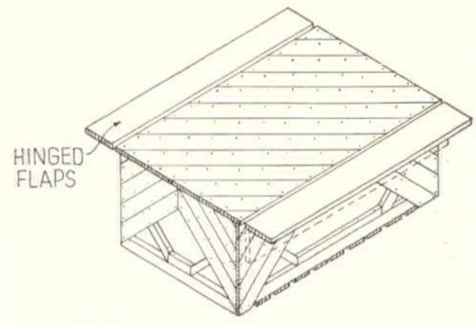
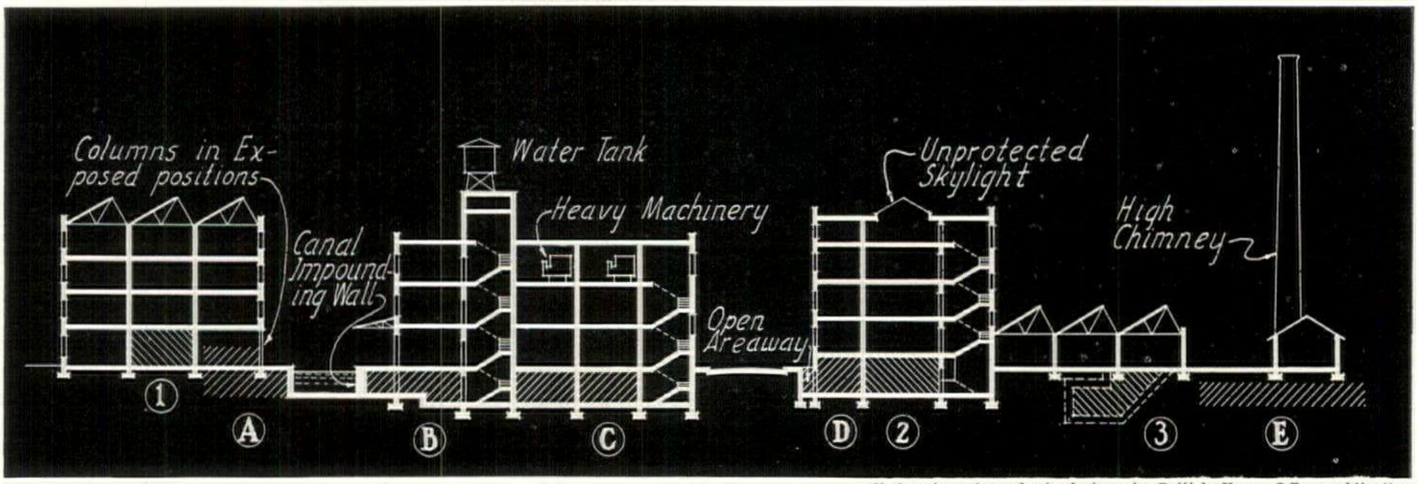



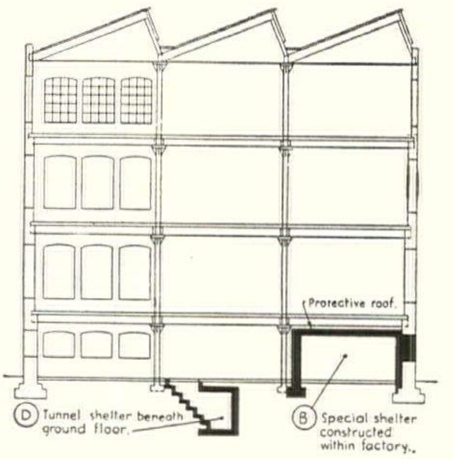

**Table shelter in wood,** recommended for home use, is presented in detail above. It has sufficient strength to withstand debris loads and requires no strategic materials. Uses about 90 board ft. of lumber and 10 lbs. of nails, and can be built for about $50. Table shelters are much more comfortable than backyard types and provide the same degree of protection if installed in a properly protected space. Solid table top or hinged flaps (left) may be added for leg room if shelter is actually to be used as a table, or a somewhat larger top provided for table tennis. For those who feel they must have some form of protection, this shelter is probably the best solution, since it is as effective as the present situation warrants and is extremely low in cost. Dimensions should be followed exactly, since they are worked out for maximum strength. Four triangular openings are provided for emergency egress. They all should be covered with outside flaps of heavy wire mesh.

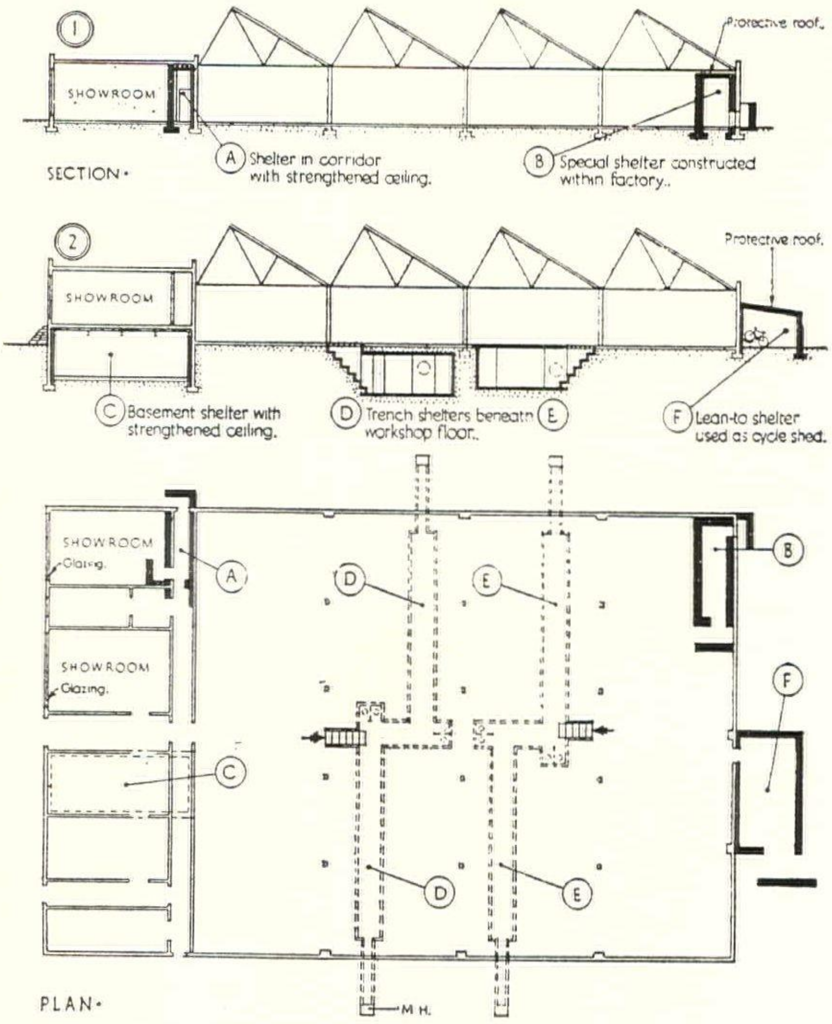
# AIR RAID SHELTERS—FACTORIES




*All drawings from basic designs in British Home Office publications*

**Factors influencing location** of shelters in industrial buildings. Locations A, B, C, D, and E are considered bad for reasons noted; locations 1, 2, and 3 are **good.**



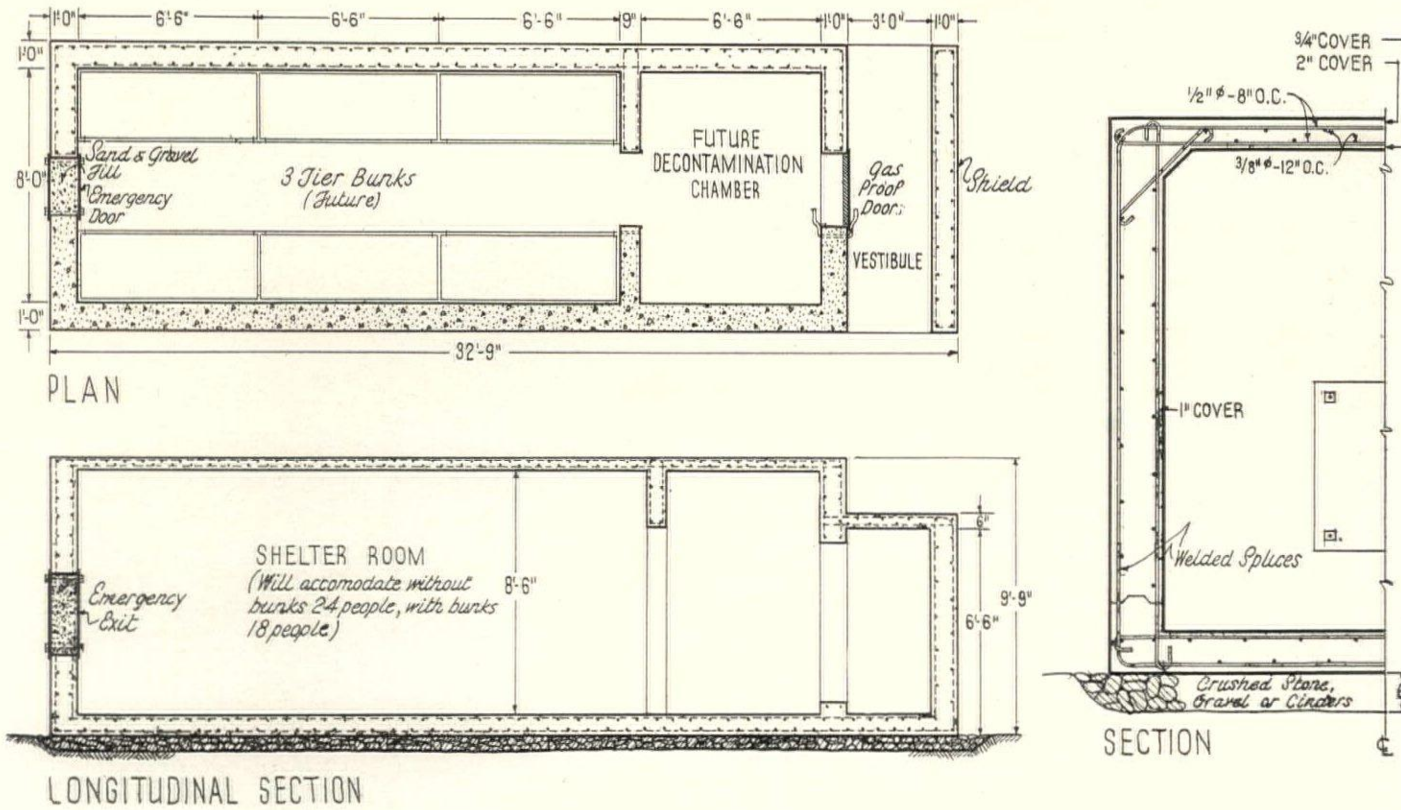



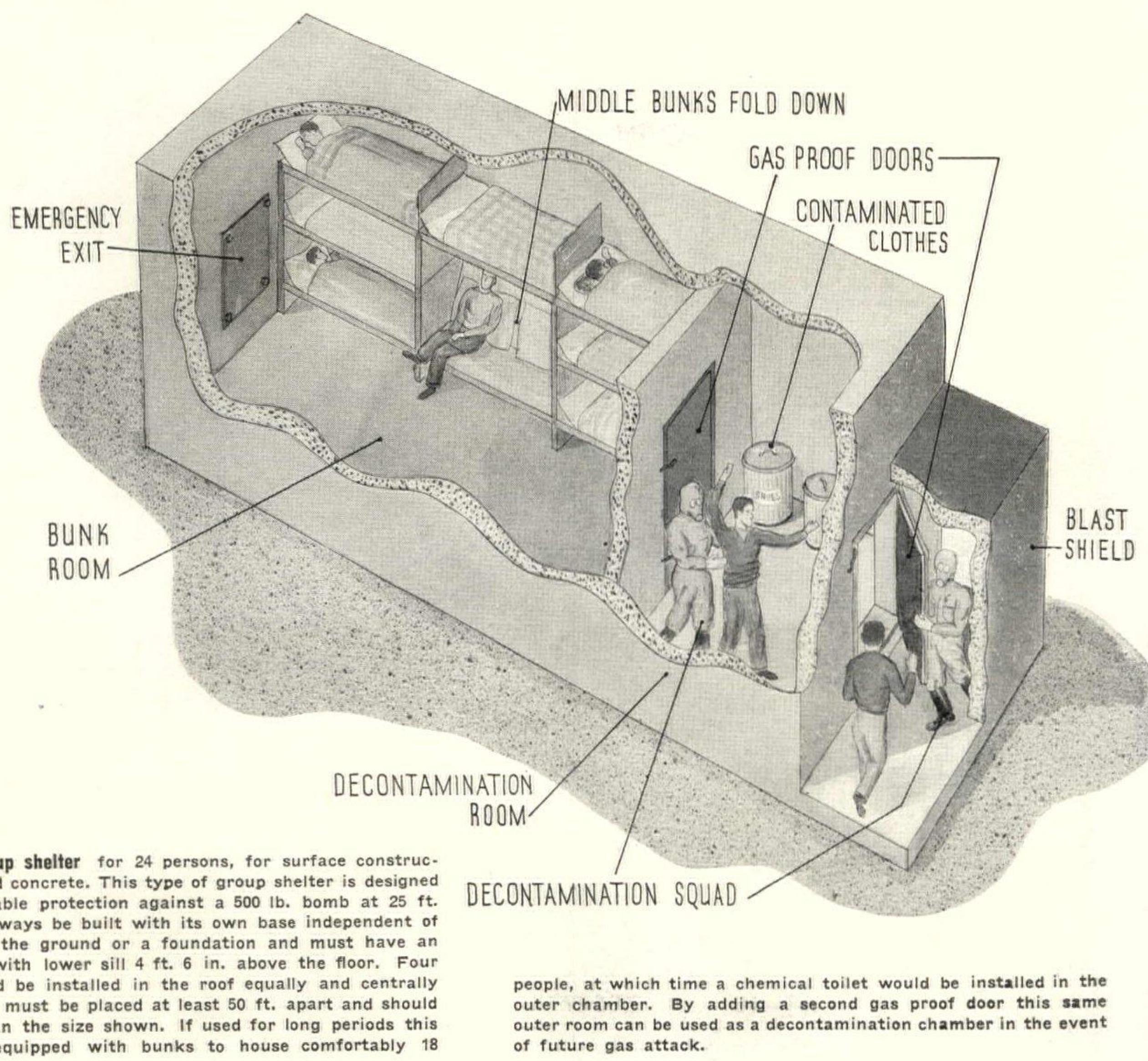

**Factory shelters,** if needed, should be located as closely as feasible to the place of work so that their use will interrupt work as little as possible. For this reason, embankments and blast walls protecting all parts of the factory, such as are shown on page 42, are preferable to special shelters. Trench shelters, beneath factory floors, should be kept small (maximum capacity 50 persons per straight-line unit) and interrupted by right-angle bends. Emergency exits, far enough from the buildings so as not to be blocked by debris, must be provided for each 50-person section, and trench shelters should not be closer than 25 ft. on centers.

Below are portable unit shelters in steel and concrete which can be placed near machinery for short periods of use. The latter is one of the most promising of England's recent developments in shelter design and construction.

*Photos, British Combine*

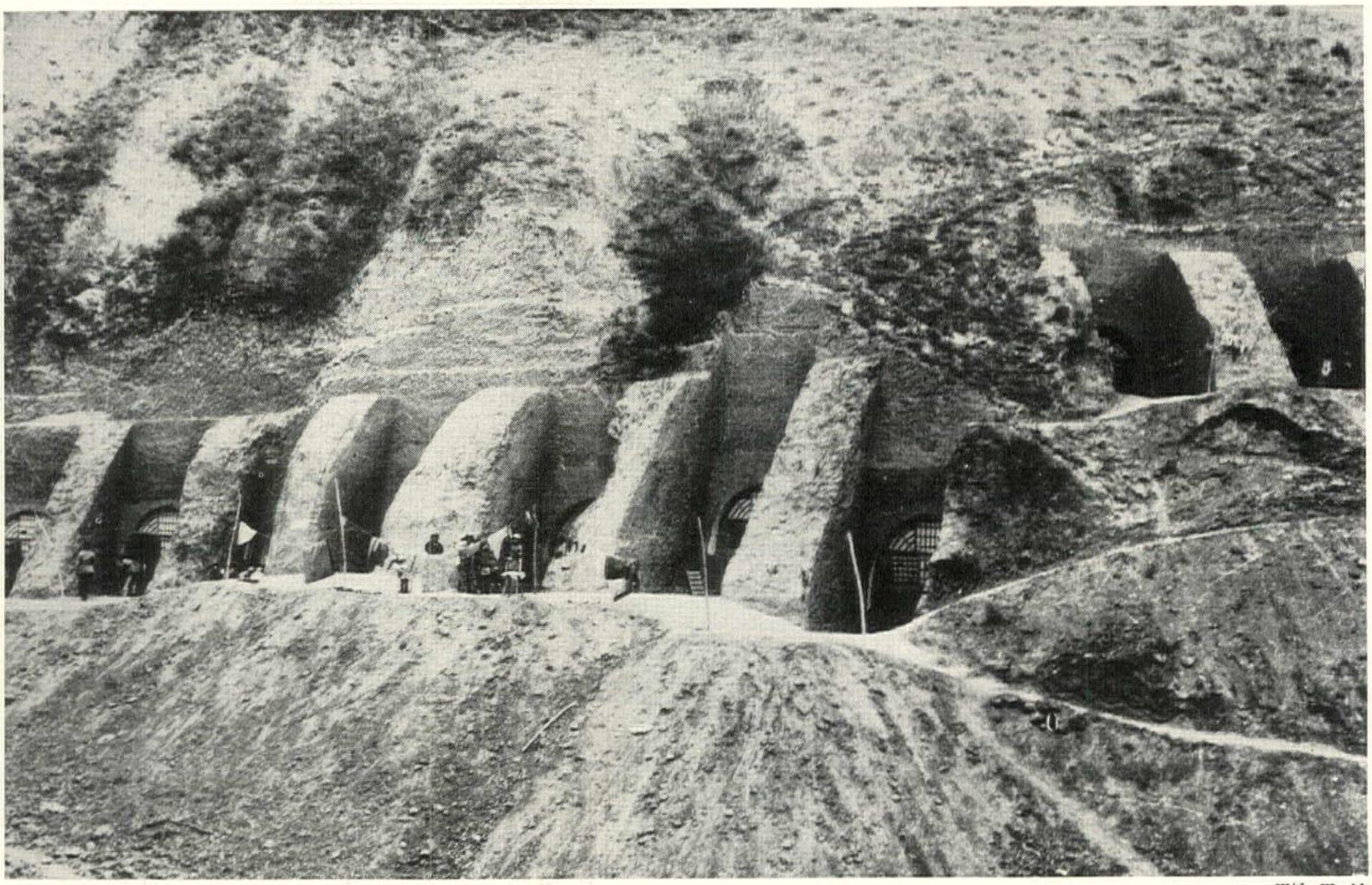
## GROUP SHELTER



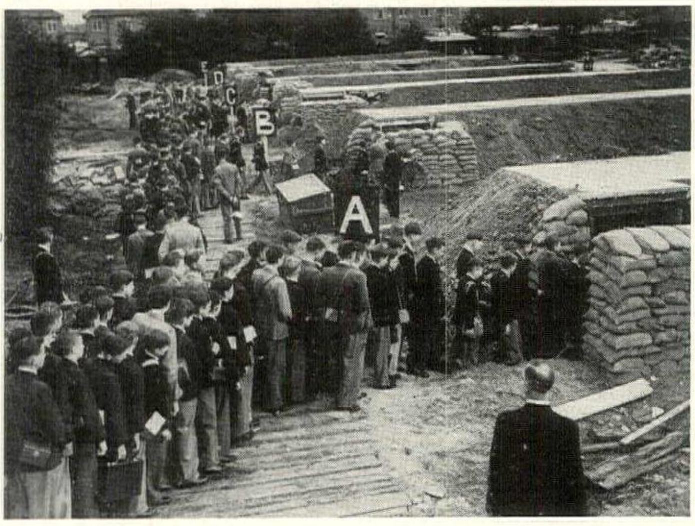




**Splinter-proof group shelter** for 24 persons, for surface construction in reenforced concrete. This type of group shelter is designed to afford reasonable protection against a 500 lb. bomb at 25 ft. Shelter should always be built with its own base independent of (not bonded to) the ground or a foundation and must have an emergency exit with lower sill 4 ft. 6 in. above the floor. Four ventilators should be installed in the roof equally and centrally spaced. Shelters must be placed at least 50 ft. apart and should not be larger than the size shown. If used for long periods this shelter can be equipped with bunks to house comfortably 18 people, at which time a chemical toilet would be installed in the outer chamber. By adding a second gas proof door this same outer room can be used as a decontamination chamber in the event of future gas attack.

# AIR RAID SHELTERS—COMMUNAL TYPE



*Wide World*





1

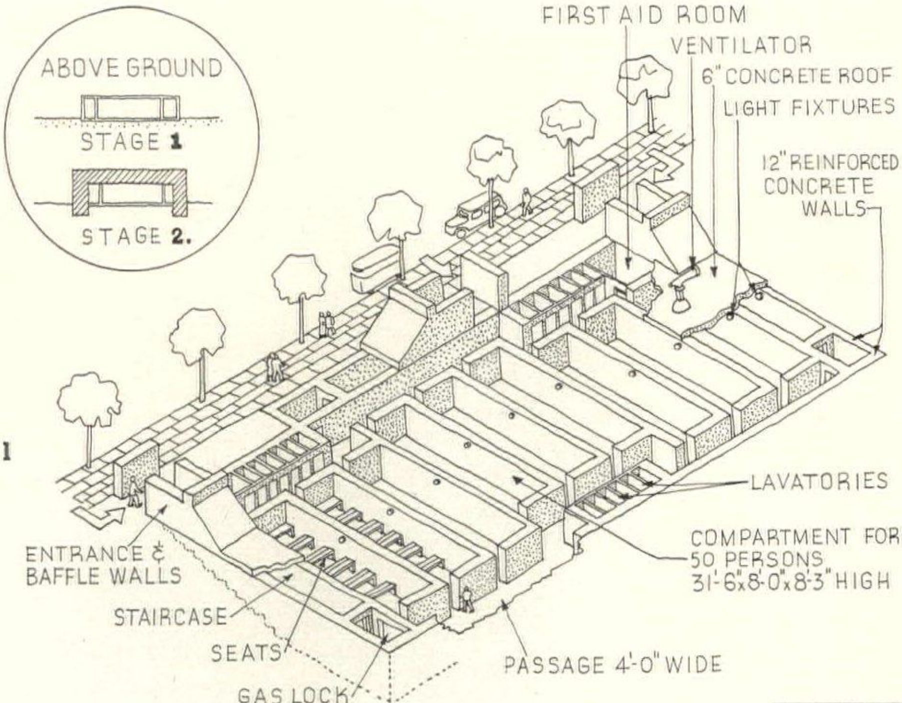
*Photos, British Combine*

2

Communal public shelters find their principal use near places of employment and entertainment, educational institutions, etc., where large numbers of people congregate; in congested residential areas where family and group shelters are impracticable; and in instances where natural features, such as caves, easily tunnelled hillsides and the like make their construction a relatively simple matter. Normally, they are designed to provide a greater degree of protection than family or group shelters, since the effect of a direct hit on a large shelter would be disastrous (particularly with reference to morale), and additional protection can be provided at lower cost per person than in the case of a smaller unit. Best and cheapest form of the communal shelter is a natural cave or tunnelled hillside, such as that in Chungking (above), which provides complete protection for 400,000 against the heaviest bombs. Potential shelters of a similar kind exist at various points in the U. S., most notably in Detroit, which has 20 miles of crystal catacombs more than a thousand feet below street level, caves that are dry, well ventilated, with a steady, year round temperature of 58 degrees.

Even where such ideal protection is available ready-made by Nature, it is of little use unless provision can be made to move large numbers of people quickly and safely in and out. Otherwise, as the tragic experience at Chungking has demonstrated, their use may involve a greater danger than bombardment. Unless sure warnings can be given a long time in advance, an almost impossible condition, it is necessary that those using the shelter be able to reach an entrance within a few minutes, and that entrances be wide enough to permit the bulk of the occupants, who will arrive during the latter part of the warning period, to enter and reach a point of safety within one or two minutes.

**1. British trench shelters,** abandoned shortly after the war began.
**2.** Direct hit on 50-person trench shelter caused only a single casualty but might well have killed every occupant.

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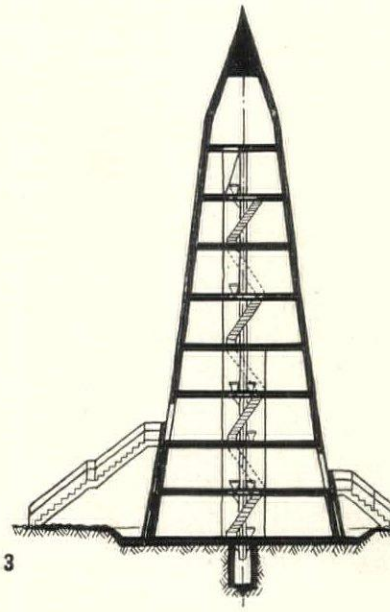

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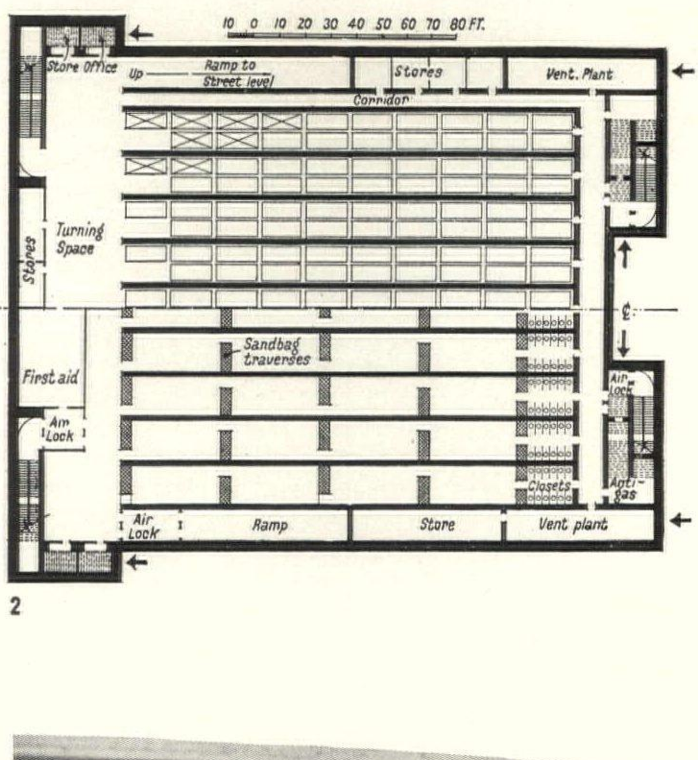


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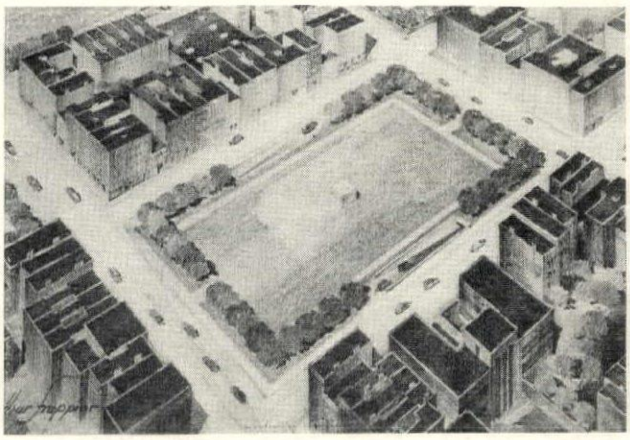
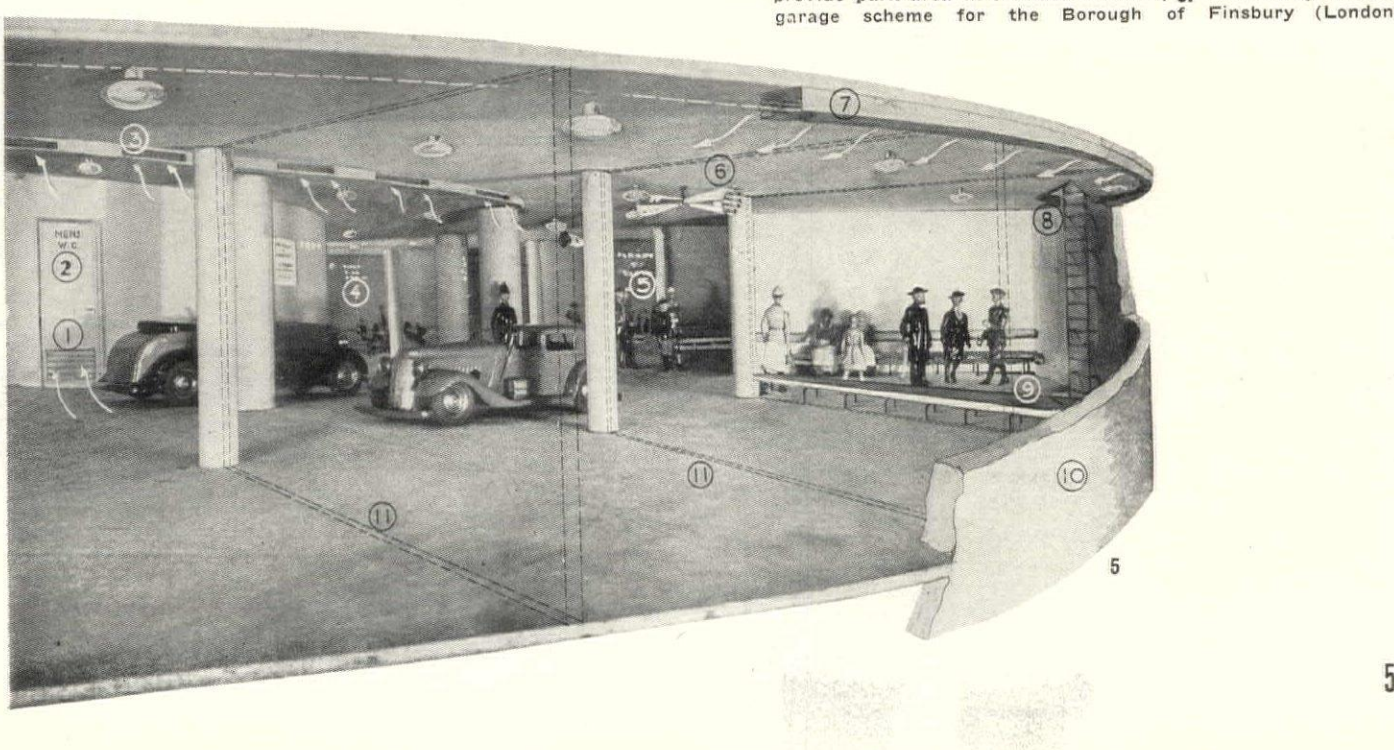


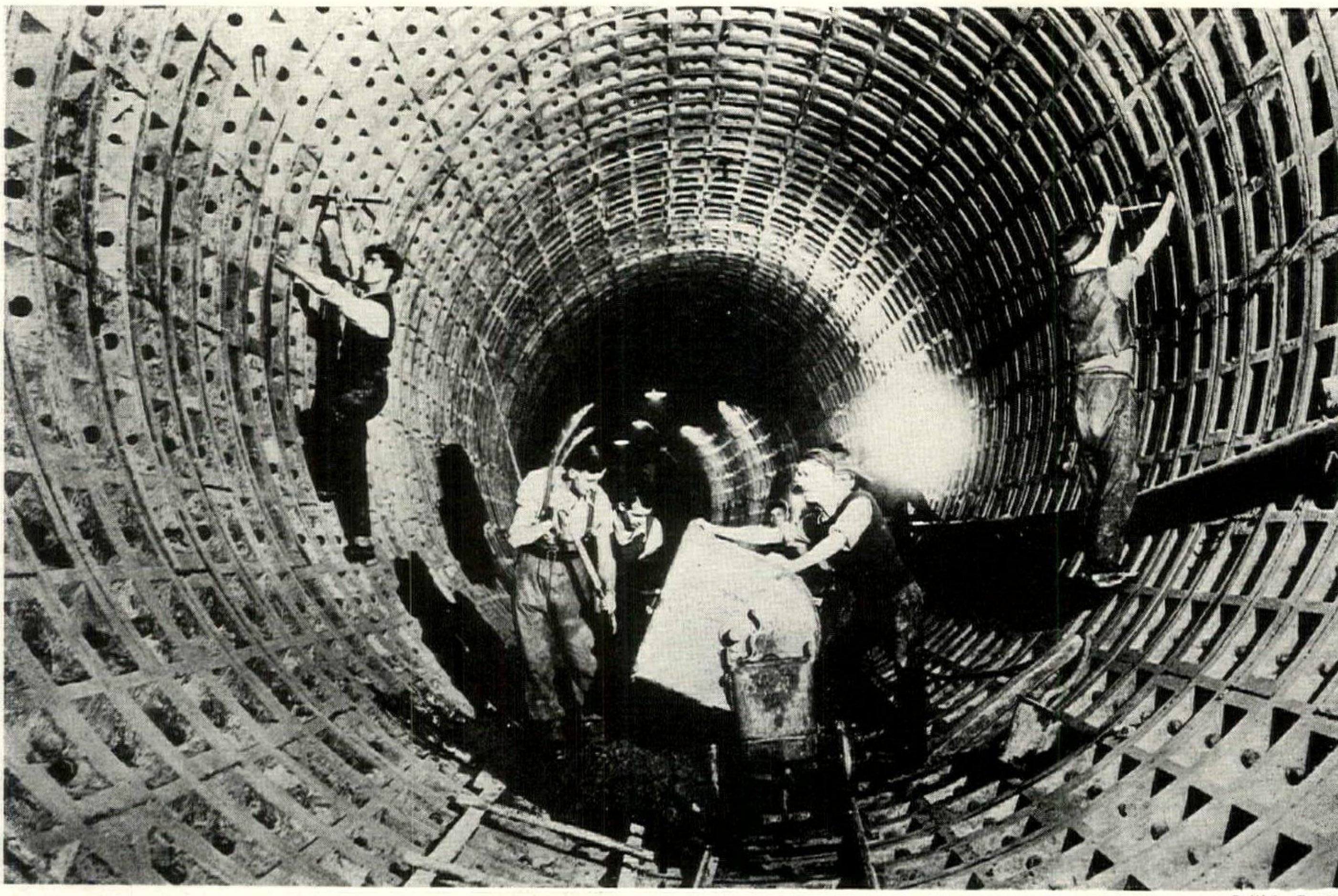
4

**Various proposals for public shelters. 1.** shows the Haldane shelter for 450 persons, designed primarily to give the same class of protection as regular family and street shelters but with improved sanitation and ventilation, and to allow addition of bombproof slab if necessary; **2.** is a shelter designed for ultimate use as a garage (with mechanical parking), actually built at Cardiff; **3.** a German concrete shelter designed primarily to be hard to hit and also to deflect the bomb (the value of this latter feature is problematical, since bombs do not travel vertically); **4.** is an American proposal (Ely Jacques Kahn, Architect) for sub-surface bombproofs to be used as garages and to provide park-area in crowded districts; **5.** Tecton's spiral-ramp garage scheme for the Borough of Finsbury (London).



5

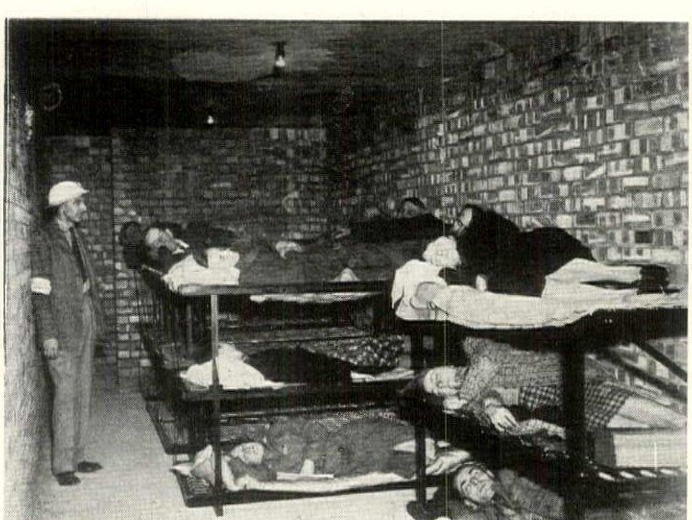
# AIR RAID SHELTERS—BOMBPROOF TYPE



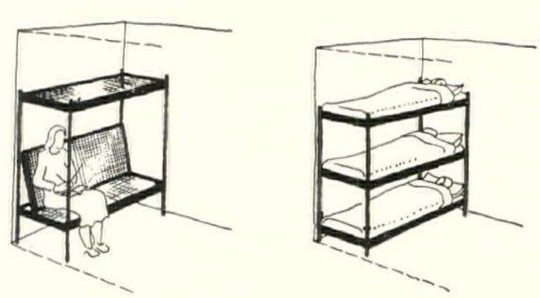
*British Combine*

*Parkinson—BS*

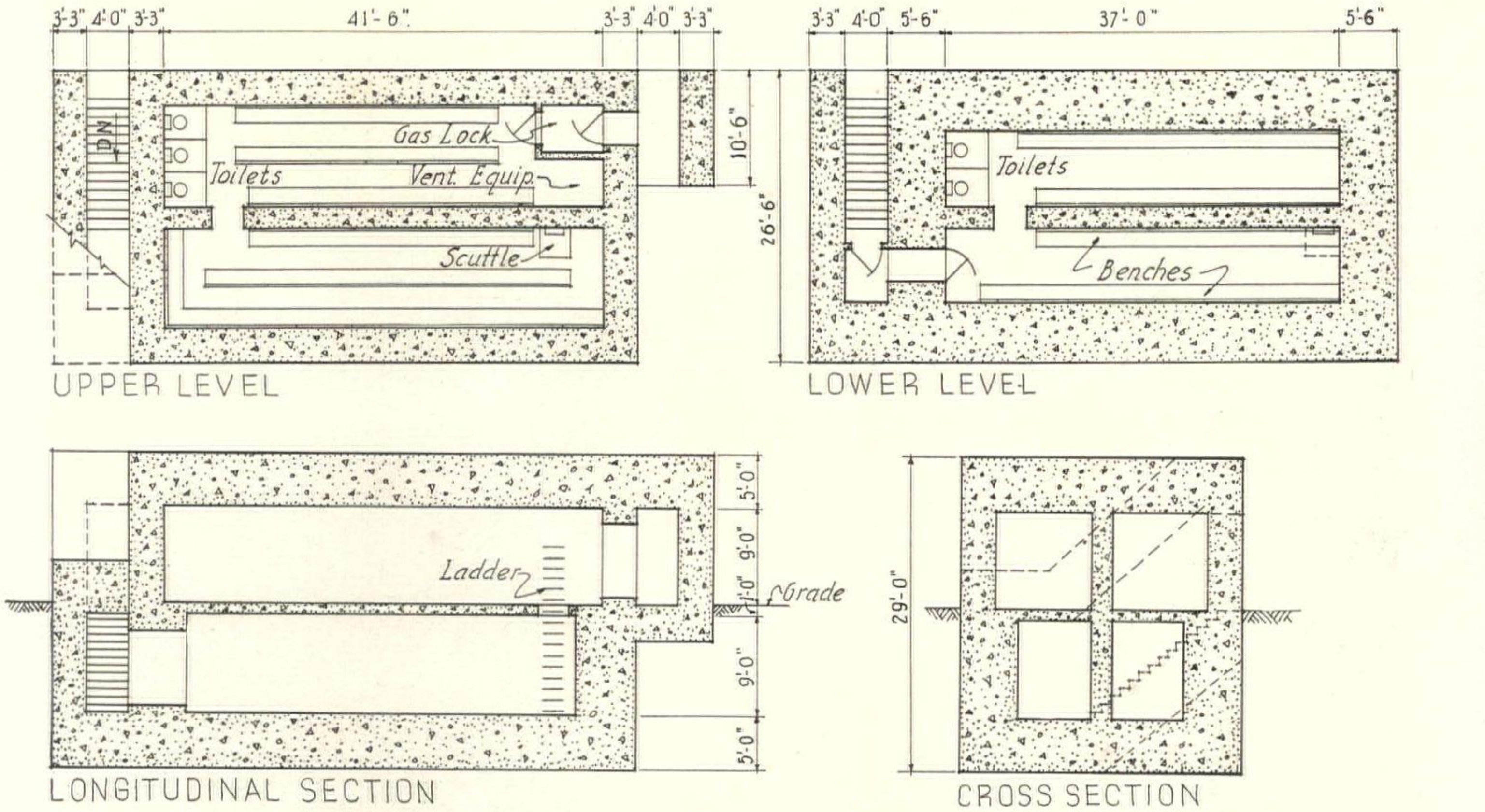
Taking advantage of its easily-tunnelled clay subsoil, and the access provided by existing subway stations and moving stairways, the city of London is providing bombproof shelter for 250,000 and sleeping accommodations for almost half that number by tunnels extended from subway platforms. For normal soil conditions, the cost of deep tunnels is comparable with other forms of shelter affording equal protection, and since they can be extended without regard to surface congestion and provided with widely scattered entrances, many European authorities advocate their use in preference to all other types of completely bombproof construction. Photo above shows tunnel under construction, picture at left typical subway sleeping accommodations. Most U. S. subways are unsatisfactory for use as shelters.



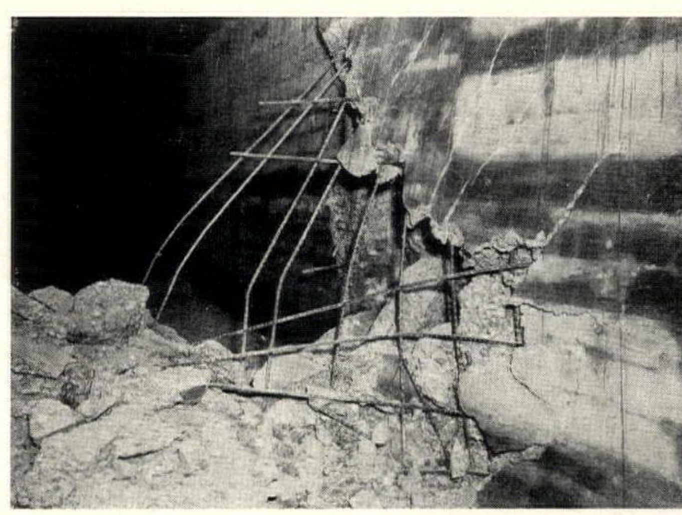
*Black Star*

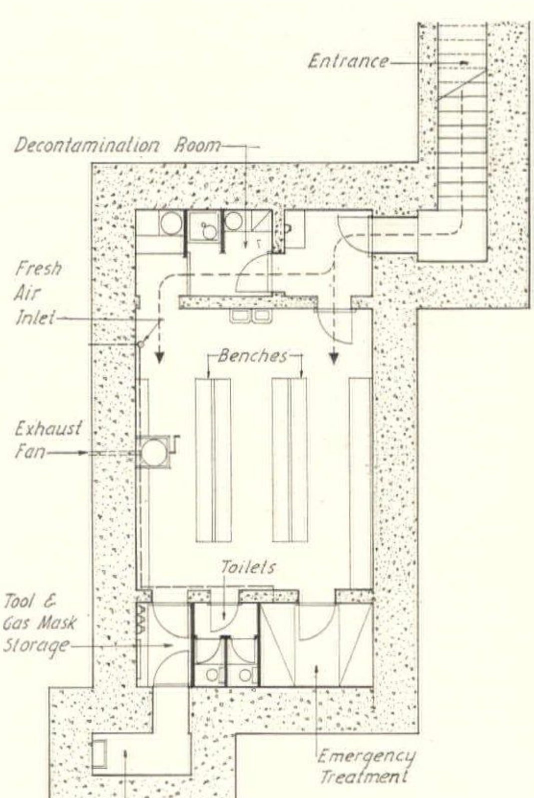


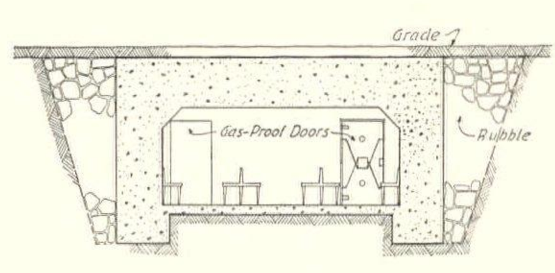
**Beds in British public shelters,** often built of wood, soon became vermin-infested. Later metal type (left) was more easily disinfected, but was criticised because the lower bunk was too close to the floor for comfortable sitting during daytime use, while the space between the bottom and top bunks was insufficient for sitting erect. Drawing above, suggested by the Association of Architects, Surveyors and Technical Assistants, shows improved spacing to correct these deficiencies.




**Large British bombproof shelter** accommodating 400, which has been tested under actual bombardment by the U. S. Corps of Engineers. Designed to resist direct hits from 500 lb. medium case bombs, it withstood 600 lb. bombs striking near the edge of the roof panel. Breaching of the sidewall in the sub-grade level of the shelter (photo, right) caused by earth shock from the tamped explosion of a nearby 600 lb. bomb, led engineers to conclude that it would be desirable to place the entire structure above ground, with a concrete apron to prevent penetration of bombs into the ground near sidewalls.





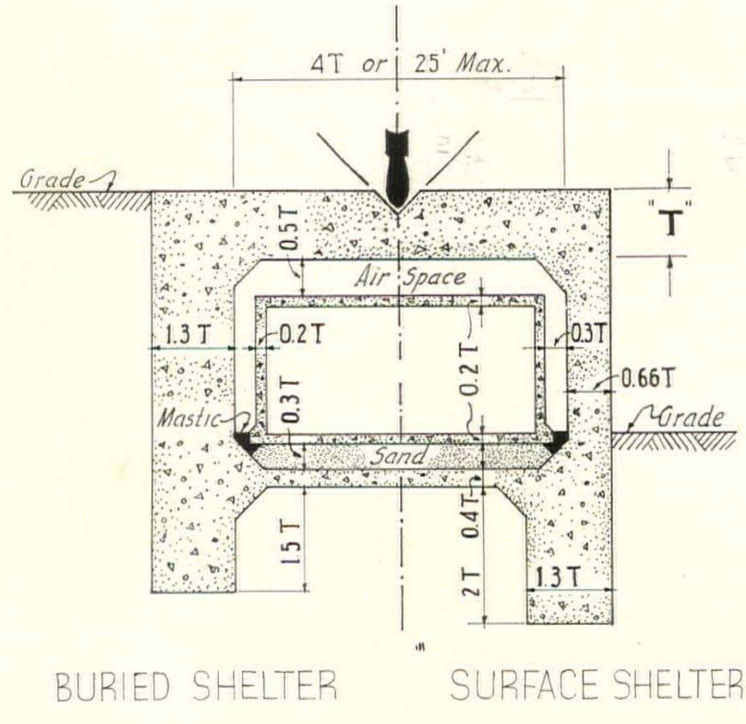




**Smaller, Swiss bombproof** with an especially good plan providing a right-angle break at the entrance and alternate paths for contaminated and uncontaminated users. Emergency exit, necessary in all shelters, is provided in this example at opposite end, in the shelter above by ladder connecting the two levels, which have entrances at opposite ends of the structure.

# AIR RAID SHELTERS—BOMBPROOF TYPE

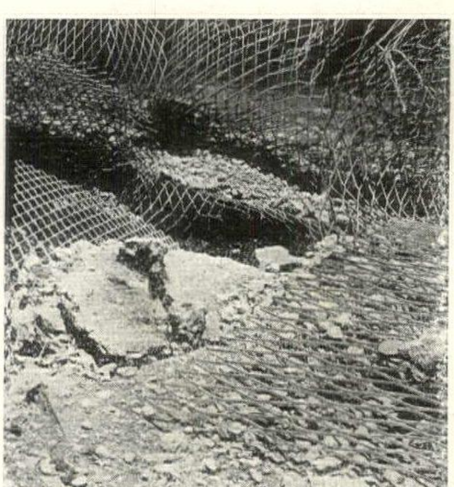
**Burster slabs** are frequently provided over underground quarters to cause detonation of the bomb above or in the burster. Such slabs must be thick enough to prevent the penetration of the bomb lest the explosion be augmented by confinement between the burster and the construction. Bursters which will stop the bomb will ordinarily distribute the force of the subsequent explosion widely enough so that the construction beneath will not suffer. Without a burster, underground construction must be at a depth equal to the sum of the expected penetration of the bomb in earth plus the radius of severe earth shock from the center of explosion. Use of burster therefore permits construction much nearer the surface.

For a good sized bomb, typical burster thickness may be 6 to 10 ft. of 2800 lb. concrete moderately reenforced. Actual thickness depends on the velocity and cross-sectional density of bomb. Since bursters of this magnitude will in themselves absorb the energy of an explosion, the tendency is to make them the roof of the construction. A further logical tendency is to bring the whole construction above ground with only enough earth cover to support grass or other concealment growths.

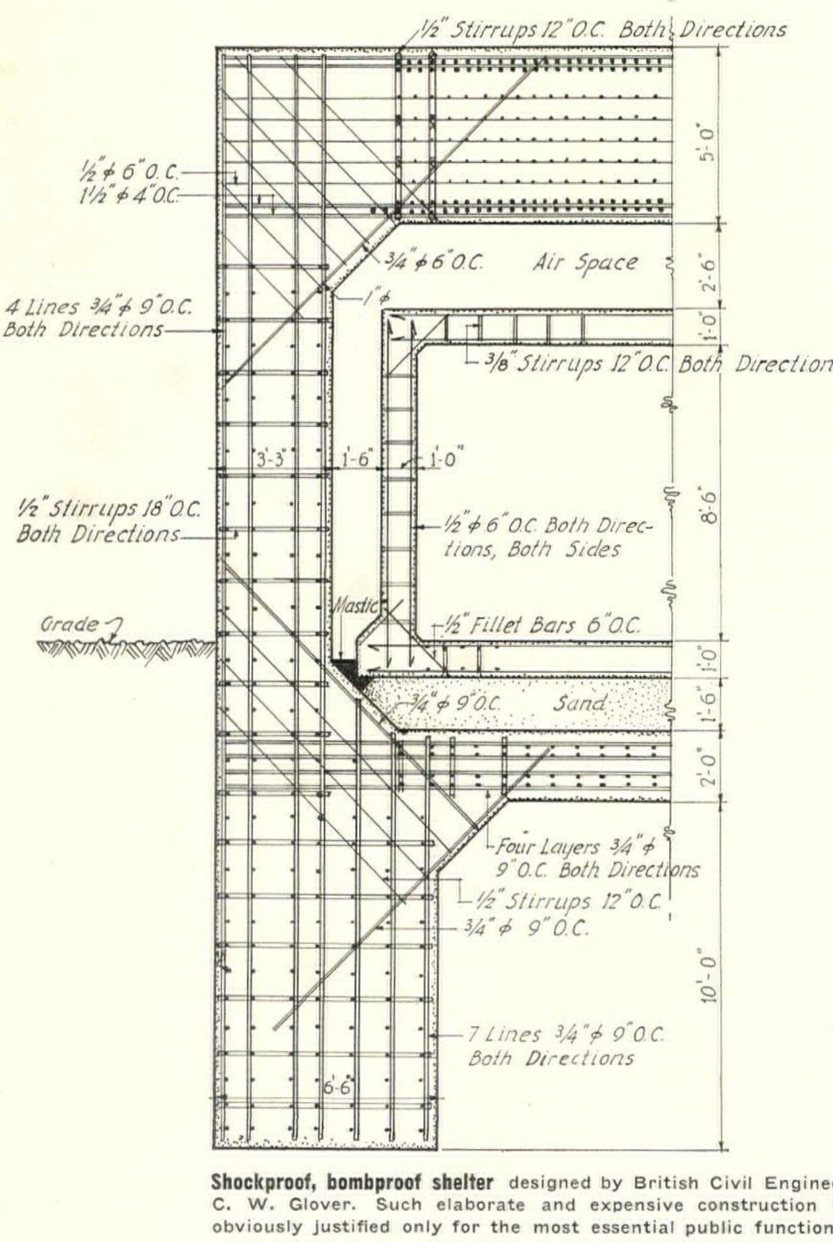




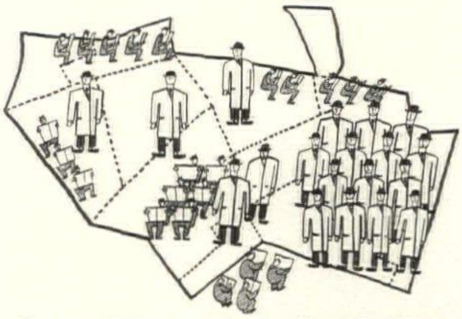
1


2

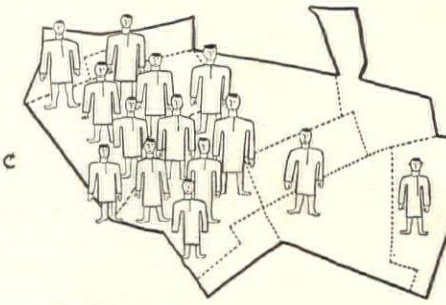
**Results of U. S. Army tests** on typical burster slabs. 1 shows penetration of inert bomb due to impact and 2 effect of typical explosion. Separation of slab on line of expanded mesh reenforcement led engineers to conclude that this type was unsuitable for bomb resistant construction, and should be replaced by welded, open mesh. Reenforcement apparently plays no major part in resistance to penetration, is needed only for static strength and to prevent cracks due to expansion and contraction and to retain the scab.




**Shockproof, bombproof shelter** designed by British Civil Engineer C. W. Glover. Such elaborate and expensive construction is obviously justified only for the most essential public functions, such as central ARP stations, which must be kept in action during the height of a raid, military and naval headquarters.

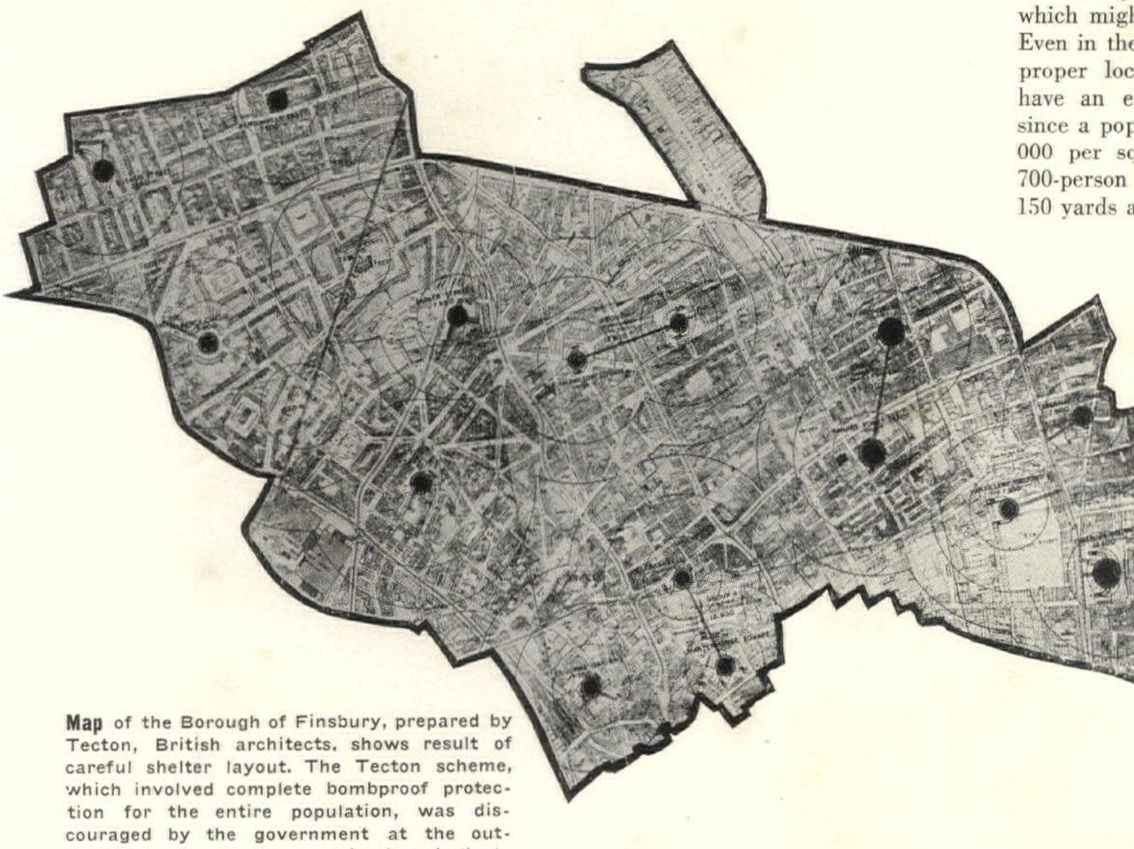


**Day** population may be considerably different from census figures, since it includes transients and commuting workers and should be taken into account in any shelter plan.

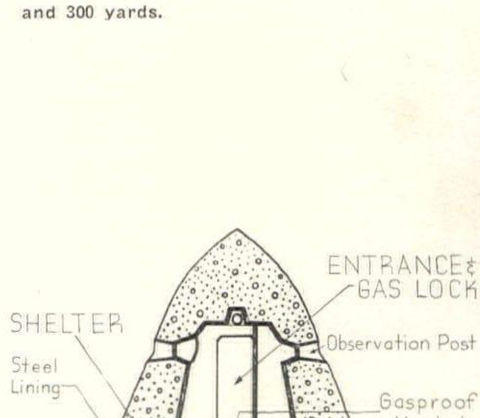


**Night** population must also be provided for, unless family shelters are to be supplied for residents, a practice which might involve unnecessary duplication of effort. (Sketches by Tecton.)

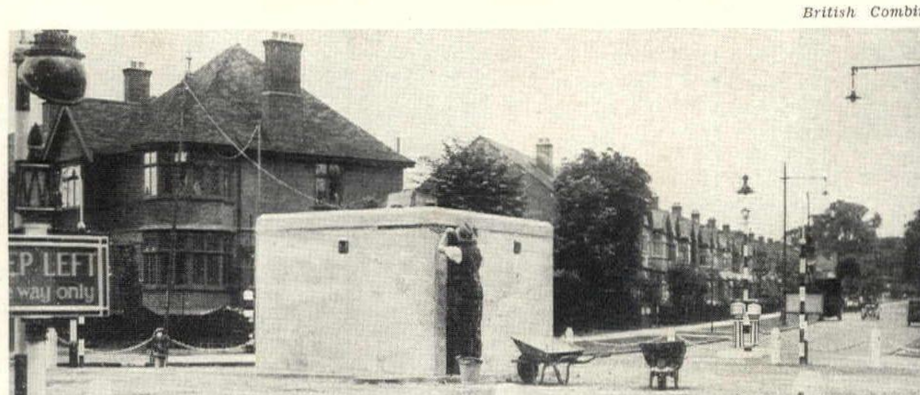
**LOCATION** —Location of public shelters in congested areas depends on a complex of factors including concentration of population, both transient and static, available sites, type of shelter employed, length of probable warning period, etc., all of which have yet to be determined for U. S. conditions. In general, shelter entrances must be within quick walking distance and sufficiently numerous to prevent concentration of large numbers of people at any particular point. Buildings must also be examined in order to determine where the entrances to shelters can best be placed so as to reduce the risk of their being blocked by falling masonry, and low spots which might become gas pockets, avoided. Even in the most densely populated areas, proper location of shelters would also have an effect on their maximum size, since a population density as high as 100,000 per square mile would require only 700-person shelters if they were located 150 yards apart.



**Map** of the Borough of Finsbury, prepared by Tecton, British architects, shows result of careful shelter layout. The Tecton scheme, which involved complete bombproof protection for the entire population, was discouraged by the government at the outbreak of the war. Concentric rings indicate distance from shelter entrances: 100, 200, and 300 yards.

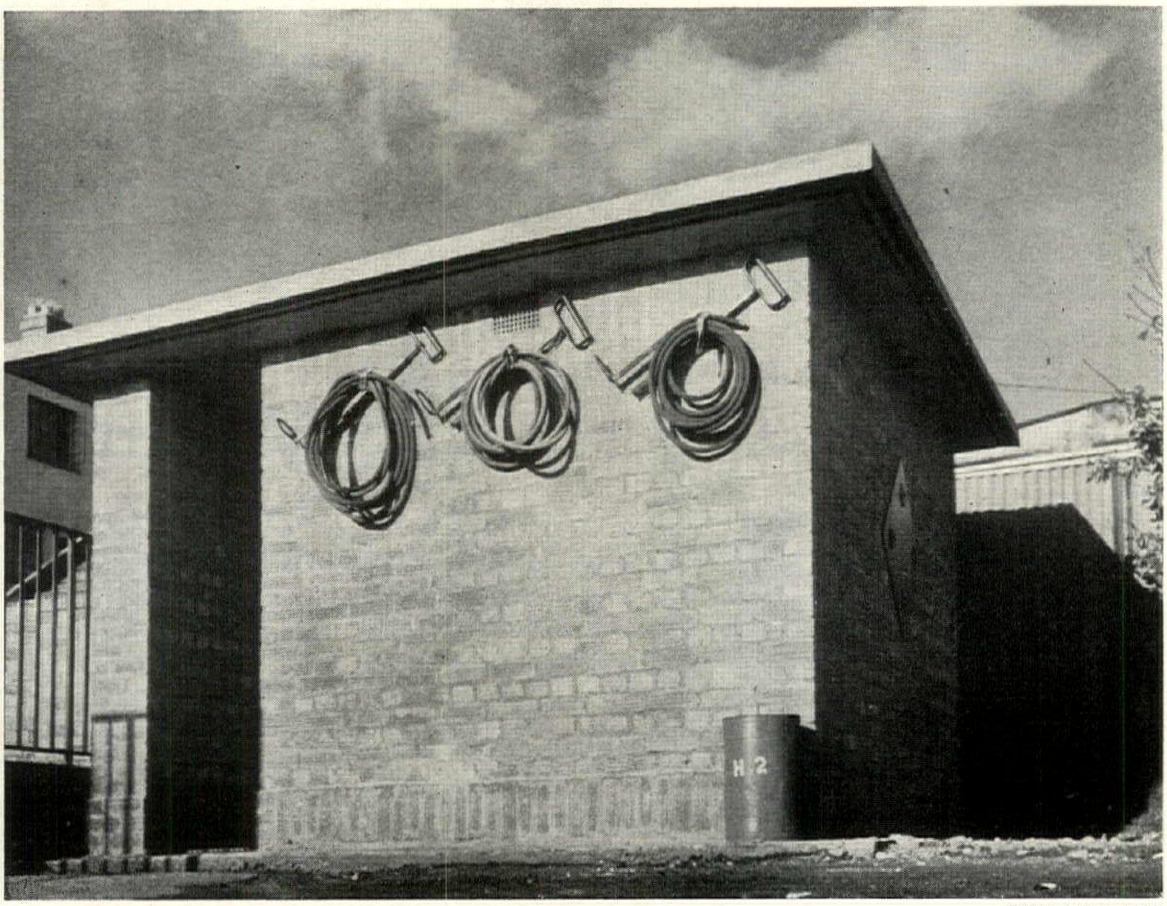



*British Combine*




**Scheme** for combined wardens' observation post and air raid shelter (left). Actual posts, as shown by the photograph at the right, are of considerably lighter construction, affording protection against blast and splinters, but not direct hits. However, central air-raid stations, detailed in the section which follows, are being built to provide completely bombproof protection, to guard the nerve centers which direct rescue work, fire prevention, and other vital services which must continue even during raids.

# CIVILIAN DEFENSE BUILDINGS




*Peter A. Ray—BPS*

Buildings in this category, as distinguished from purely military establishments, cover a wide range of types. In the more secure areas away from the coasts there are the boarding schools, evacuation centers and hospitals; in the exposed cities there is need for first aid and decontamination stations, rest centers for bombed-out citizens, feeding centers, wardens' posts and district warning centers. There are also mobile units, such as the one shown at the left, for information, for food and for first aid.

Not all of these, obviously, are new buildings. The wardens' post, for instance, may be a freestanding splinter-proof of brick or concrete, similar to the one illustrated above, or convenient spaces in the various neighborhoods may be taken over and made suitable for the needs of the men and for storage of their equipment. In the case of first aid and decontamination centers, new buildings would probably be required, or in any event, a very thorough remodeling would be in order. The same would be true of new emergency hospitals and evacuation centers in the rear.

The responsibility of the architect or engineer in this field is clear. As a trained citizen he is better equipped to handle these special planning problems than anyone else, and such buildings, unlike the great military bases, are within the scope of the average office. The responsibility of the architect's professional organizations is equally clear, for the design of these buildings requires coordinated effort, a very considerable amount of research and the prompt dissemination of information. Immediate cooperation with the other interested organizations, such as the Red Cross, is equally necessary if the architectural profession is to take its part in meeting the national emergency.

*British Combine*

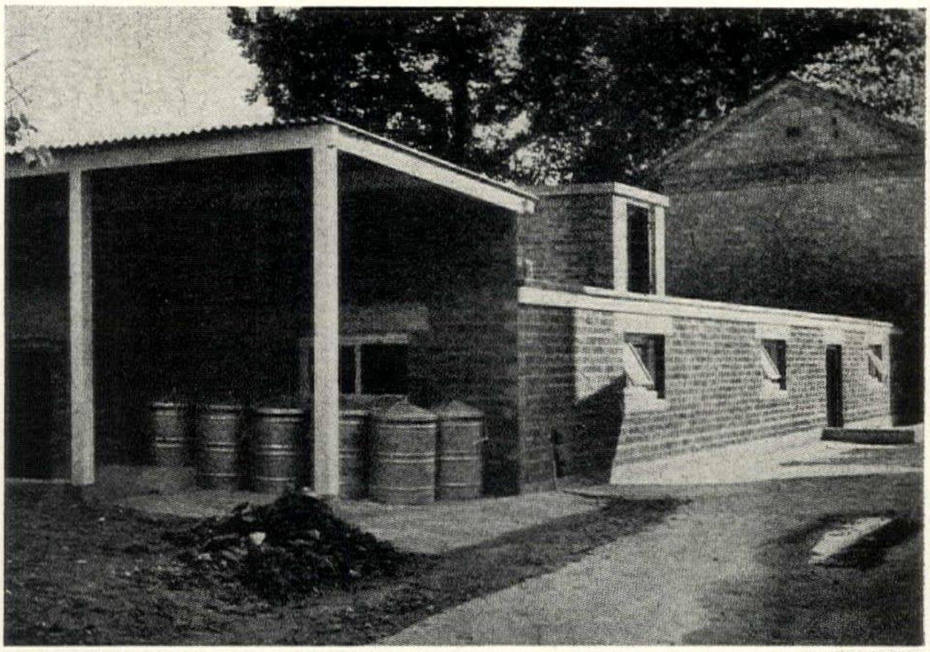
**Mobile canteen.**

## FIRST AID DECONTAMINATION STATIONS

While the two allied functions of first aid and decontamination are usually combined in one building, expediency sometimes isolates them. Thus, the small reenforced brick building to the right was designed solely for the purpose of decontaminating gas casualties among the ARP police force of West Sussex, England. Following the accepted English pattern, this building has six basic elements arranged in tandem: (1) an open shed for the removal of contaminated outside clothing, (2) and air lock leading to (3) an undressing room, (4) a cleansing room equipped with showers, (5) a dressing room and (6) a rest and waiting room which may be expanded in larger buildings to handle first aid cases.

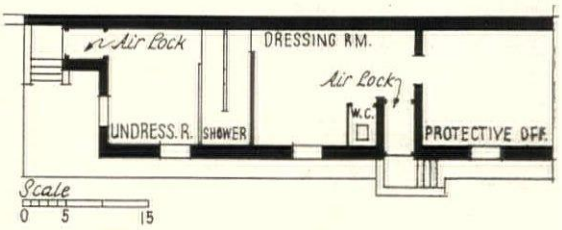
Where a building of this type is to be used by the general public, provisions must be made for both sexes by duplicating all but the rest-waiting-first-aid room. In the English proposal below, this is accomplished by a central screen running the full length of the building. Note that entrances for uncontaminated casualties are provided at the center of the building and lead directly into the first aid rooms.

These civilian defense buildings serve emergency purposes only; after decontamination and first aid treatment, the casualties are moved as quickly as possible to hospitals, shelters or their homes. To facilitate cleaning of the buildings, all furniture should be covered with easily washable material such as oilcloth, and walls, floor and ceilings should be finished with materials which will withstand constant hosing and scrubbing with chloride of lime. Artificial ventilation must prevent the accumulation of gasses within the building and provision must be made through gastight fenestration for natural ventilation when the building is not in use. It should be "aired-out" for 24 hours after the gas has dissipated.



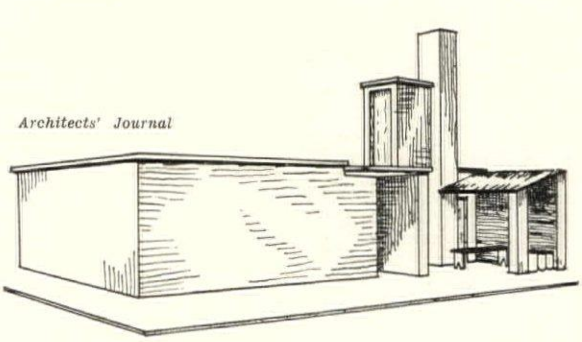
C. G. STILLMAN, COUNTY ARCHITECT

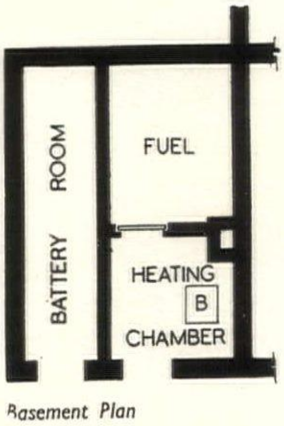
*The Builder*



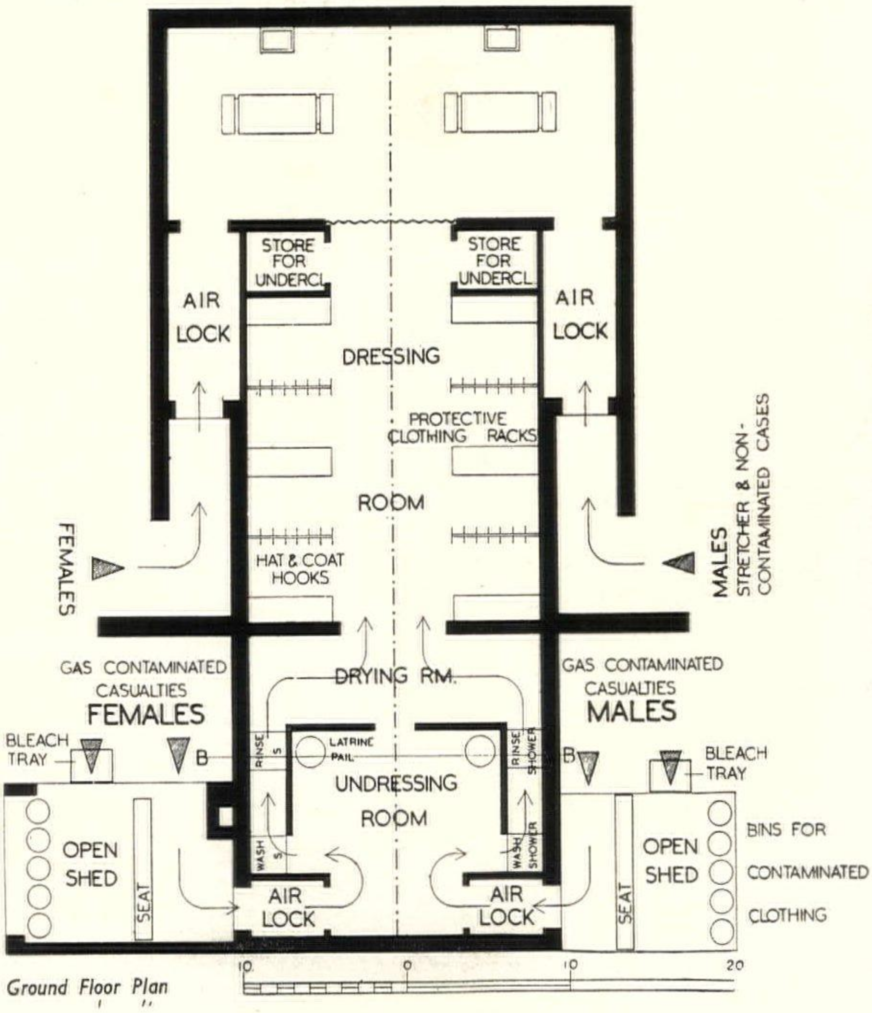

F. W. B. YORKE, ARCHITECT

*Architects' Journal*



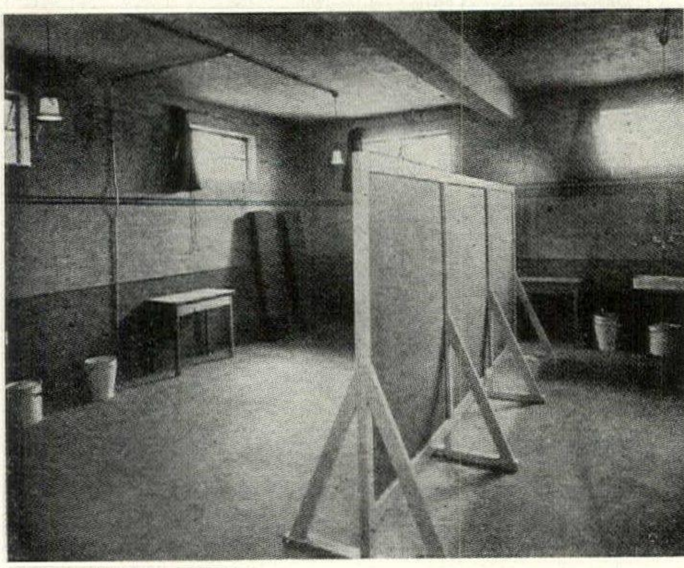



Basement Plan

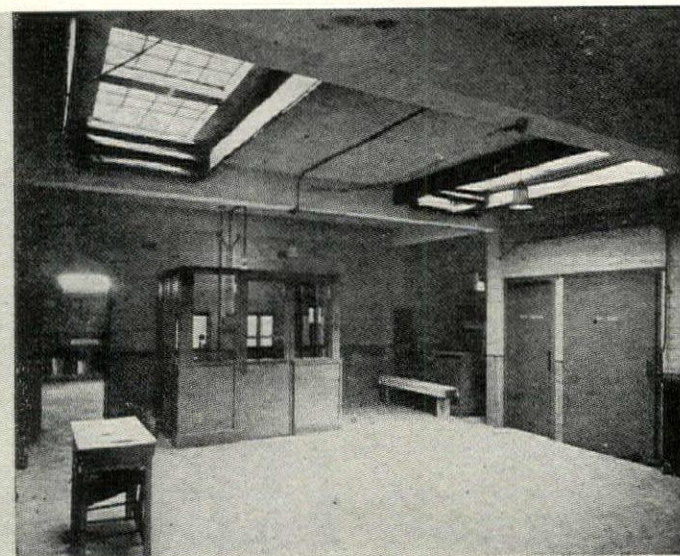



Ground Floor Plan

# FIRST AID DECONTAMINATION STATIONS



**TREATMENT ROOM**

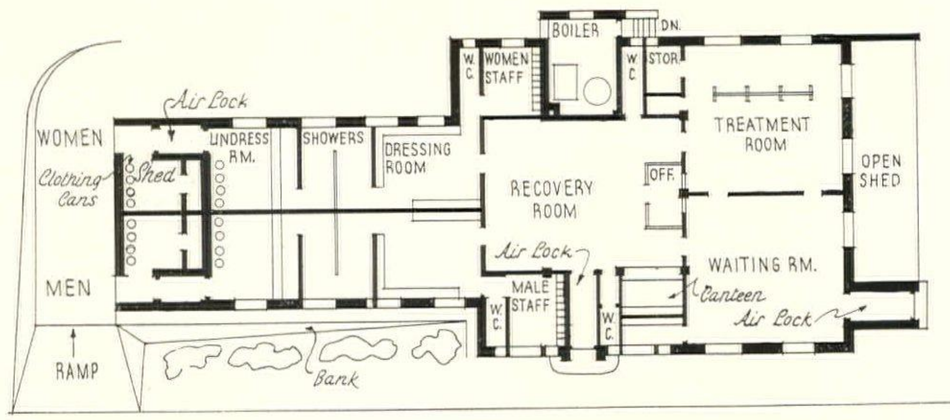


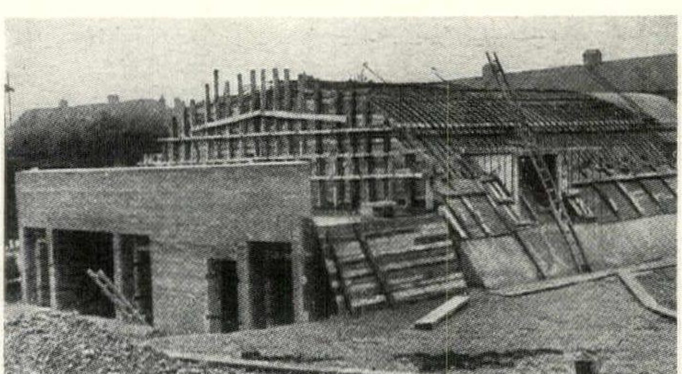
**RECOVERY ROOM**

*Architect's Journal*

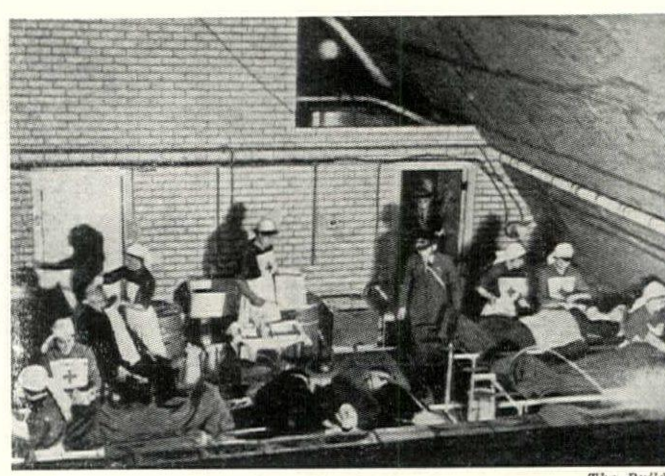
CLARK FYFE, ARCHITECT

Somewhat larger than the examples shown on the preceding page, this decontamination and first aid station in Falkirk, England follows the same general layout pattern, but includes space for administrative offices and increased medical facilities. Note that windows are near the ceiling to escape gasses which usually hug the ground. Construction: reenforced concrete piers and beams, 15 in. brick walls, 5 in. reenforced concrete roof. The provision of a clerestory would have made the highly vulnerable skylights unnecessary.

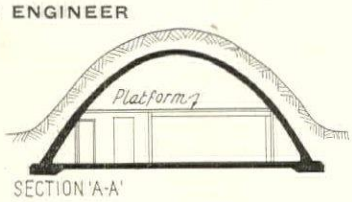


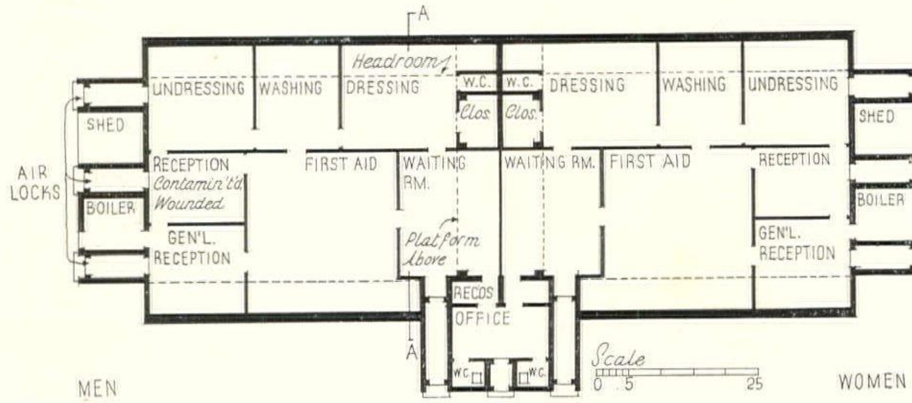
JOHN H. CLAYTON, BOROUGH ENGINEER



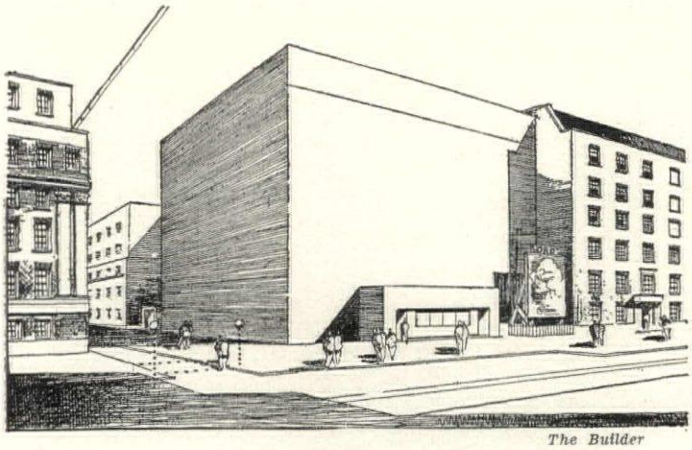
*The Builder*



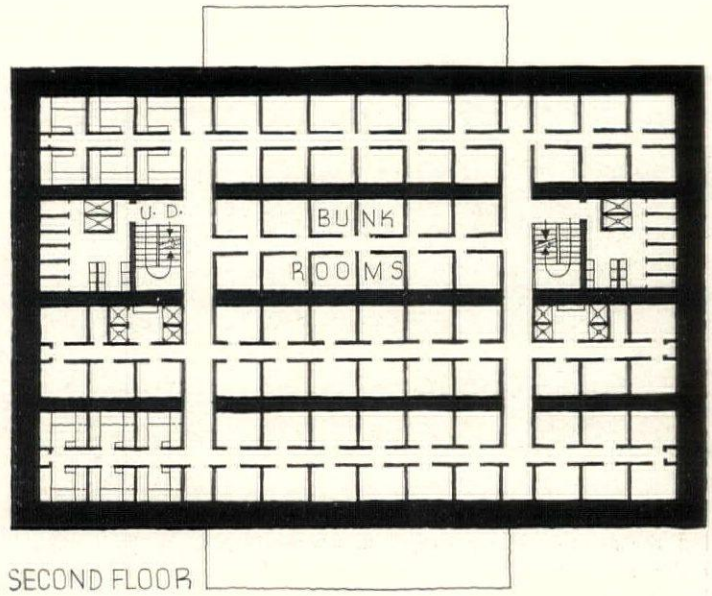

Offering the added advantages of bomb-resistant construction, this large station differs from the others in that it is divided laterally — instead of longitudinally — into identical quarters for males and females. Both sections are served by three entrances for casualties: one for the injured, one for the contaminated and a third for those who are both injured and contaminated. Of reenforced concrete this building was erected in Erith, Kent (England).



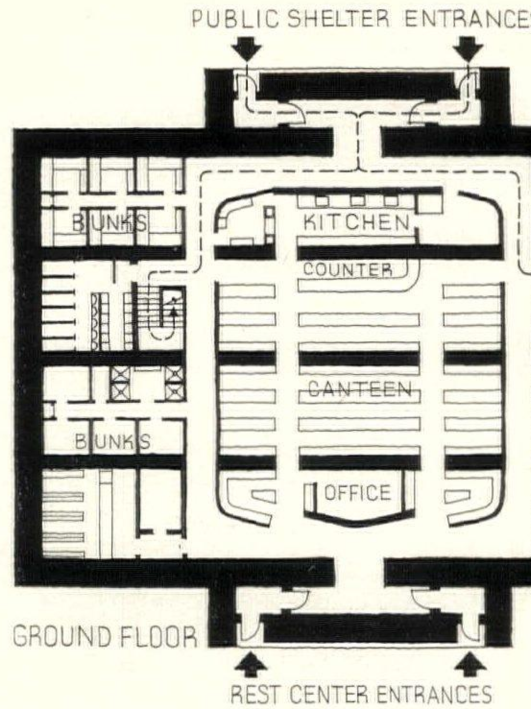
## SHELTER-REST-CENTER



*The Builder*



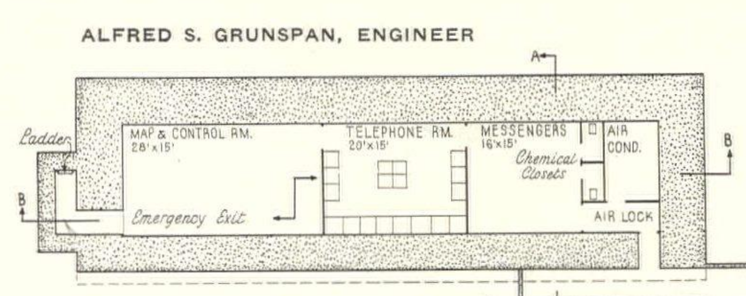

Shelter-rest centers such as this English proposal of the AASTA serve two functions: 1) to shelter bombed-out families while they look for new homes and 2) to feed them as well as those whose home cooking facilities have been disrupted by the bombing of public utilities. English experience indicates that the former function is best accomplished by the provision of a cubicle for each family—see upper floor plan, right—and that the latter is best served by central or communal dining facilities, whereby government employees may discourage food and fuel waste and release all members of the families for extra-household civilian defense activities. It has been suggested that England provide rest centers and shelters to accommodate from 5 to 25 per cent of the population of each community—in larger communities a smaller proportion of the population will acquire accommodations. This windowless, six-story building accommodates about 2,500 people, is heavily protected by 4½ ft. "mass concrete" walls and a 10 ft. reenforced concrete roof. The two lower floors are used as a rest center, the other four as shelters with separate canteens.

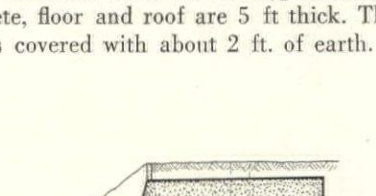


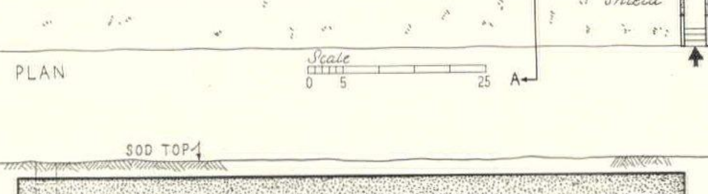

## CENTRAL CONTROL STATION

To house the nerve center of its ARP activities, Borough of Deptford in England built this underground shelter, designed to withstand a direct hit by a 500 lb. bomb. It is partitioned into four rooms: a map and control room, telephone room, messenger room and a room which houses air-conditioning equipment capable of changing the air at a rate of 450 cu. ft. per person per minute. Other equipment includes an auxiliary electric lighting plant, gas-tight doors and chemical toilet facilities. Walls are of 6½ ft. reenforced concrete, floor and roof are 5 ft thick. The station is covered with about 2 ft. of earth.

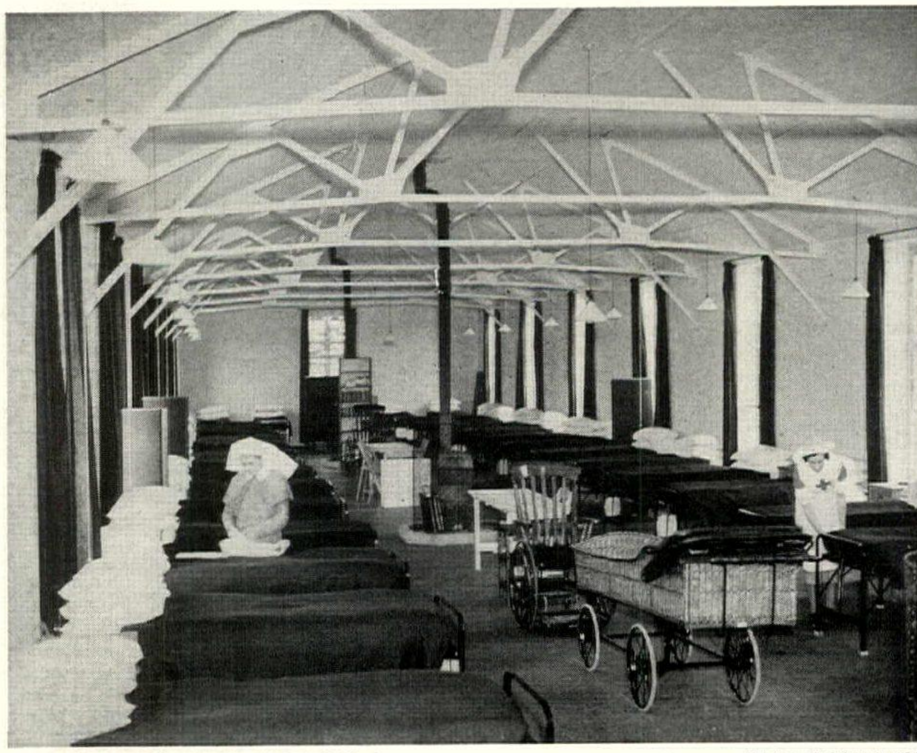
ALFRED S. GRUNSPAN, ENGINEER



## EMERGENCY HOSPITALS



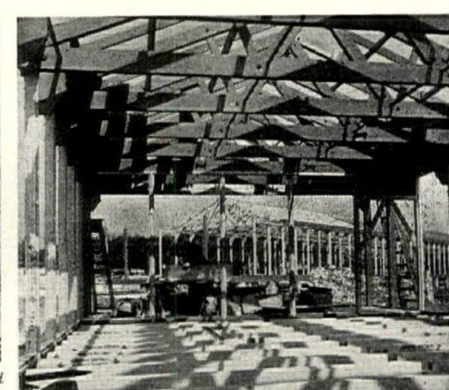
Steel, "hut type" emergency hospital

*Photos, British Combine*

During an emergency, the discharge of all but the most seriously ill patients would make much room available in existing hospitals for the care of civilian war casualties. However, in some areas new hospitals might be necessary. Restrictions on the use of critical building materials will probably dictate that these new buildings be of one or two story frame construction. Shown above and to the right is one of England's "hut type" emergency base hospitals built of corrugated steel siding on a steel frame and roofed with steel sheets. While this building offers considerable protection against fire, its steel construction is out of the question as far as U. S. duplication is concerned. A more likely prototype is the prefabricated frame building shown below, 22 of which were erected in one hospital group in England by the American Red Cross. Together, they make room for 9 wards, staff quarters and auxiliary buildings. Walled with a fireproof material, each building or ward is equipped with its own light, heat and water supply system, can therefore carry on independently of the others in case of bombardment.

New hospital buildings should be located in rural areas, hidden from aerial observation by camouflage. In site planning, enclosed courts should be avoided. Windows may be of the usual size but should be designed to open flat against the walls and should be divided into smaller-than-average panes as a bomb-blast precaution.

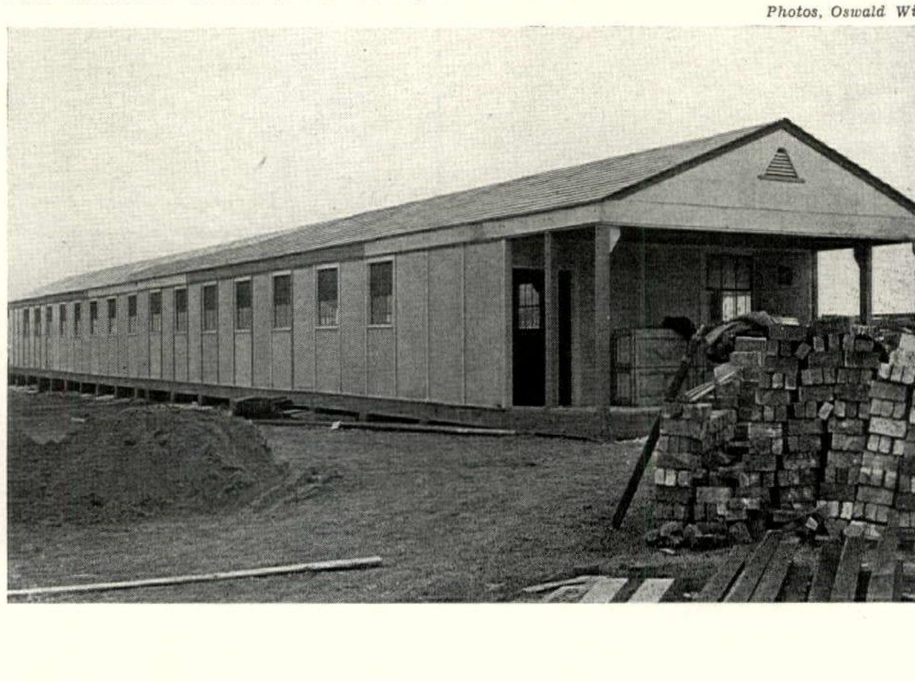
*Wide World*



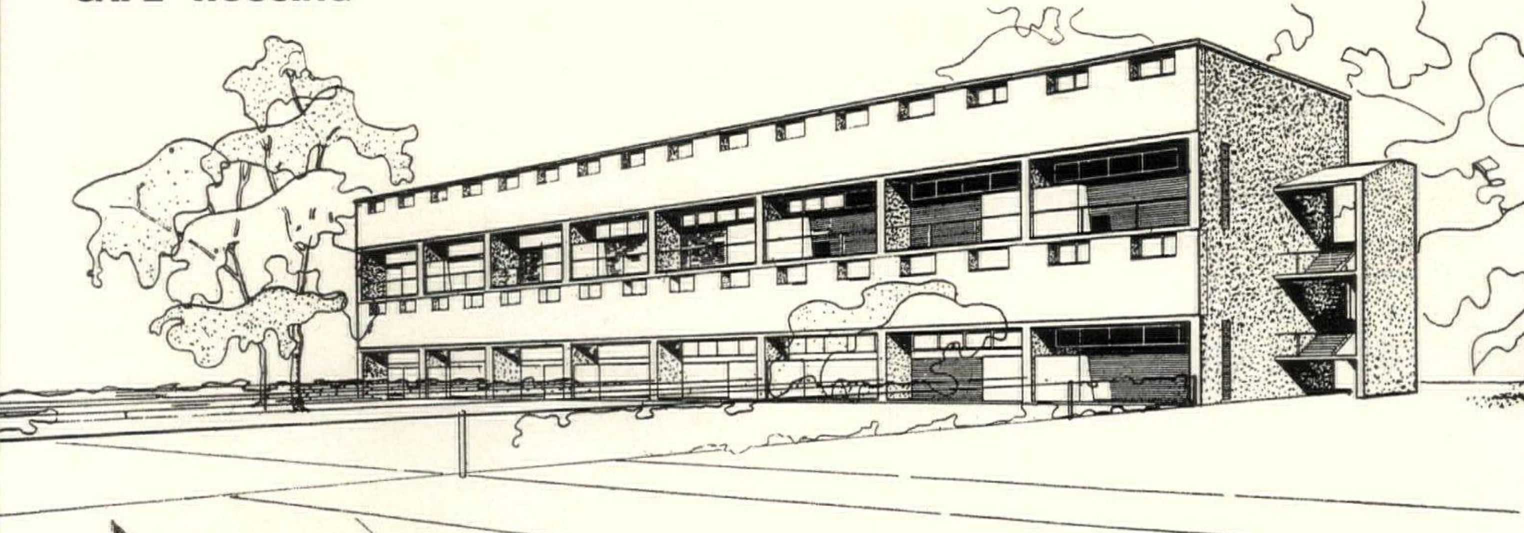
AMERICAN RED CROSS HOSPITALS, ENGLAND

PHC HOUSING CORP., (NEW YORK) PREFABRICATORS

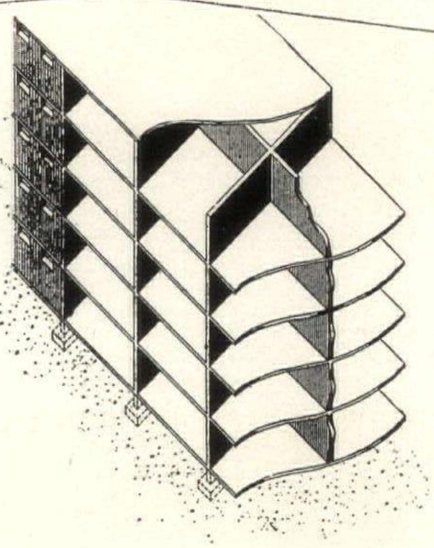
*Photos, Oswald Wild*

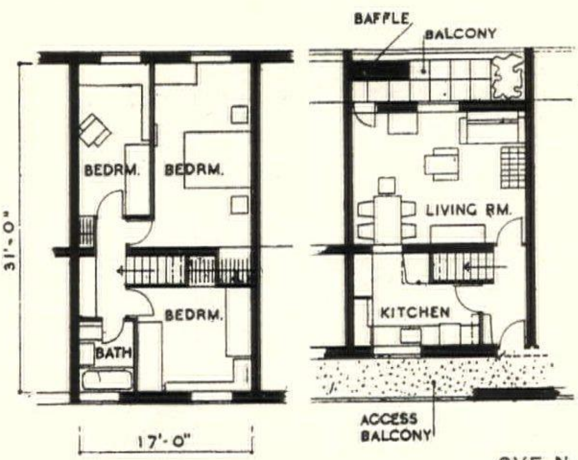


# SAFE HOUSING



*Architect's Journal*






OVE N. ARUP, ENGINEER

Cut-away section illustrates principle of construction which provides protection on the order of that afforded by splinter proof shelters for new buildings of various types, as devised by British engineer Ove N. Arup, author of "Safe Housing in Wartime." Floors and interior walls are of reenforced concrete, while exterior curtain walls are of brick with horizontal "slit" windows. Theory is that these small windows minimize the effect of bomb fragmentation and provide an outlet for possible bomb explosions inside the building, while the brick construction permits the windows to be easily enlarged for peace-time use. The "cross walls" would localize the effect of direct hits and near misses.

Application of Engineer Arup's principle is shown in the 16 family building above. Divided with thick masonry party walls, each of the eight cells contains two two-story houses, one above the other. All windows are horizontal slits, but the living room is set back of an open balcony from which the family may enjoy the view and fresh air when air raids are not in prospect.

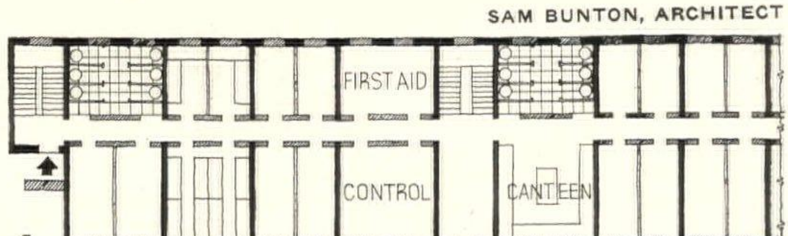
At the right are sketched three stages in the war-to-peace transformation of a building proposed for construction in Clydeside, Scotland.

Stage 1: An air raid shelter for immediate use with all windows filled with masonry.

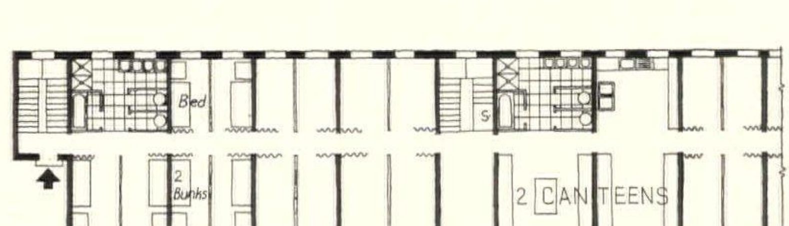
Stage 2: After baffles have been removed and windows "knocked out," the building may serve as a hostel during the transitional period between war and peace.

Stage 3: Removal of minor partitions and erection of some new ones along with the installation of bathroom equipment converts the building into a peace-time apartment house.

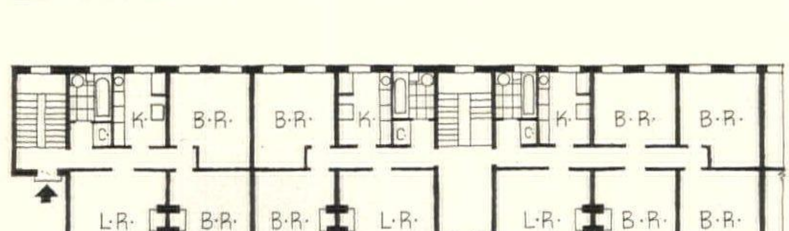
SAM BUNTON, ARCHITECT




**1.** AIR RAID SHELTER




**2.** HOSTEL

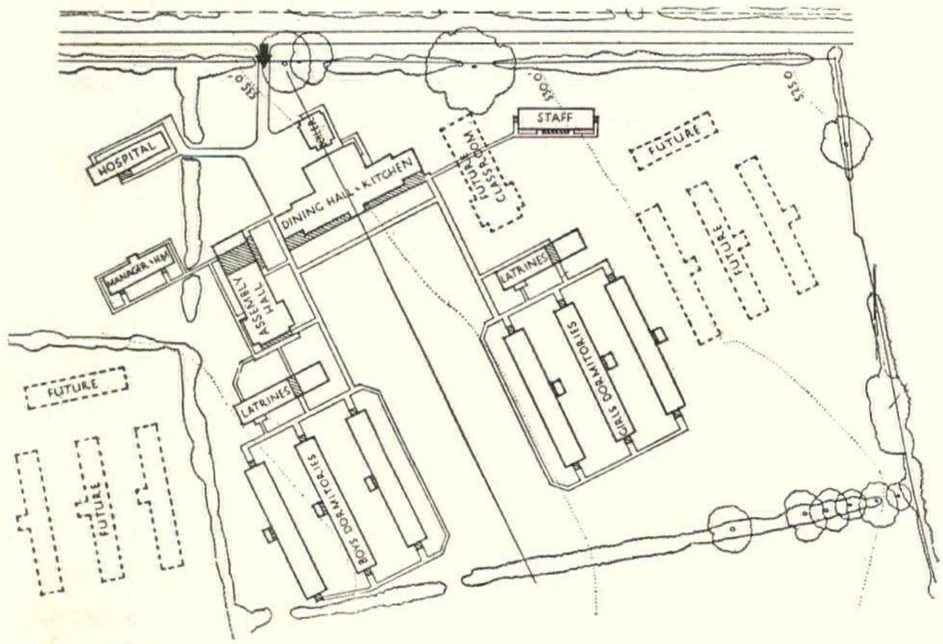



**3.** APARTMENT

Evacuation presents a whole series of staggering problems. The removal from danger areas of children between five and sixteen, mothers with children under five, and invalids means a movement of millions of individuals, the preparation of the requisite number of dwelling and other facilities in the interior, and the organization of transport on an unprecedented scale. In this respect the British experience, unsuccessful as it was, offers valuable lessons. Shortly after Munich, work was begun on a scheme to take care of 3,000,000 evacuees. The country was divided up into danger, neutral and reception zones, the last being canvassed for available living facilities. All children and mothers were registered, 30,000 special trains were arranged for, and trucks, buses and private cars were used as well. Difficulties began, not with the movement of people, which was very well organized, but with the necessary adjustments to be made thereafter. These have been sufficiently well publicized to need no repetition: the behavior of city children in a new environment, the annoyances to their hosts, the lack of educational facilities for them, etc. The result of all the trouble taken was the return, after a few months, of about five-sixths of those who had left the big cities.

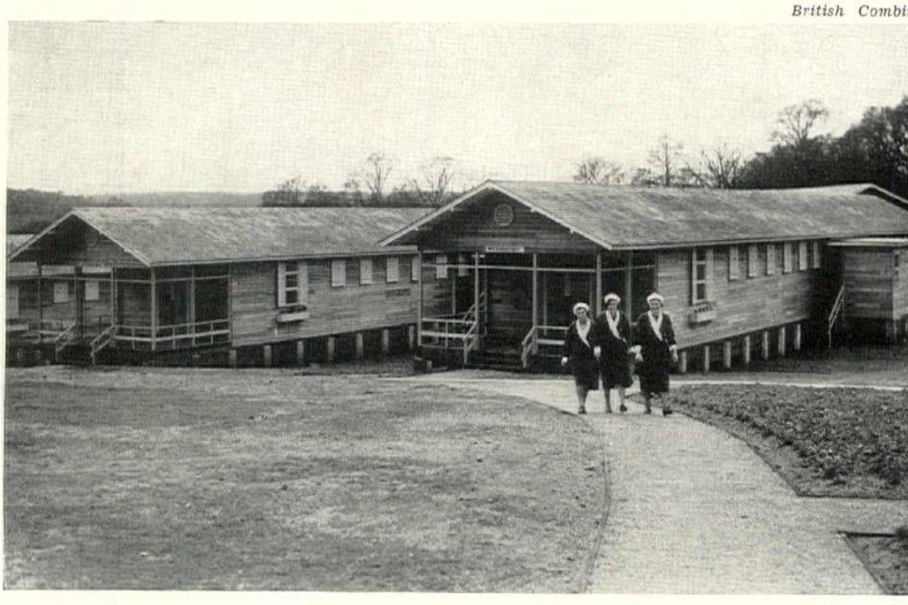
An analysis of the causes for the drift back to the cities led to several widely held conclusions. Chief of these was that billeting had to be replaced with special centers, with dormitories, classrooms, trained personnel, etc. A major objection of parents hinged on the necessity of leaving children subject to the whims of a strange housewife. Visiting was also difficult under such conditions. There seemed to be much less objection to the idea of evacuation centers where children would receive adequate, and equal care. The other conclusion was that if the government was unwilling to spend the $400,000,000 estimated as necessary for such centers, and to make attendance for children compulsory, every school in the danger area should be given full air-raid protection.

Applied to American conditions, these conclusions are valuable. Should the government decide that evacuation of certain areas is desirable, we are far better equipped with camps, country houses, resort hotels and similar facilities with which to meet the first rush of evacuees. In addition there are such establishments as the CCC camps, which could be taken over. And finally, the shortage of labor, non-strategic materials and experience, with which to build the necessary additional centers are not as acute as they were in England.




**Camp at Hertfordshire, H. P. G. Maule, Architect.**

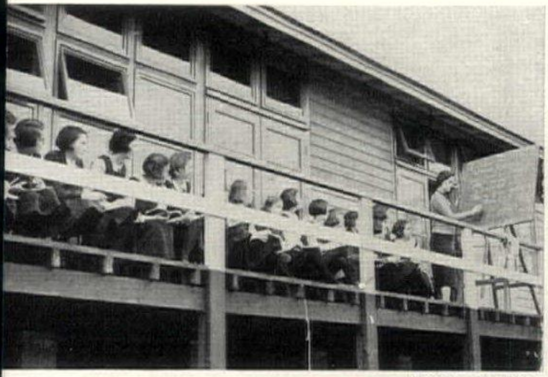
*British Combine*



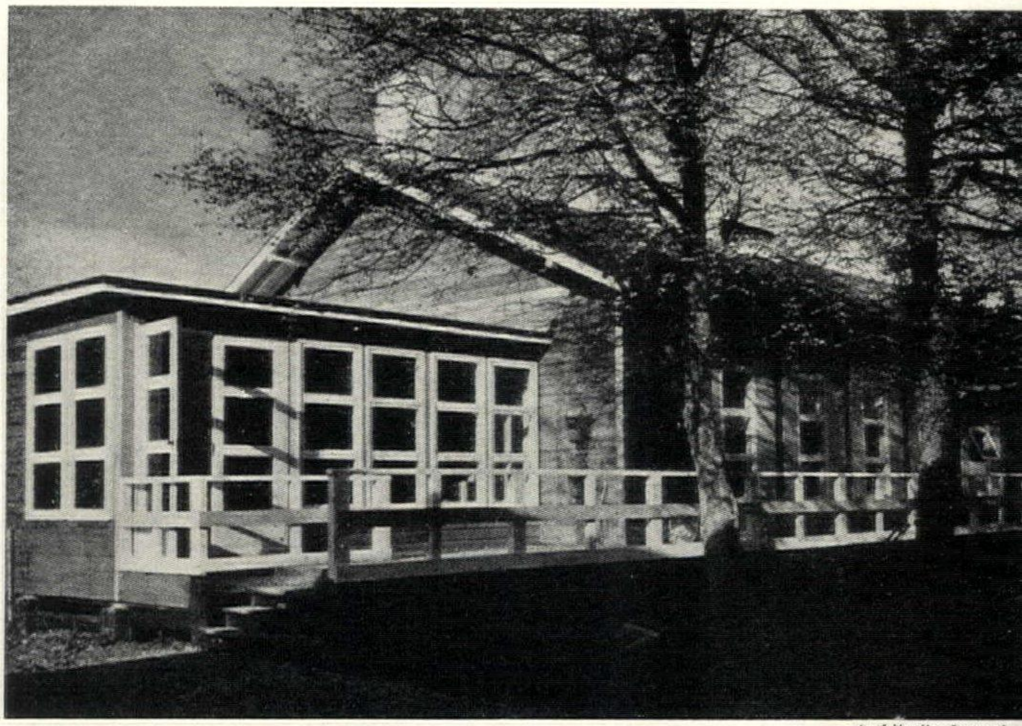
**Sheephatch Camp,** near Farham, Surrey, together with most British evacuation centers, was completed too late to be of much use.

*W. J. Mead*

**1500 CCC Camps,** like Camp Roosevelt, Va., (right), could provide quarters for about 270,000 evacuees in ideally rural locations.



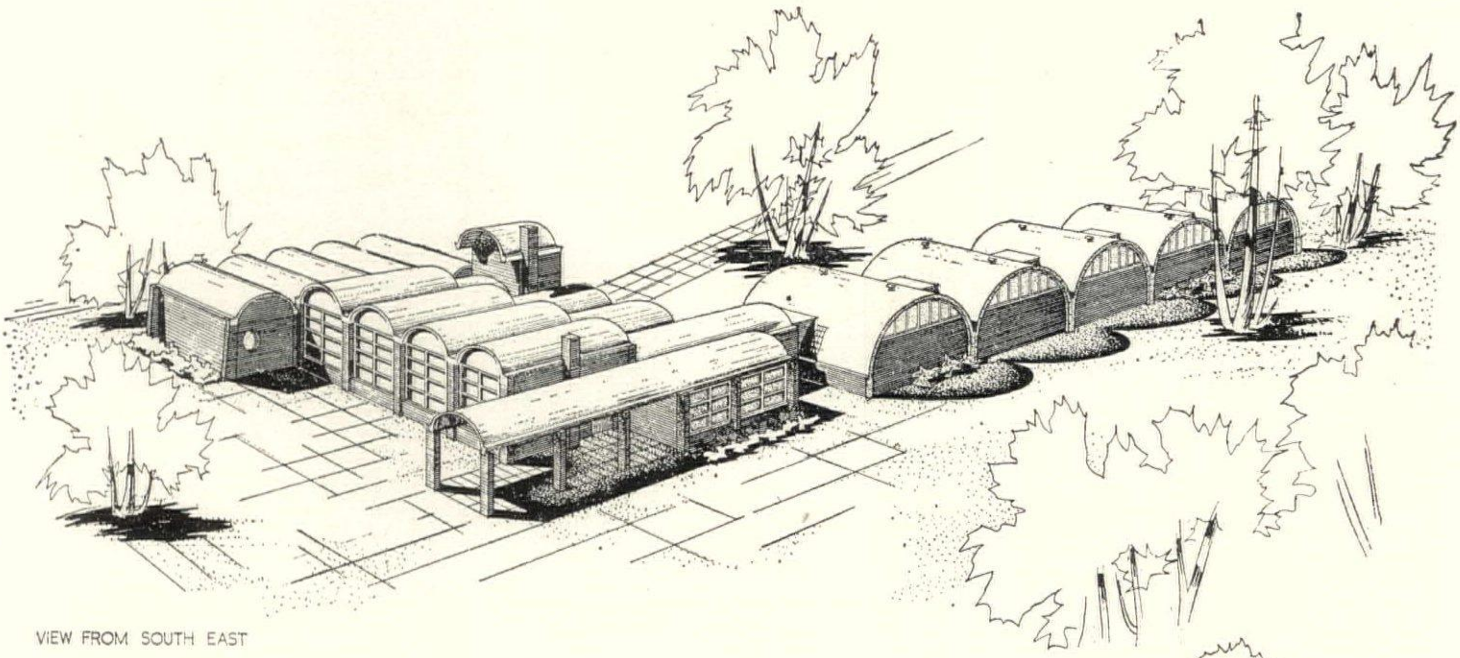
*British Combine*



*Architect's Journal*

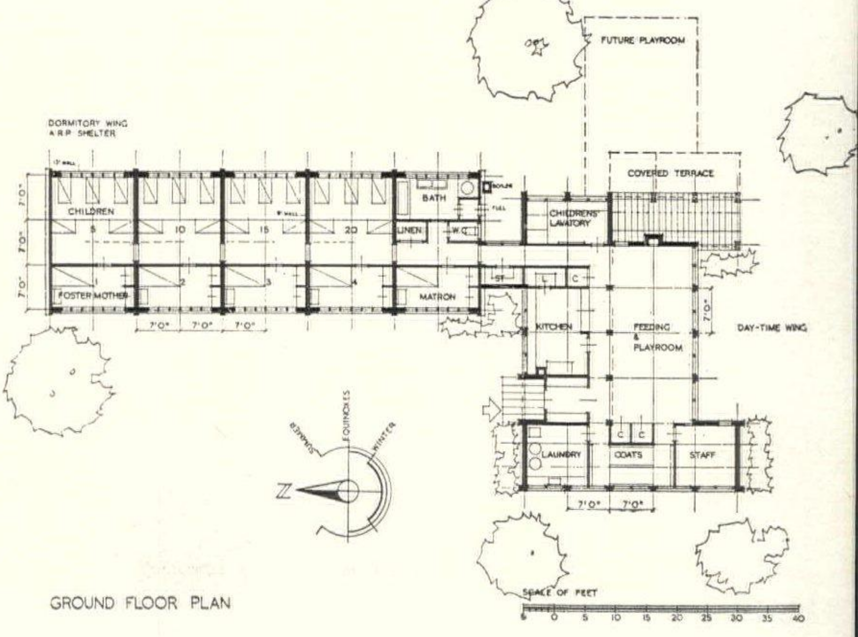
This evacuation camp for girls shows a very simple handling of wood not unlike that developed in this country. There is no glass shortage in England, and Architect T. S. Tait took advantage of the fact to create a very well-lighted series of rooms.

T. S. TAIT, ARCHITECT



VIEW FROM SOUTH EAST

BIRKIN HAWARD, ARCHITECT




GROUND FLOOR PLAN

**Residential nursery school** designed by Birkin Haward, submitted as part of a report on evacuation by the British Association of Architects, Surveyors and Technical Assistants. The building has full-time facilities for 40 small children and a staff of ten or twelve. Most interesting is the manner in which the designer attempted to avoid use of strategic materials, which in England include timber as well as metals. Walls were therefore specified as brick, stone, precast blocks, etc., and roofs were limited to self-centering block arches or a structure of prefabricated plaster. Windows and ventilators are separated in the design. All glass is in fixed sash.

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. . . a compact synthesis of the best British Government practice and the U. S. engineers' theories and tests. Some of this data has since been revised as results of subsequent tests.

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. . . this contains the most complete compilation of all the European thinking on Air Raid Precautions up to the time of British blitz. The most important of the British Government instructions are included, as well as other current British theories and schemes. The book is fully illustrated with photographs, diagrams and plans.

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. . . an analysis of ARP, with the best thinking abroad compactly condensed. A good textbook. Few illustrations.

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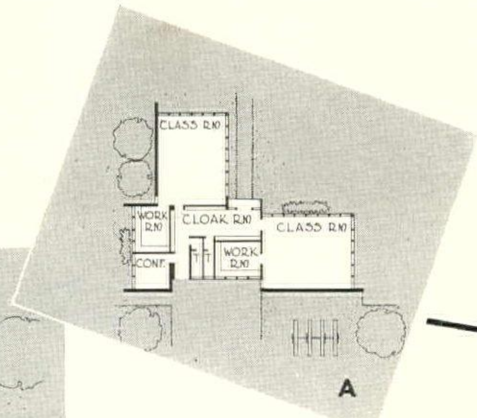
(*Continued on page* 60)

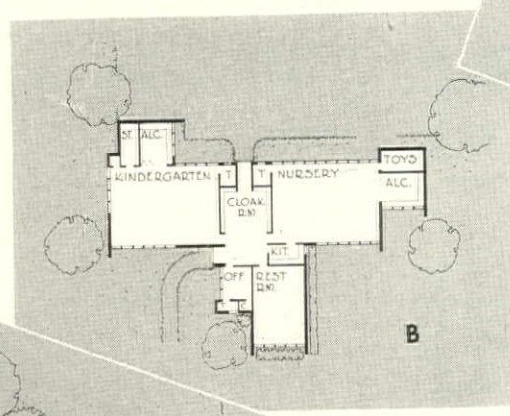
THE UNITED STATES GYPSUM COMPANY
PRESENTS A STUDY FOR

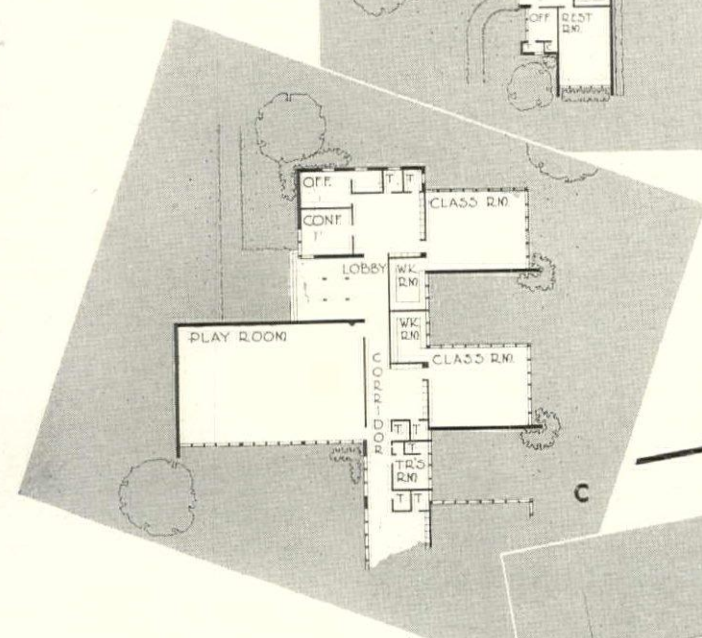
# A Park-School

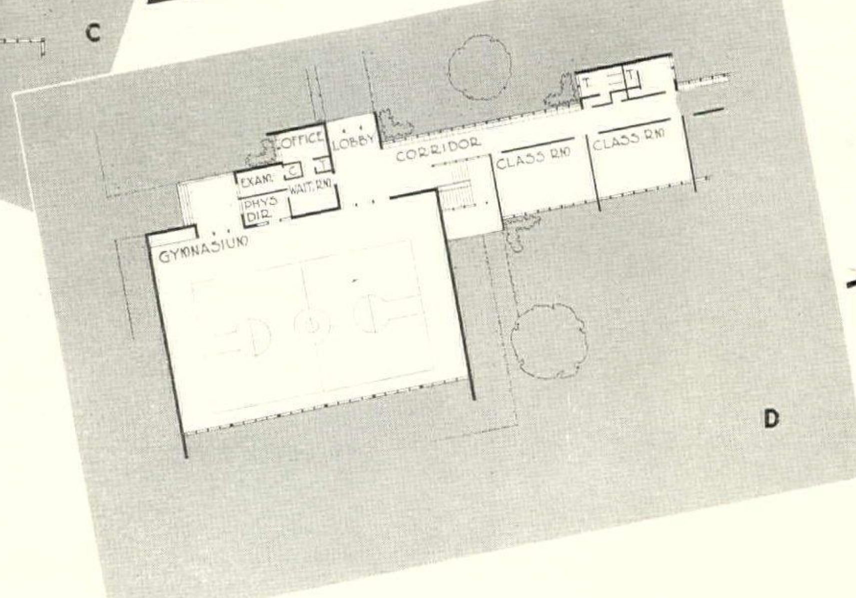
## FOR POST-WAR AMERICA

*By* Perkins, Wheeler & Will, *architects*
McFadzean & Everly, *consultants*




**A.** Separate classroom-cottages for each lower grade aids adjustment from home to school.

**B.** Nursery School and Kindergarten cottage an independent, self-sufficient unit.

**C.** All classrooms oriented to morning sun. Intermediate grades share separate playroom.

**D.** Gymnasium planned for child and adult use. Upper grades continue activity program.

**E.** Community House — Constant inter-association of children and adults, working on arts, crafts, music, drama, literature, induces appreciation of unity of all art and living.

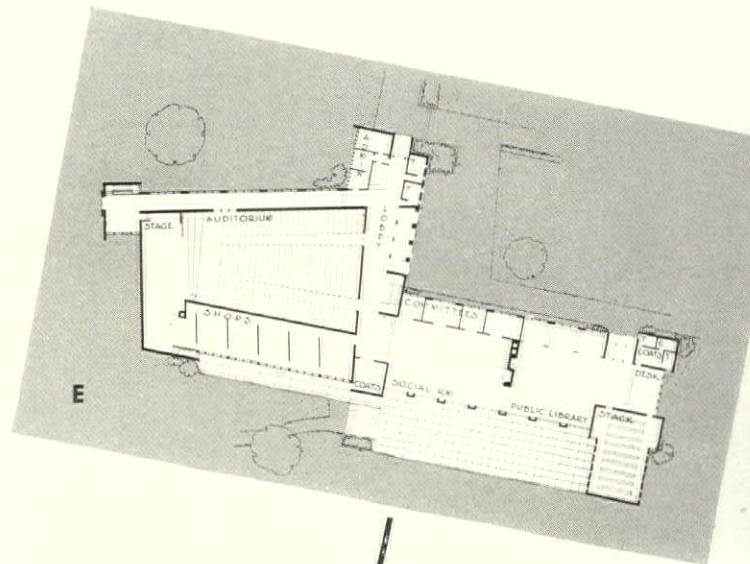
**For Better Living** All community agencies in post-war America must accomplish more with less . . . contribute more than ever to a richer, happier community life . . . take less than ever from the taxpayer's dollar.

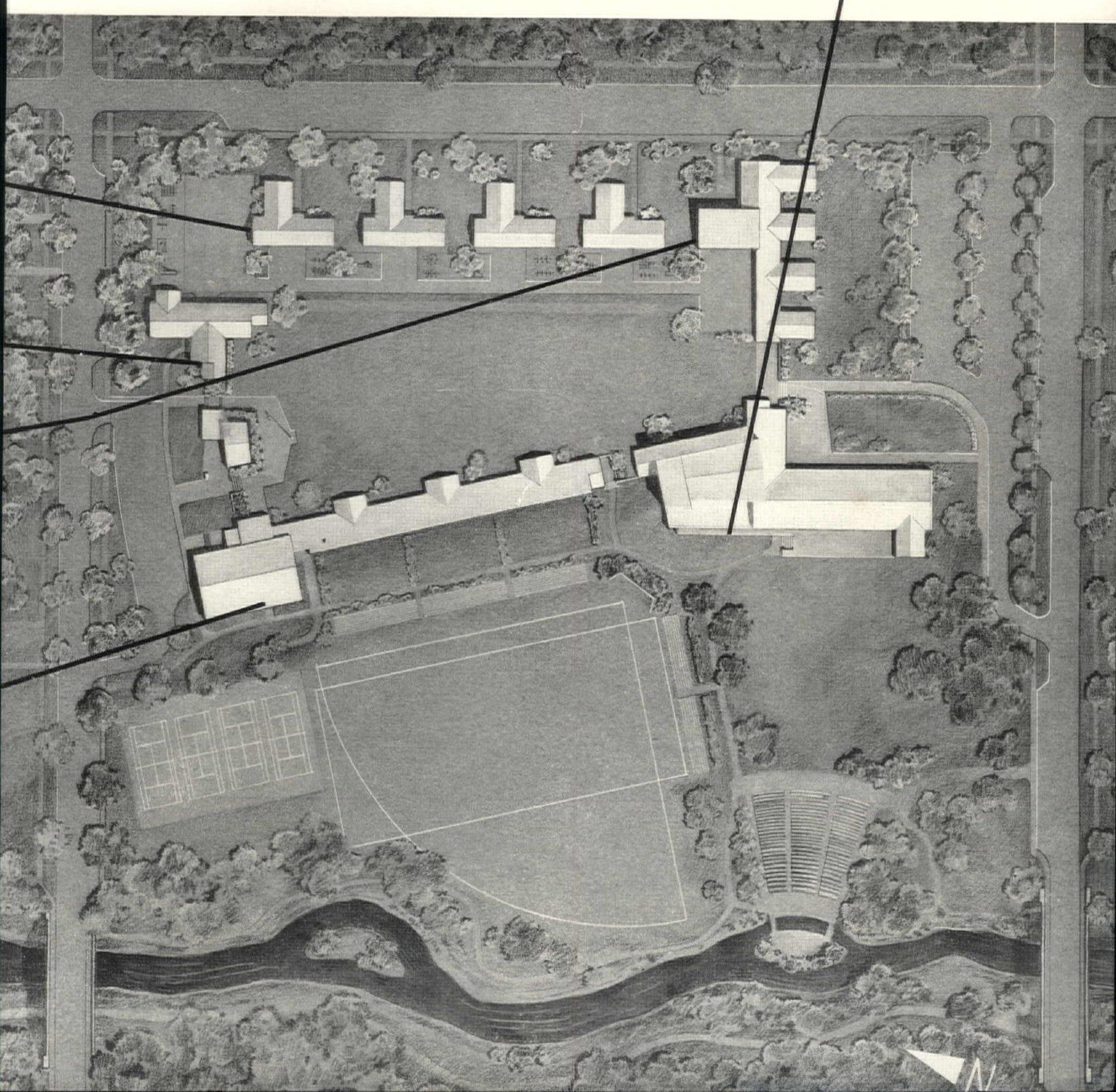
Americans have wasted billions in overlapping school, park, library, and recreational facilities that lie idle half the time.

This study proposes focusing the educational, recreational, and cultural life of an American community on the campus of a "Park-School."

Here classrooms, workrooms, community house, auditorium, public library, art gallery, gymnasia, play fields, gardens, and outdoor theater are used by all the community, children and adults, day and evening, the year round.

By pooling resources, by sharing facilities, each agency strengthens the other in their common goal—preparing children for better living . . . providing a richer community life for them to enter. Each does its job better, more efficiently, at a lower cost.

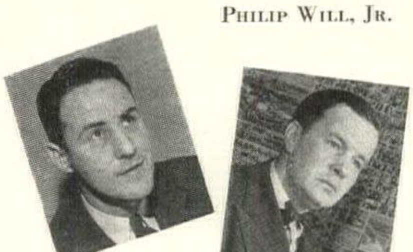


**PERKINS, WHEELER & WILL**
Chicago architects who contributed to the educational planning of Crow Island School, Winnetka, Illinois.

McFADZEAN & EVERLY, consultants, who developed "Park-Schools" in Glencoe, Illinois.

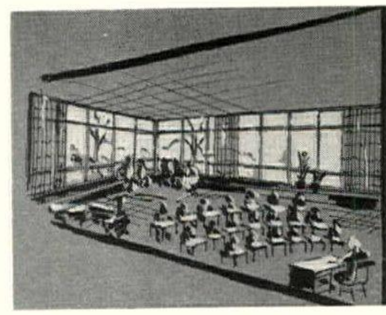
Lawrence B. Perkins
E. Todd Wheeler
Philip Will, Jr.



John McFadzean
Robert Everly

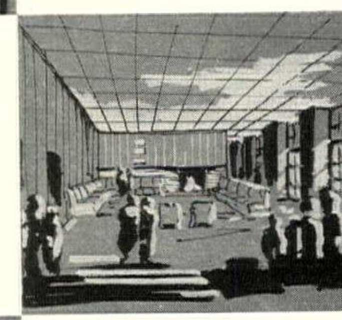
## CENTER OF ALL COMMUNITY ACTIVITY

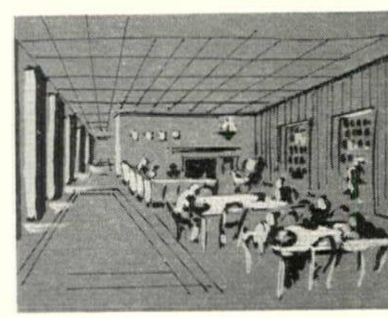
is the large community house, its lounge and terrace the informal meeting place of children and parents, of athletes, scholars, craftsmen. Public library, theater, art-craft shops, music rooms, clubrooms, and kitchens offer each member of the community opportunity for greater individual self-expression and richer group associations.



**Classrooms**—Centers for growth and experience. Friendly colors in Texolite. Homelike character. Structure and materials obvious to youngest child.

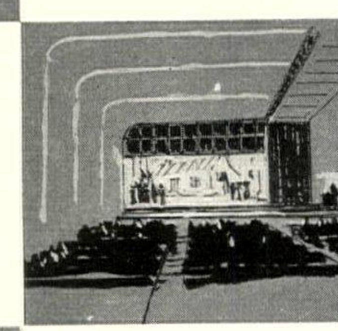
**Community Lounge**—A large, informal clubroom adjoining library, social terrace, auditorium. The focal point of all community social activity.

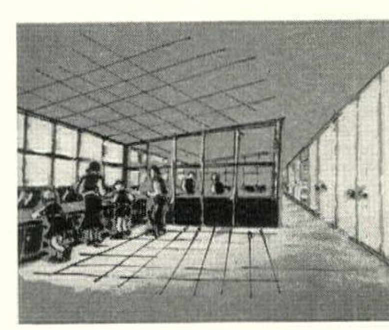




**Public Library**—Combined with school reading room, offers children and adults greater combined resources. Adjacent to community lounge, invites all to enter.

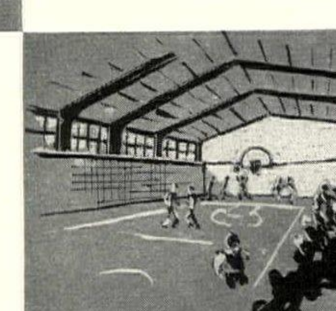
**Auditorium**—Visually and acoustically this assembly room must serve equally well a six-year-old's recitation or the annual concert of the town band.

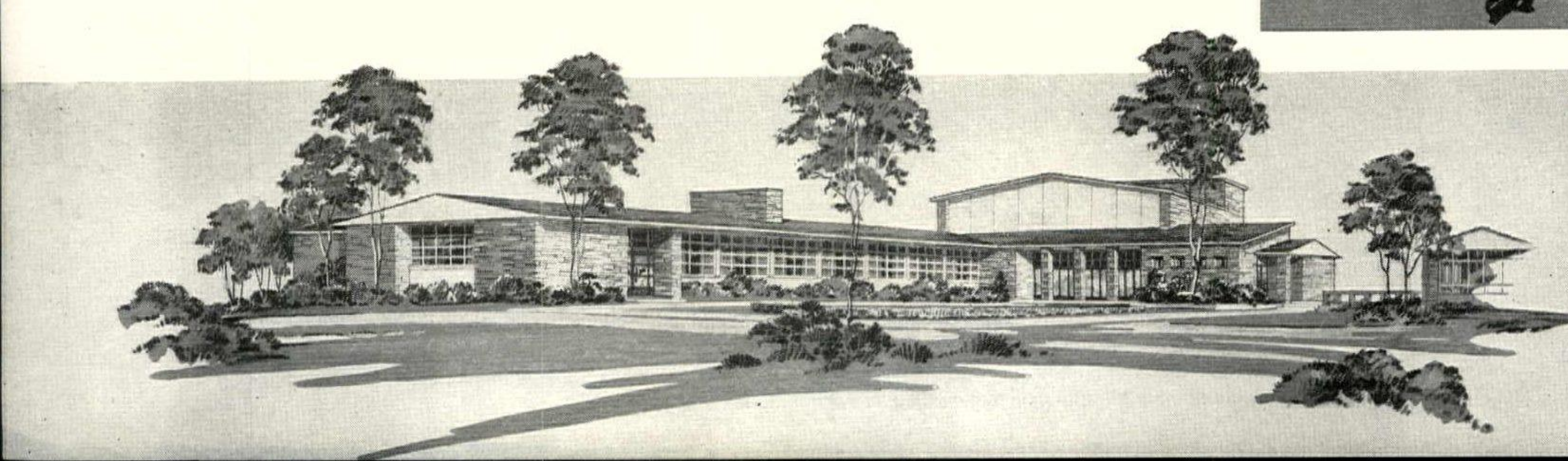




**Shops**—Arts and crafts, for both education and recreation, are carried on side-by-side to show the identity between handicraft, arts and fine arts.

**Gymnasium**—Playrooms, and play fields all emphasize wide individual participation more than spectator sports. Park Board operates playgrounds.





| CHILD USE | ADULT USE |
|---|---|
| Group and individual arts, crafts, music, study, play in an "activity" program in which children follow their interests, learning by doing. | Evening classes in languages, citizenship, literature, vocational studies, discussion groups, committees, dramatic rehearsals, music clubs. |
| Individual, informal study, reading, discussion. Consultation with teachers and parents. A place for displaying and viewing child work. | Here one pauses momentarily, enroute to library, little theater, shop or gym to relax, read, chat, or to enjoy soft, recorded music. |
| Reading time and study periods, corrective reading, story groups. Central clearing house for books, recordings, films, visual material for all ages. | General reading and circulating library supplemented by films, recordings. Greater use stimulated by proximity to all community recreational activity. |
| The peaks of school life come here. The child realizes his relation to the community as a whole through dramatics, music and visual aids. | Maximum usefulness to the entire community the year round, dictates careful provision for little theaters, lectures, concerts, forums, motion pictures, and church services. |
| Older children prepare their hands for useful work by making models and paintings for themselves. Youngsters become familiar with handicraft by association with tools. | Adults enjoy handicraft and art hobbies, work together, or with their children, to make scenery for the minstrel show, or furniture for community house. |
| Indoors and outdoors, children learn individual and group sports that will prove enjoyable health-builders throughout life. | Modest fees for basketball, handball, badminton, tennis, squash racquets, billiards and bowling help finance expanded community facilities. |

## CONSTRUCTION AND MATERIALS

Quick egress, with all students on the ground floor, makes it possible to utilize the full 1 hr. fire protection given frame constructions by Perforated Rocklath and Red Top Gypsum Plaster, (Pg. 12, Sec. 9, Cat. 14, 1942 Sweet's.) for (1) safety, (2) low insurance rates and (3) lower costs. All of the buildings, except the Community House, will have wood stud exterior walls and wood joist floors and roofs.

For the Community House the walls of the auditorium are masonry with wood trusses supporting the roof and the auditorium ceiling.

### *Exterior Walls*

Exterior faces of auditorium walls are of native stone except for gable ends and areas under windows, which are in Oriental Stucco, as shown in construction EW 2 on page 11, Catalog 14, Section 9, 1942 Sweet's. The interior of the exterior walls are furred as shown in construction IW 20, on page 10 of Catalog 14, Section 9, 1942 Sweet's.

In all other buildings exterior walls are generally stucco with contrasting areas in field stone. See construction EW 8, page 11, Catalog 14, Section 9, 1942 Sweet's, and page 30, same catalog, for full color card.

### *Partitions*

Wood stud partitions with Perforated Rocklath and Red Top Plaster and Red Top Prepared Trowel Finish will provide a full hour fire rating.

### *Ceilings*

U S G construction C 3 on page 6 of Catalog 14, Section 9, of the 1942 Sweet's is utilized throughout the smaller buildings. It provides ample fire protection, and, when combined with Red Top Blanket Insulation (see below), will make the economies of radiant heating all the more effective.

### *Heat Insulation*

Within the stud walls and in the joist spaces Red Top Insulating Blankets (page 9, Catalog 14, Section 9, and Catalog 10, Section 10, 1942 Sweet's) incombustible and enclosed with an effective vapor barrier on the warm side and vapor permeable material on the cold side provide a high degree of insulation protected against condensation difficulties. For the ceiling of the assembly room metal cross furring, metal lath and plaster with Red Top Blanket Insulation is indicated. (Assembly C19, page 7, Cat. 14, Sec. 9, 1942 Sweet's.)

### *Acoustics*

Ceilings in the class room buildings to be Sabinite, Acoustical Plaster in Standard Cream, and/or Quietone (see page 6, Cat. 52, Sec. 10, 1942 Sweet's) as selected. Auditorium and library to have Motif'd Acoustone (page 2, Cat. 52, Sec. 10, 1942 Sweet's) ceiling with painted Acoustone walls. Shop and gymnasium acoustical treatment to be Perfatone appropriately painted.

### *Painting*

The glossless, colorful finish of Texolite (Cat. 31, Sec. 17, 1942 Sweet's) is utilized throughout the entire project to provide the "warm, friendly" colors. Stenciled silhouettes (black Texolite) in appropriate juvenile themes are used in the wall dadoes of the Kindergarten rooms. All painted areas to have a prime coat of K-Cemo Primer (Cat. 31, Sec. 17, 1942 Sweet's).

### *Roofing*

Twenty year built up asphalt roofs with 1" Weatherwood Roof Insulation (Cat. 25, Sec. 10, 1942 Sweet's).

## UNITED STATES GYPSUM

USG

*This famous trademark identifies products of United States Gypsum—where for 40 years research has developed better, safer building materials.*

PLASTER • LATH • WALLBOARD • INSULATION • ROOFING • PAINT

## BLACKOUT

*(Continued from page 8)*

as sacking may be pressed into a bituminous emulsion spread over the glass. Since this type of installation offers considerable resistance to splintering, the War Department recommends it as "a suitable method for use on factory skylights." 4) Finally, several commercially available liquid composition materials which contain rubber latex — preferably prevulcanized or including vulcanizing ingredients — may be quickly sprayed or brushed on glass. When dry, the material is both opaque and elastic and may be easily peeled or rubbed off.

While paper and cardboard obscuration materials should be applied to the inside of glazed areas to avoid deterioration, it is suggested that additional resistance to splintering may be obtained by similar applications on the exterior. Major limitations of these glass-coating obscuration methods are the impossibility of window ventilation during blackout and the elimination of natural light during the day.

**Shades and curtains** of heavy building paper or opaque fabrics have the added advantage of flexibility — they may be adjusted to admit natural light during the day—and are currently recommended for use in dwellings and hotel rooms. To insure complete obscuration, they should overlap the glazed opening by about 6 in. on all sides. If fixed at the top and weighted at the bottom, shades and curtains will return to their proper positions after a blast but they will not prevent the penetration of wind and rain nor remain light-tight if a breeze is blowing through the broken window. Moreover, they do not easily lend themselves to ventilation, are therefore recommended only where blackouts of comparatively short duration are anticipated. At considerable effort, these disadvantages may be overcome by the provision of light-trapping ventilators at head and sill and masking boards at the jambs (see details, p. 9). Portable curtains may be made by tacking rubberized cotton fabric to two wooden uprights which may be wedged into the wall openings during a blackout and rolled up for convenient storage during the day.

**Rigid screens,** panels and shutters, are unquestionably the most satisfactory means of obscuration—where blackouts are frequent and lengthy and where work must proceed despite them. Reasons: 1) They permit the opening of windows during blackout, thus diminishing the effect of blast and facilitating ventilation through built-in light-traps. 2) They will provide protection against the elements, if the glass is broken — an important factor since the immediate replacement of glass is foolish, if not impossible, during periods of frequent bombardment. 3) Hung elastically on rings cut from tire inner tubes and secured in place by ball catches, these screens will blow out with blast but will remain against the opening and, if covered with stout materials, they may offer some resistance to flying pieces of glass.

Low in cost, blackout screens may be easily constructed of any inexpensive, flexible light-weight sheet material that is not subject to warping. If not rigid enough to stand by itself, the material should be mounted on a light wood frame and, in any event, its outside surface should receive one coat of oil paint as rainproofing. Recommended materials include: corrugated fibre board and double faced corrugated board (may be used without framing in conjunction with small 2 x 4 ft. windows), such thick cardboards as container board and clip board, insulating wallboard about ½ in. thick, dense pressed building board about ⅛ in. thick, plywood of any grade and thickness, opaque fabrics backed with wire netting of ½ in. mesh, and, with additional reinforcement via cross battens and corner braces, thin box crate boards, bituminous roofing felt and plaster board. Strong liner paper, at least .016 in. thick, is also suitable for framed screens in windows which are well protected from blast and weather by nearby outside walls. While strong and fireproof, asbestos-cement panels are comparatively brittle and will shatter if hit by bomb fragments.

Obscuration screens need not be heavily reinforced with elaborate framing. Says the War Department: "If the frame can be carried in the hands without flapping or distortion, it is strong enough." While they will usually be tailored to fit snugly into the reveal between window and inside wall face, the screens may also be applied directly to the window frame or the inside wall surface.

**Glass substitutes.** The permanent replacement of glass with opaque, non-shatterable, weatherproof materials is costly but is the best solution to the blackout problem posed by overhead skylights. Awkwardly located, these glass areas are difficult to treat with removable screens, difficult to weatherproof once broken, are dangerous from the standpoint of falling glass. Complete glass substitution may prove particularly feasible in flat-roofed industrial, commercial and apartment buildings where the skylights are small, widely separated and not absolutely essential for daytime illumination. In such cases the glass may be replaced by metal sheeting or bituminous covered boarding. Less satisfactory is the alternative provision of a fixed weatherproof external obscuration, an adhesive coating on the inside surface of the glass and an internal suspended protection against falling glass.

**Light locks,** or traps, such as those illustrated on page 12, must be provided at all doors subject to use during blackout.

*(Continued on page 44)*

## BLACKOUT

*(Continued from page 42)*

Where the entrance is a single door, the width of the light lock passage should ordinarily be 2 ft. 3 in. Screening partitions should extend to the ceiling or be capped with a hood, and all surfaces inside the lock should be painted a dull black.

### INDUSTRIAL BLACKOUT

Because their continual operation is essential to the war effort and because they are largely enclosed with glass, factories present tough obscuration problems. These problems must be completely solved to insure the feeling of security and confidence among the workers and, in turn, the maximum production and efficiency of machinery.

At the present time, only the simplest, least expensive types of obscuration (paint and screens) seem warranted, but preparation should be made now for more permanent blackout installations which will offer protection against blast, flying pieces of glass and incendiaries as well (see pp. 38 and 42). All necessary measurements of glazed areas should be recorded, plans should be drawn and material quantities tabulated, for, unlike installations in dwellings, offices and stores, factory blackout treatments are not easily improvised. In addition to obscuration, consideration should be given to the isolation and protection of inflammable materials, which, if touched off by a bomb, will nullify all other efforts at industrial blackout. Special protection is also in order for telephone switchboards and other essential elements of communication and control. If expansion of the plant is proposed, the feasibility of windowless and bomb-resistant construction should be carefully studied.

Before preparing for the blackout of an industrial plant, under today's conditions, decision must first be made as to whether daylight is essential to operation. (The fact that most plants are now operating efficiently at night is an indication that daylight is usually not essential.) If not, the glazed areas may be permanently obscured with paint. Spraying is quicker and cheaper than brushing, and application to the exterior surface will prevent reflections, assist in camouflaging the plant's existence.

A suitable one-coat exterior blackout paint may be comprised of 100 lbs. of black ground in oil, 50 lbs. of paste dryer, 2 gal. of turpentine, ½ gal. of boiled linseed oil and 1 pint of terebene. This will produce about 10 gals. of paint and will cover 700-800 sq. yds. at a material cost of about $18, or less than 3 cents per sq. yd. It is removed by a mixture of 5 gals. of benzene, 3.3 gals. of acetone, 15 lbs. of paraffin wax — a total of 10 gals. While they are equally suitable and may be re-

*(Continued on page 46)*

# AN ADVERTISEMENT THAT WILL

# *HIT HOME WITH HOME BUYERS*

● This ad is one of an eye-catching series that's selling GAS and Gas appliances to millions of prospective home buyers . . . *many right in your neighborhood!* Put Gas to work selling homes for you! Build it into your homes from now on . . . *it's the most widely accepted modern fuel!*


**FULL PAGE FOUR COLOR ADVERTISEMENTS LIKE THIS WILL APPEAR IN**—Life • Good Housekeeping
Ladies' Home Journal
McCall's
Better Homes and Gardens
Woman's Home Companion

**AMERICAN GAS ASSOCIATION**

## BLACKOUT

*(Continued from page 44)*

moved more easily by peeling, "elastic" paints are considerably more expensive, cost about 25 cents per sq. yd. A satisfactory one-coat blackout paint for interior use may consist of a pigment of carbon black and filler (57 per cent by weight) and a medium of four parts gum and oil to 6 parts volatile thinner (43 per cent by weight).

Another recommended method of permanent industrial obscuration is the brushing or spraying of glazed areas with a heavy asphalt emulsion applied cold to the exterior surface. While still wet, it is covered with a treated reinforcing membrane and topped with two more coats of the emulsion. Total material cost: about 30 cents per sq. yd.

In plants where daylight is deemed essential, obscuration may be obtained by the installation at night of any of the various types of framed screens discussed on page 38. The screens would naturally be larger than those used in residential and commercial buildings, but should not be too large for convenient handling and storage.

If the frequency of blackout and possibility of raids should increase, the costly installation of mechanically operated hinged and sliding shutters would be necessary for "daylight" plants (see p. 11). Under these same air raid conditions and where daylight is non-essential, glass substitution (see p. 38) is the best answer.

No matter what method of industrial obscuration is adopted, natural ventilation will be almost impossible at night. If blackouts are apt to be lengthy, forced ventilation must be provided.

**Smoke control.** A definite indication of industrial activity, smoke is visible at night and may therefore defeat the purpose of blackout. There are two solutions to this tough problem, but neither should be entrusted to blackout amateurs as may most forms of light control. If smoke abatement is the solution recommended by civilian defense authorities, the problem should be handled by smoke control boards and technical combustion experts. The second solution is actually a form of camouflage whereby additional smoke sources are created to conceal likely targets or decoy smoke sources are established to confuse enemy airmen. Under the decision and direction of military authorities, this deceptive smoke may be generated from such fixed positions as tall buildings, captive balloons and existing factory chimneys or by mobile equipment, including trucks, automobiles, railroad trains, airplanes, blimps and boats.

**Glow and glare control.** Another knotty blackout problem is presented by steel mills and their slag dumps, the glow from which is frequently visible for more than

*(Continued on page 48)*

It's
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WASHINGTON NATIONAL AIRPORT
Statesmen, diplomats, big business men, little business men, dollar-a-year men, and all the thousands who fly in and out of the nation's busy capital city these days, pass through America's most beautiful airport administration building.
It's all Architectural Concrete—outside and inside. And there are five architectural concrete hangars now rapidly nearing completion—to serve the planes that use the port.
Speed and economy of construction, and the availability of concrete materials make architectural concrete the No. 1 medium for the hundreds of vitally needed airport facilities.
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For Washington National Airport Buildings—Louis A. Simon, supervising architect; Howard L. Cheney, consulting architect; Neal A. Melick, supervising engineer; John McShain, contractor.
4 PASSENGER ENTRANCE 2
THE GREAT SILVER FLEET

## BLACKOUT

*(Continued from page 46)*

25 miles under good weather conditions (fig. 4 p. 7). Glow also results from these industrial processes: sugar refining, oil and gas "mining," oil refining, coke production and brick and pottery baking. There is no general method of preventing glow or glare; but the logical first step is to rearrange the sequence of the various industrial operations, if possible, so that the phases producing glow will take place during the day. Further steps are suggested by methods employed successfully in Europe where 1) blast furnace glare and cupola top flames have been screened with large fireproof louvered hoods carried over the charging platforms, 2) glare from inspection holes, slag pipes and other side openings in cupolas have been screened with large sheds, 3) light from kiln chimneys has been obscured by asbestos sheet baffles, 4) open hearth furnaces, soaking pits and foundries have been blacked out by building louvered side walls and large roof overhangs. For sugar refineries, the War Department suggests that methods be developed for drawing off sugar being processed, so that boiler fires may be extinguished without damage to refinery equipment which caking of the sugar would otherwise produce. And, since heavy gasses released from oil fields without flaring do not rise rapidly in damp weather and therefore constitute a fire hazard, it is suggested that operators might prepare for blackout either by closing gas wells or by extending flare lines with 40 to 50 ft. risers.

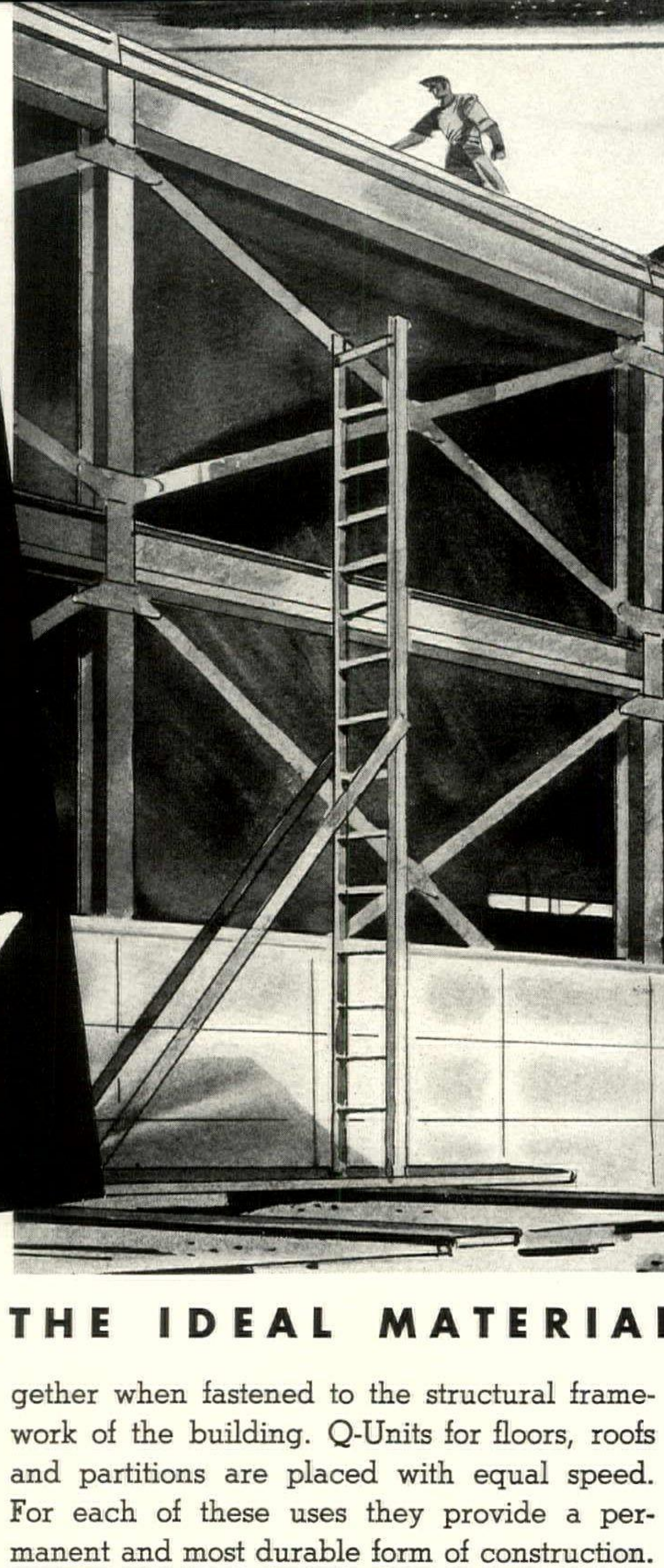
### PUBLIC RESPONSIBILITIES

Besides its many preparatory functions, including the passage of blackout legislation, provision for blackout enforcement and coordination of its own civilian defense activities with those of military officials and surrounding communities, a local government is responsible for the blackout of all publicly owned light sources. A wide field, this covers school buildings and court houses, airports and docks, street and traffic lights, power and water works, sewage plants and garbage dumps, transportation facilities and illuminated directional signs. Moreover, the local government is responsible for the marking and the lighting of many publicly owned objects which must be seen even in blackout — curbings, street obstacles, directional signs, etc. Typical solutions to a few of these special municipal blackout problems are illustrated on page 13; blackout of municipal buildings may be accomplished by obscuration methods already suggested. Suffice it to say that, since a local government will automatically set an example for the general public, it must be beyond reproach in its blackout provisions and must be even more stringent with itself than with the public in the enforcement of blackout.

# A Q-PANEL EVERY 9 MINUTES

## ENCLOSES NEW FLOOR SPACE

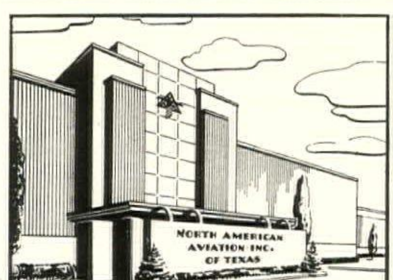
# *Quick!*



## THE IDEAL MATERIAL

Now you can "Specify Speed" and get "50 square feet of factory wall every 9 minutes." With the suddenly imposed demand for new plants and additions . . . "black-out" or "daylighted" . . . the speed of Q-Panel erection and the enduring qualities of Q-Panel construction will be factors in the all-out effort.

Each Q-Panel Section is a complete insulated structural unit, cut to the proper length and furnished in widths that facilitate easy handling and rapid placement. Interlocking lips on the edges of each section automatically lock them together when fastened to the structural framework of the building. Q-Units for floors, roofs and partitions are placed with equal speed. For each of these uses they provide a permanent and most durable form of construction.




This 23-Acre Aviation Plant at Dallas was built in 105 days for North American Aviation, Inc., J. Gordon Turnbull, Consulting Engineer; James Stewart & Co., Inc., General Contractors. Q-Panels were also used in the 32-Acre Plant for this company at Kansas City.

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## FOR "BLACKOUT" BUILDINGS

Q-Panel construction is well suited to use in a wide range of structures . . . aircraft buildings, munitions plants, powerhouses and other types of manufacturing buildings. *It facilitates winter building because it is "dry" construction.* No waiting for wet materials to set, no fire hazard from combustible forms. It is a permanent form of construction, for Q-Panels have a 100% salvage value.

Further details in addition to the cross section shown opposite will be gladly furnished together with cost estimates.

**H. H. ROBERTSON COMPANY**
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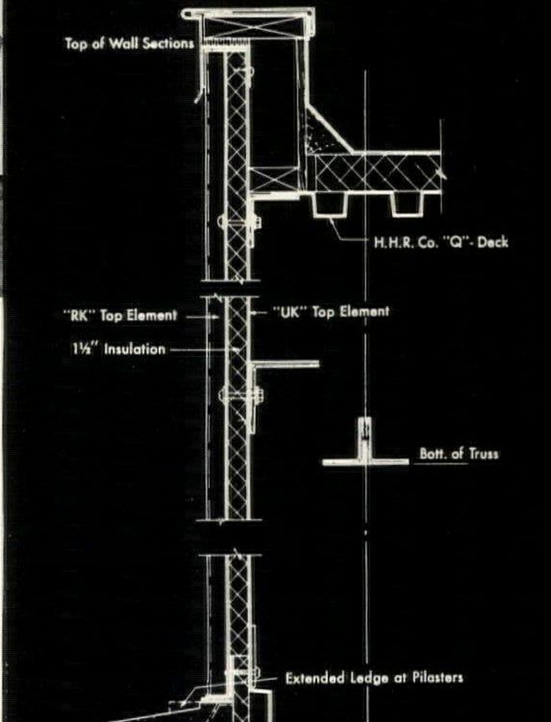
# –PANELS




TYPICAL WALL SECTION

## BOOKS

(Continued from page 20)

**THE NEW GARDEN ENCYCLOPEDIA,** Edited by E. L. D. Seymour. Wm. H. Wise & Co., New York, 1348 pp., about 750 illustrations. $5\frac{3}{4}$ x $8\frac{3}{4}$. Cloth, \$4.00. Leather, \$5.00.

A revised and enlarged edition of the well-known reference book. Subject matter is arranged alphabetically, in standard encyclopedia fashion, and is thoroughly cross-indexed. Descriptions are non-technical, and cover plant material, soil preparation, etc., with great completeness. The residential architect who concerns himself with the surroundings of his houses will find this an exceedingly valuable one-volume reference library.

**UNIT COSTS OF SCHOOL BUILDINGS,** by Henry H. Bormann. Bureau of Publications, Teachers College, Columbia University. 83 pp. $6\frac{1}{4}$ x $9\frac{1}{4}$. \$1.60.

The Teachers College publications on school and classroom design form a very valuable body of data. This new study, an analysis of methods of estimating costs, is the latest in the series. Nine methods of computing costs are investigated in considerable detail and their advantages and limitations discussed. Methods of comparison and research procedure are described.

**OLD CHICAGO HOUSES,** by John Drury. The University of Chicago Press. 518 pp., illustrated. $6\frac{1}{2}$ x $9\frac{1}{4}$. \$4.00.

A sentimental journey through the residential architecture of 19th century Chicago, more interesting for the people than

LOUIS SULLIVAN'S HOUSE

their houses. The illustrations, which leave a good deal to be desired, show the usual hodge-podge of styles characteristic of the period and include a few buildings of more lasting interest such as the Robie house by Wright.

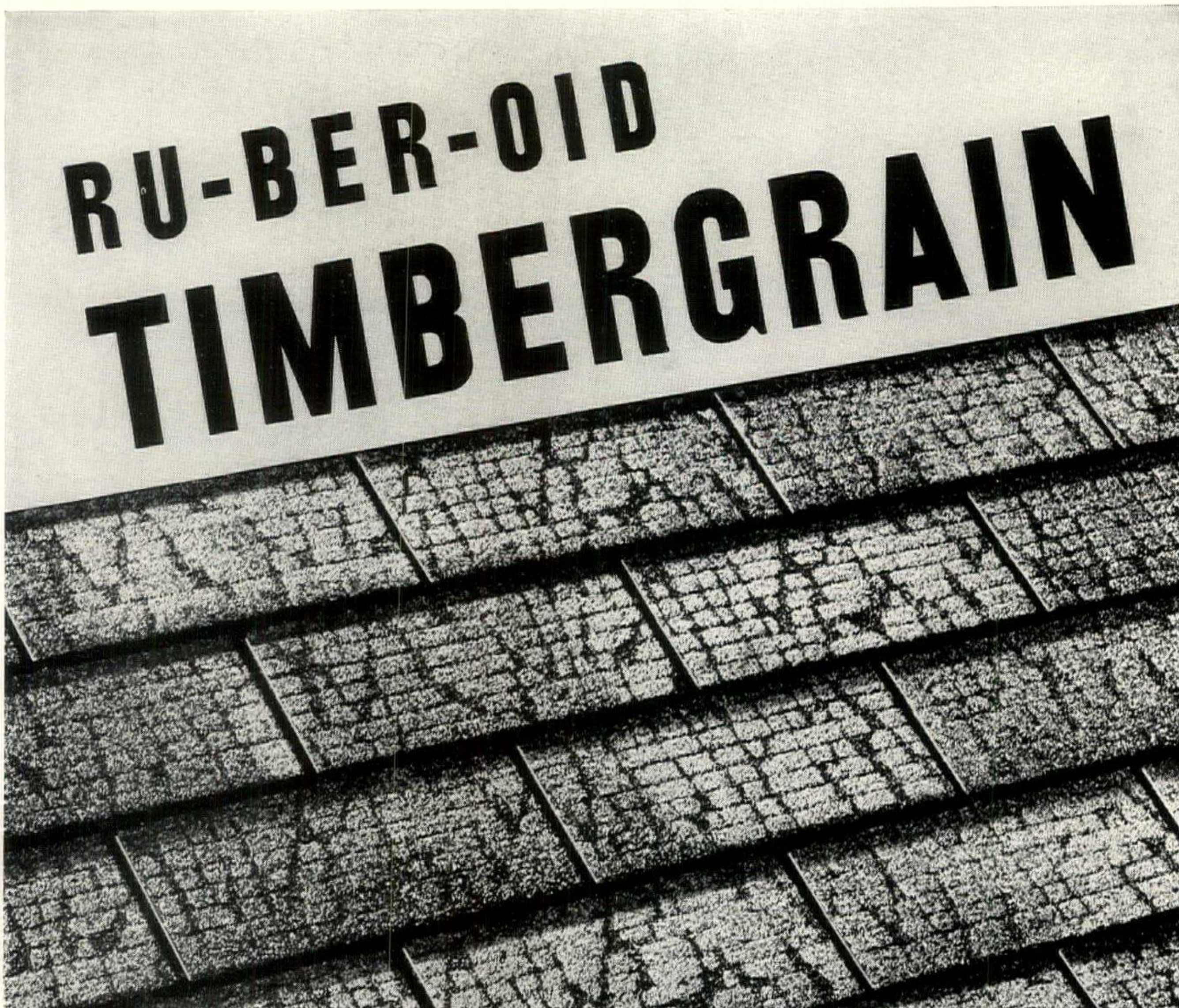
**ART TODAY,** by R. Faulkner, E. Ziegfeld and G. Hill. Henry Holt and Company, New York. 358 pp., illustrated. $6\frac{1}{2}$ x $9\frac{1}{4}$. \$2.60 College edition, \$3.50 Trade edition.

In their preface the authors comment on the phenomenal increase of interest in the arts during the past few decades. This book, which covers almost every phase of esthetic activity, not only gives substance to this observation, but is in itself significant evidence of the maturity which has accompanied the steady growth in popular interest. Unlike its many predecessors, it indulges in no dry recital of names,

HANGAR AT ORLY

places and dates, employing instead a far more rational approach which discusses the arts against a triple background of human needs, problems of design, and the possibilities and limitations of materials and processes. Within such a framework

(Continued on page 56)




# THE SHINGLE YOU ASKED FOR!

**1 You wanted an asphalt shingle of OUTSTANDING BEAUTY**

Timbergrain is! It is *revolutionary* in its beauty! All say, "It's the most beautiful asphalt shingle ever made."

**2 You wanted ROUGH, RUGGED TEXTURE . . . EYE VALUE!**

Timbergrain has it! Timbergrain's textured surface, in two-toned coloring, is rough, rugged, *built-up*—providing unusual transverse shadow effects!

**3 You wanted DEEP SHADOW LINES**

Timbergrain's thick-butts are accentuated by deep, black, *built-in* shadow lines, intensifying shadow depths on roof.

**4 You wanted CHARACTER and MASSIVENESS**

Timbergrain's extra-thick butts, with the deep shadow lines, provide a roof of character, distinction and massiveness.

# TODAY'S MOST TALKED ABOUT ASPHALT SHINGLE!

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"Go *all-out* for *enduring beauty* in an asphalt shingle!"

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Timbergrain has *everything* the building profession asked for in an asphalt shingle. A textured surface, in two-toned coloring, that is rough, rugged, *built-up*, providing transverse shadow effects. Thick-butts, accentuated by deep, black, *built-in* shadow lines. Character. Massiveness. Strength. Extra weather protection. Fire-safety.

Read—on these pages—each one of the five features that make Timbergrain so outstanding. And remember, this shingle comes in four attractive color blends—Greentone, Redwood, Bluetone, Slatetone.

For new homes—or homes being remodeled—Timbergrain is the year's sensation! Recommend and sell this style leader. Write for colorful folder and complete information. Address Dept. AF-1, The Ruberoid Co., 500 Fifth Avenue, New York, N.Y.

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SPECIFICATIONS:

| | |
|---|---|
| Size each Strip | 12″ x 36″ |
| Av. approx. weight per square | 250 lbs. |
| Strips per square | 80 |
| Bundles per square | 3 |
| Exposure | 5″ |
| Headlap | 2″ |

Available in GREENTONE, REDWOOD, BLUETONE and SLATETONE BLENDS

**5** You wanted INWARD LONG LIFE and DURABILITY

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ROOFING AND BUILDING PRODUCTS

Reg. U.S. Pat. Off.

# BOOKS

(*Continued from page 52*)

it is possible, for instance, to study city planning and ceramics as related activities, or to compare with sympathetic understanding churches built five hundred years apart, or to consider amateur photography with the same seriousness as Romanesque sculpture. The advantages of this contemporary approach to the critical analysis of art are impressive. There is no necessity for the author to favor one style against another, nor to indulge in confusing and unnecessary displays of erudition, nor for anything, in short, except to present the reader with


POSTER BY McKNIGHT KAUFFER

related facts which make sense in terms of average human experience. This the authors have done, and they have told their story in a lively and intelligent manner. The layman can read this book quite painlessly and come away with a vastly broadened comprehension of contemporary art and its relationship to the past and present. In addition, the book has the great merit of being inquiring rather than dogmatic, a fact which multiplies its educational value many times. The publication of "Art Today" should solve many problems for the educator and student, as it fills a large gap in the list of available texts.

### GARDENS AS ILLUSTRATED IN PRINTS,

**The Metropolitan Museum of Art. 20 plates, 5 x 7½. 25 cents.**

An amusing little booklet in which gardens of the sixteenth to eighteenth centuries are illustrated by contemporary engravings and other prints. There is a short introductory chapter in which Margaret H. Daniels outlines the develop-

ment of the garden during this period. The illustration shows an engraving of the fountain and bosquet at Belvedere, a conventional scheme of clipped hedges and trees which suggests in a very curious fashion some of the most advanced features of architecture today.

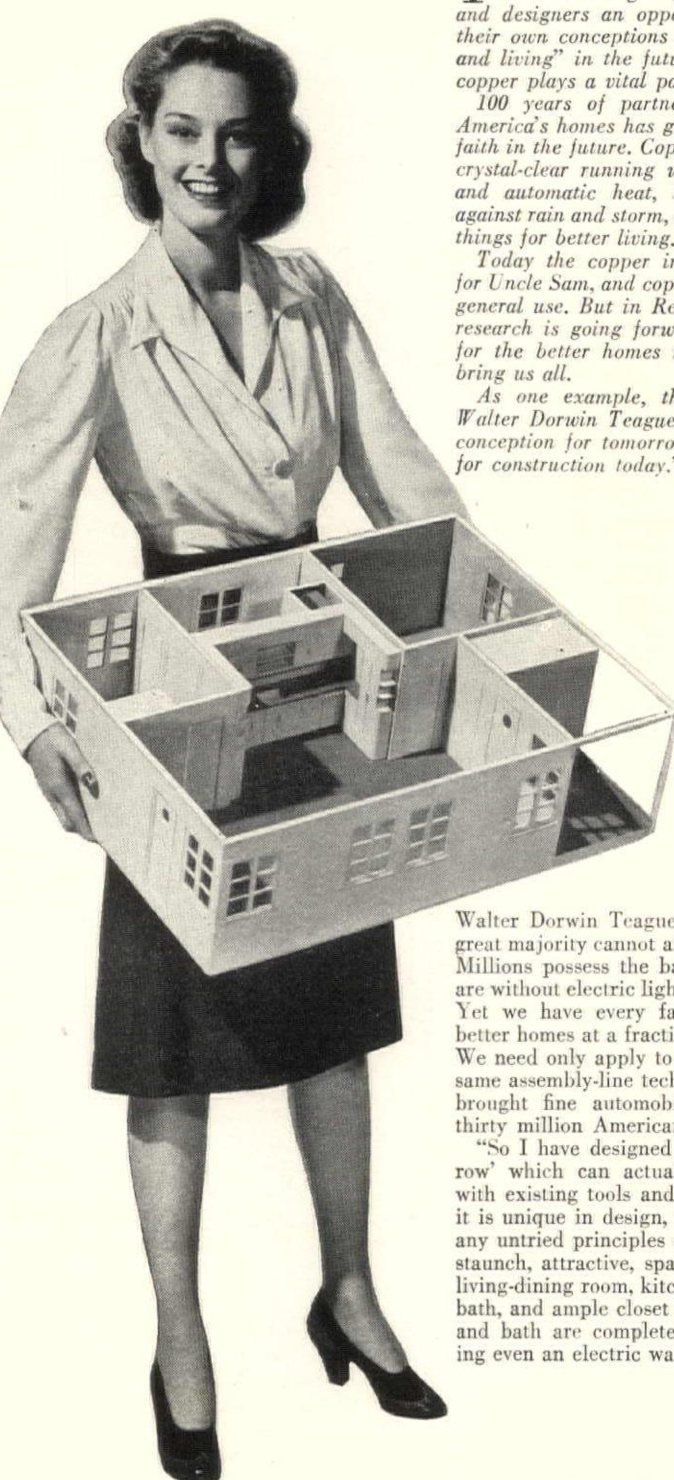
### ELEMENTARY SCHOOL CLASSROOMS,

**by N. L. Englehardt and School Planning Associates. Teachers College, Columbia University. 80 plates, 9 x 11. $3.00.**

This is a highly specialized and exceedingly valuable study of one type of room in one kind of school. It is presented as a series of drawings which show the plans and important features of elementary classrooms which have been built fairly recently in all parts of the country, The contents are largely plates. The uniform drawings give the necessary information on structure and planning, in most cases, and they are supplemented by notes by the architects on lighting, color, features, etc. Supplementing the 80 plates are a check list, bibliography and index, and a cross-index of typical and special features. The book is a thoroughly business-like job, with its information arranged in an accessible and compact manner. It is to be followed by a series of portfolios on other elements of schools; the collection should be invaluable to architects, school building committees and superintendents.

# "Your home of tomorrow is ready today"

WALTER DORWIN TEAGUE



*"THIS is the 4th in a series of Revere advertisements giving noted architects and designers an opportunity to present their own conceptions of "better housing and living" in the future. In all of them copper plays a vital part.*

*100 years of partnership in building America's homes has given Revere a deep faith in the future. Copper has brought us crystal-clear running water, instant light and automatic heat, lifelong protection against rain and storm, and countless other things for better living.*

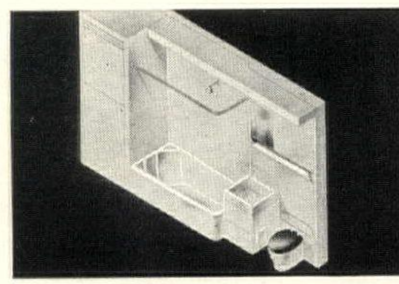
*Today the copper industry is working for Uncle Sam, and copper is restricted for general use. But in Revere's laboratories, research is going forward in preparation for the better homes that tomorrow can bring us all.*

*As one example, the noted designer, Walter Dorwin Teague, presents here his conception for tomorrow's home designed for construction today."*

Walter Dorwin Teague says—"Today the great majority cannot afford to own homes. Millions possess the barest shelter. Many are without electric light, or running water. Yet we have every facility for building better homes at a fraction of present costs. We need only apply to home building the same assembly-line techniques which have brought fine automobiles to more than thirty million Americans.

"So I have designed a 'home of tomorrow' which can actually be built today with existing tools and equipment. While it is unique in design, it does not rely on any untried principles or techniques. It is staunch, attractive, spacious, with a large living-dining room, kitchen, two bedrooms, bath, and ample closet space. The kitchen and bath are completely modern, including even an electric washing machine.

"All plumbing and heating arrangements are built into a single service unit at the factory. This is made practical by the extensive use of copper and brass, which guards against rust, leaks and repairs. In fact, only by the use of fine materials throughout can you make a house both durable and free from upkeep.



"This house can take as many different forms as you wish. There is nothing standardized about its appearance. It is shown here with a modern exterior, but it can just as easily have a pitched roof—and it can actually grow according to the family's needs and finances. You can add a bedroom, a dark room, a workshop and later remove them if you wish.

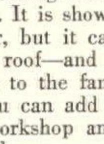
"It would come to you by truck, with all its elements perfectly finished just as they left the factory. It could be erected within eight hours. Being completely demountable and mobile, it could be taken down and moved whenever necessary.

"As new and improved types become available, the original house could be traded in for the latest model, like a car, so that you would never be tied to an out-of-date or partially worn-out home.

"Complete with its insulated walls and roof, its resilient floors, its heating system that supplies all rooms with filtered, humidified fresh air, and its entire modern equipment — this house would cost less than $3,000. now, and less than $2,000. in full production. Here is truly tomorrow's home today, made possible by the resources and techniques which we in America now have at our command."

WALTER DORWIN TEAGUE

* * *




*Naturally, Mr. Teague could not begin to tell you all about his house in this limited space. Revere has no plans or blueprints, but instead has prepared a detailed, illustrated booklet which we will gladly send to you, free. Just write to:*

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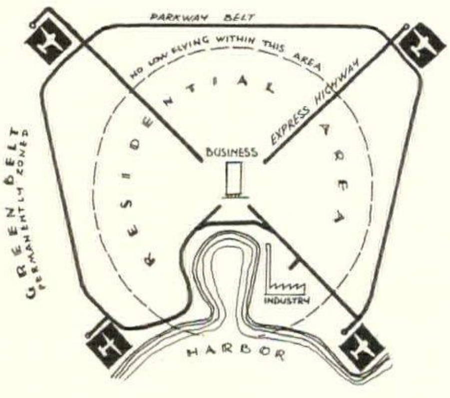
# LETTERS

(Continued from page 16)

areas will have to be channelized for its own safety and for the preservation of pleasant living conditions on the ground. For this the proper location of airports in relation to other features of the city plan is of the utmost importance; successful surface planning for air transportation is a matter of comprehensive town planning. For today's cities transportation be-




OUT-CITY AIRPORTS
SCHEMATIZED SYSTEM FOR A PRESENT-DAY AMERICAN CITY.

tween airports and business centers by helicopter is undesirable if not actually impossible. Backyard flying fields and midtown airports can be feasible only in open schemes of the type of Broadacre City.

In place of the mid-town airport for the city of today let us visualize a system of out-city airports, of which New York already has the beginnings. All flying below a certain height is forbidden over congested areas. Airports are located for safe flying conditions and are surrounded by permanently zoned farm land and recreation or greenbelt areas. A system of express highways and other rapid surface transportation connects the airports with business, industrial, and residential centers, and with each other. Dispersal replaces congestion and the first milestone toward a happier urban pattern is in sight.

This much is certain: airplanes are changing the course of civilization. Mastery of the air must be made to serve the common good, if not in war then in peace. Surface facilities for air transportation are the architect's and town planner's job and should not be taken lightly.

MARK FORTUNE

*Elmhurst, New York*

## BIBLIOGRAPHY *(Cont'd from p. 68)*

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FORUM OF EVENTS

(Continued from page 18)

## COMPETITIONS

The American Institute of Steel Construction has announced the names of the Jurors for the Students' Annual Bridge Design Competition. They are: Mr. Lorimer Rich and Mr. Don E. Hatch, Architects; Mr. Henry C. Tammen, Consulting Engineer; Mr. Roger W. Sherman, Managing Editor of The Architectural Record, all of New York; and Mr. L. G. Sumner, Engineer of Bridges and Structures, Connecticut State Highway Department. Awards are $200, $150, and $50. Selection of winning designs will take place at the Institute, 101 Park Avenue, New York City, on February 18.

The Division of Information of the Office of Emergency Management announces a competition for pictures recording defense and war activities. Suggested subjects include "impressive manufacturing and defense operations, where accessible without special permission; essential activities of the Red Cross; activities of volunteer firemen; production of foods, in the home, and at canning centers; defense construction and housing." OEM will pay $30 for each water color or oil sketch accepted, $15 for drawings, and $5 for each print. It has agreed to spend at least $2,000 for this work, but may possibly increase this sum if it finds more work suitable.

Any pictorial medium, excluding pastel, is eligible—oil, tempera, water color, gouache and prints, and the various black and white media. Work must be submitted in white or cream mats. No framed or glassed pictures will be accepted. Entries should be sent to the office of the Section of Fine Arts, 7th and D Streets, SW, Washington, D. C., delivered or postmarked not later than January 15, 1942.

## PERSONALS

The association of RAYMOND HILL WILCOX and EDWARD H. LAIRD, landscape architects and town planners, is announced. The offices will be located in the Union Guardian Building, Detroit, and the former offices of Mr. Laird in Birmingham, Mich., will be maintained as a branch.

R. DOULTON STOTT, materials consultant and industrial designer, announces the opening of offices at 509 Madison Avenue, New York City.

KURT LUBINSKI announces the change of his address to 321 West 89th Street, New York City.

THE ENGINEERING SOCIETY OF DETROIT and the Detroit Office of The Engineering Societies Personnel Service, Inc. have moved their executive offices from the Hotel Statler to The Horace H. Rackham Educational Memorial, 100 Farnsworth Avenue, Detroit.

RICHMOND H. SHREVE, president of the A. I. A., has been elected an honorary corresponding member of the Royal Institute of British Architects.

Mr. WILLIAM EDWARD KAPP announces the establishment of his office for the practice of architecture and industrial design in the Buhl Building, Detroit, Michigan.

Mr. FRANK L. WADSWORTH, associated engineer for many years with Mr. Siegmund Firestone, architect and consulting engineer of Rochester, N. Y., at year's end left the firm to work for the Navy Department in Washington. Mr. Wadsworth was a Naval Reserve Officer during the last World War.

The new address of R. C. HUGENIN and Associates, Architects and Engineers, formerly known as Hugenin and DeKay, is 1201 West Porphyry Street, Butte, Mont.

## AWARDS

Mr. FREDERICK P. KEPPEL, retired president of the Carnegie Corporation, was awarded the medal of honor of the American group of the Societe des Architectes Diplomes last month for his "distinguished service in the advance of art and architecture." For 18 years he disbursed income from a $135,000,000 fund for scientific, educational and humanitarian projects.

## CALENDAR

48th annual meeting of the American Society of Heating and Ventilating Engineers at the Bellevue-Stratford Hotel, Philadelphia, Pa., January 25-9.

(Continued on page 64)

## FORUM OF EVENTS

*(Continued from page 62)*

### DIED

Ralph Harrington Doane, 55, architect, in Milton, Mass. Mr. Doane was graduated from Massachusetts Institute of Technology, where he was a special instructor. He was consulting architect for the Philippine Government from 1916-18. For the design of the Motor Mart he received the Harleston Parker gold medal in 1927 for the "best architectural work in metropolitan Boston," and in 1930 he won three prizes awarded by The Boston Herald for architecture in New England. He was a member of the American Institute of Architects, Boston Society of Architects, and the National Advisory Council on school building problems.

Frederick J. Thielbar, 75, architect, in Chicago, Ill. Among the buildings he designed were the Chicago Temple, skyscraper church in the loop, the Moody Bible Institute Buildings, the Hall of Religion at the 1933 Century of Progress Exposition and the Wesley Memorial Hospital.

Charles Gross, 44, architect, in New York City. Mr. Gross had been associated with the late H. Craig Severance, with whom he collaborated in the designing of the Bank of the Manhattan Building.

B. J. Newman, 64, housing expert, in Germantown, Pa. Mr. Newman was graduated from Meadville Theological School and studied at the New York School of Philanthropy, Harvard University and the University of Pennsylvania. For various periods he was active in the work of Columbia Neighborhood House in New York, the Philadelphia Housing Commission, the Pennsylvania School for Social Service and Public Health. Mr. Newman was a member of the subcommittee on housing of the White House Conference on Child Health and Protection from 1931 to 1933 and chairman of the committee on legislation and administration of the President's Conference on Home Building and Home Ownership, 1931-32.

John M. Donaldson, 87, architect. Mr. Donaldson was born in Alva, Scotland. He became an architect more than sixty years ago and founded the firm of Donaldson and Maier, much of his work having been for the Roman Catholic diocese of Detroit. He also designed the David Stott and Penobscot Buildings in Detroit and planned the Belle Isle Park lagoon system and the Zoological Park in that city. A former president of the Detroit Museum of Art and of the Detroit City Planning and Improvement Commission, Mr. Donaldson was a member of the National Council of Fine Arts, National Institute of Arts and Letters, Architectural League, and National Sculpture Society. He was a director of the American Institute of Architects.

### ERRATUM

The presentation of the Cambridge Glass Company on pages 348-9 of the November issue should have included a note that Mr. Edwin Harris, Jr., head of Mr. Antonin Raymond's New York office, collaborated in the design and superintended the construction.

To Raphael de Cardenas, distinguished Havana architect, the editors offer sincere

apologies for omitting his name from the presentation of the beach house published on pages 406-7 of the December issue.

# SPECIFICATION AND BUYING INDEX

The advertising pages of THE ARCHITECTURAL FORUM have become the recognized market place for architects and all others engaged in building. Each month these pages offer the most complete guide to materials, equipment and services to be found in any magazine. A house or any other building could be built completely of products advertised in THE FORUM. While it is not possible for a magazine to certify building products, it is possible to open its pages only to those manufacturers whose reputation merits confidence. This THE FORUM does.


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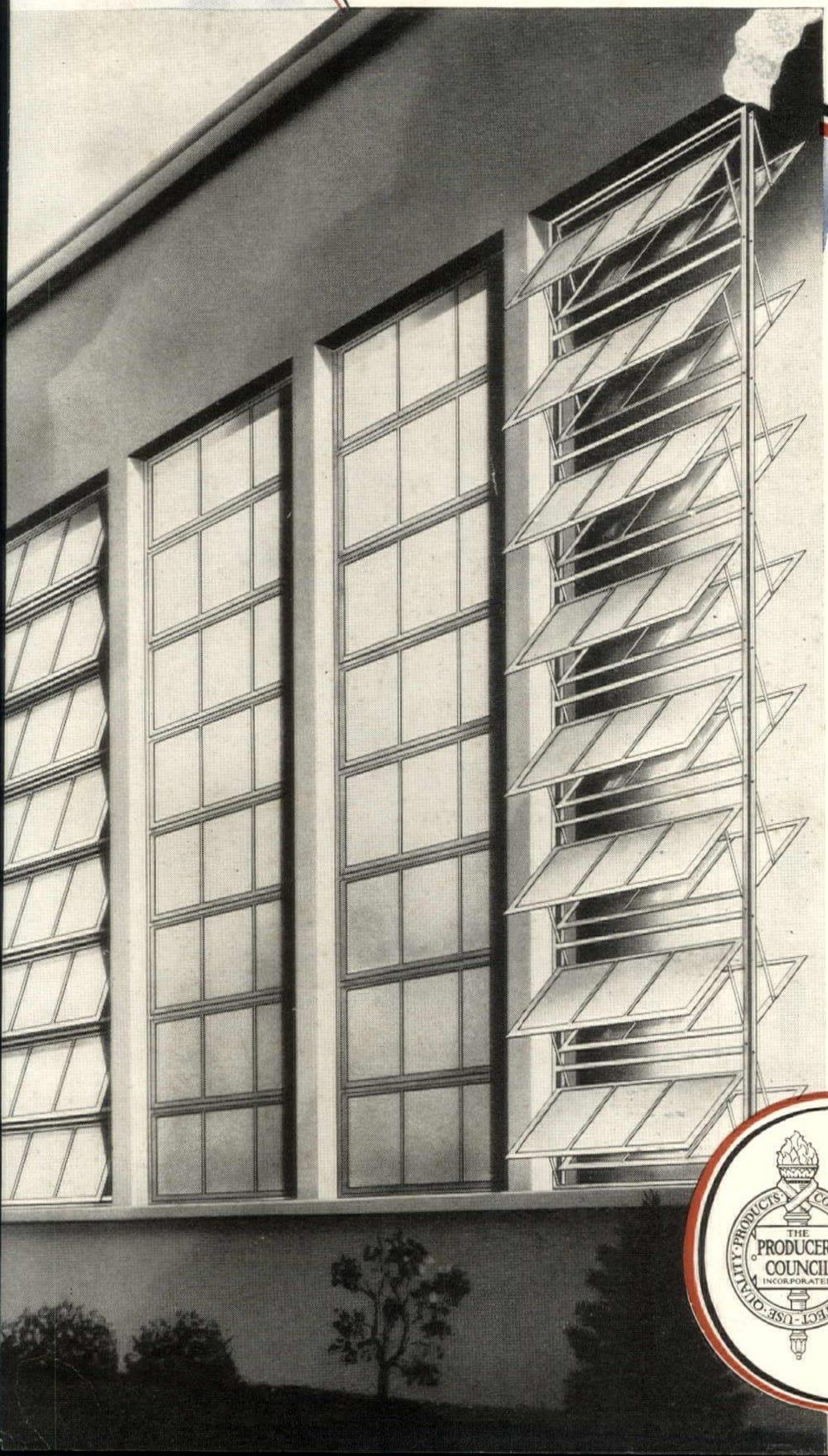

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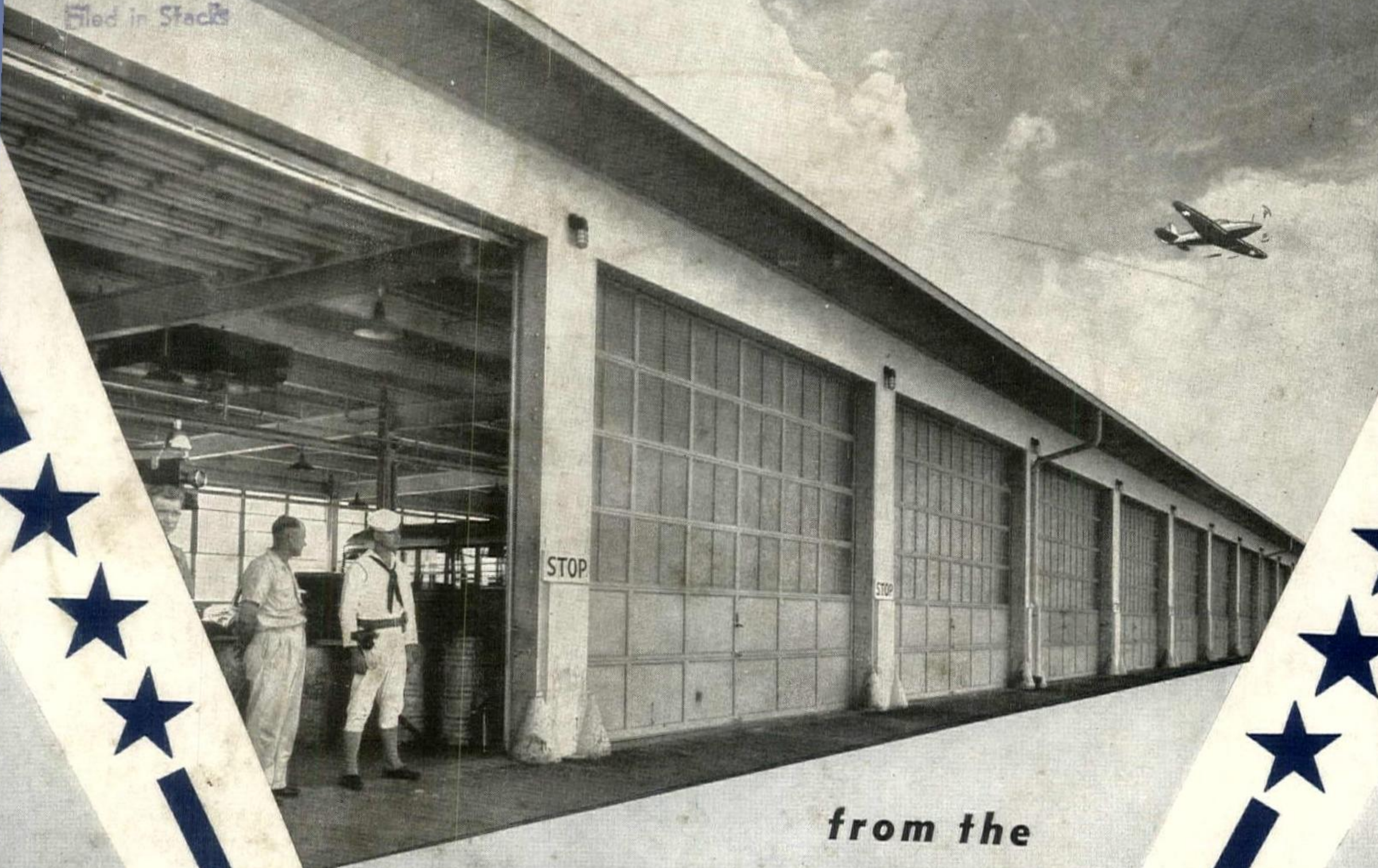

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