THE ARCHITECTS' JOURNAL

standard contents

every issue does not necessarily contain all these contents, but they are the regular features which continually recur

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No. 3243] [Vol. 125

THE ARCHITECTURAL PRESS

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★ A glossary of abbreviations of Government Departments and Societies and Committees of all kinds, together with their full address and telephone numbers. The glossary is published in two parts—A to Ig one week, Ih to Z the next. In all cases where the town is not mentioned the word LONDON is implicit in the address.

AA	Architectural Association, 34/6, Bedford Square, W.C.1.	Museum 0974
AAI	Association of Art Institutions. Secy.: W. Marlborough Whitehead, " Dyneley," Castle Hill Avenue, Berkhampstead, Herts.	
ABS	Architects' Benevolent Society. 66, Portland Place, W.1.	Langham 5721
ABT	Association of Building Technicians. 1, Ashley Place, S.W.1.	Victoria 0447-8
ACGB	Arts Council of Great Britain. 4, St. James' Square, S.W.1.	Whitehall 9737
ADA	Aluminium Development Association. 33, Grosvenor Street, W.1.	Mayfair 7501/8
ARCUK	Architects' Registration Council. 78, Wimpole Street, W.1.	Welbeck 2915
BAE	Board of Architectural Education. 66, Portland Place, W.1.	Langham 5721
BATC	Building Apprenticeship and Training Council. Lambeth Bridge House, S.E.1.	Reliance 7611, Ext. 1706
BC	Building Centre. 26, Store Street, Tottenham Court Road, W.C.1.	Museum 5400
BCC	British Colour Council. 13, Portman Square, W.1.	Welbeck 4185
BCCF	British Cast Concrete Federation. 105, Uxbridge Road, Ealing, W.5.	Ealing 9621
BCIRA	British Cast Iron Research Association. Alvechurch, Birmingham.	Redditch 716
BDA	British Door Association. 10, The Boltons, S.W.10.	Fremantle 8494
BEDA	British Electrical Development Association. 2, Savoy Hill, W.C.2.	Temple Bar 9434
BIA	British Ironfounders' Association. 145, Vincent Street, Glasgow, C.2	Glasgow Central 2891
BID	Building Industries Distributors. 52, High Holborn, W.C.1.	Chancery 7772
BINC	Building Industries National Council. 11, Weymouth Street, W.1.	Langham 2785
BOT	Board of Trade. Whitehall Gardens, Horseguards Avenue, Whitehall, S.W.1.	Trafalgar 8855
BRS	Building Research Station. Bucknalls Lane, Watford	Garston 4040
BSA	Building Societies Association. 14, Park Street, W.1.	Mayfair 0515
BSI	British Standards Institution. British Standards House, 2, Park St., W.1.	Mayfair 9000
BTE	Building Trades Exhibition. 32, Millbank, S.W.1.	Tate Gallery 8134
CABAS	City and Borough Architects Society. C/o Johnson Blackett, F.R.I.B.A., Civic Centre, Newport, Mon.	Newport 65491
CAS	County Architects' Society. C/o F. R. Steele, F.R.I.B.A., County Hall, Chichester.	Chichester 3001
CCA	Cement and Concrete Association. 52, Grosvenor Gardens, S.W.1.	Belgravia 6661
CCP	Council for Codes of Practice. Lambeth Bridge House, S.E.1.	Reliance 7611 Ext. 1284
CDA	Copper Development Association. 55, South Audley Street, W.1.	Grosvenor 8811
CIAM	Congrès Internationaux d'Architecture Moderne. Doldertal, 7, Zurich, Switzerland	
COID	Council of Industrial Design. 28, Haymarket, S.W.1.	Trafalgar 8000
CPRE	Council for the Preservation of Rural England. 4, Hobart Place, S.W.1.	Sloane 4280
CUC	Coal Utilization Council. 3, Upper Belgrave Street, S.W.1.	Sloane 9116
CVE	Council for Visual Education. 13, Suffolk Street, Haymarket, S.W.1.	Reading 72255
DGW	Directorate General of Works, Ministry of Works, Lambeth Bridge House, S.E.1.	Reliance 7611
DIA	Design and Industries Association. 13, Suffolk Street, S.W.1.	Whitehall 0540
DPT	Department of Overseas Trade. Horseguards Avenue, Whitehall, S.W.1.	Trafalgar 8855
EJMA	English Joinery Manufacturers' Association (Incorporated). Sackville House, 40, Piccadilly, W.1.	Regent 4448
EPNS	English Place-Name Society. 7, Selwyn Gardens, Cambridge.	
FAS	Faculty of Architects and Surveyors. 68, Gloucester Place, W.1.	Welbeck 9966
FASS	Federation of Association of Specialists and Sub-Contractors, Artillery House, Artillery Row, S.W.1.	Abbey 7232
FBBDO	Fibre Building Board Development Organization, Ltd. (Fidor), 47, Princes Gate, Kensington, S.W.7.	Kensington 4577
FBI	Federation of British Industries. 21, Tothill Street, S.W.1.	Whitehall 6711
FC	Forestry Commission. 25, Savile Row, W.1.	Regent 0221
FCMI	Federation of Coated Macadam Industries. 37, Chester Square, S.W.1.	Sloane 1002
FDMA	The Flush Door Manufacturers Association Ltd., Trowell, Nottingham.	Ilkeston 623
FLD	Friends of the Lake District. Pennington House, nr. Ulverston, Lancs.	Ulverston 201
FMB	Federation of Master Builders. 26, Great Ormond Street, Holborn, W.C.1.	Chancery 7583
FPC	The Federation of Painting Contractors, St. Stephen's House, S.W.1.	Whitehall 3902
FRHB	Federation of Registered House Builders. 82, New Cavendish Street, W.1.	Langham 4341
GPDA	Gypsum Plasterboard Development Association, 11, Ironmonger Lane, E.C.2.	Monarch 8888
GC	Gas Council. 1, Grosvenor Place, S.W.1.	Sloane 4554
GG	Georgian Group. 2, Chester Street, S.W.1.	Belgravia 3081
HC	Housing Centre. 13, Suffolk Street, Pall Mall, S.W.1.	Whitehall 2881
IAAS	Incorporated Association of Architects and Surveyors. 29, Belgrave Square, S.W.1.	Belgravia 3755
ICA	Institute of Contemporary Arts. 17-18, Dover Street, Piccadilly, W.1.	Grosvenor 6186
ICE	Institution of Civil Engineers. 1, Great George Street, S.W.1.	Whitehall 4577
IEE	Institution of Electrical Engineers. Savoy Place, Victoria Embankment, W.C.2.	Temple Bar 7676
IES	Illuminating Engineering Society. 32, Victoria Street, S.W.1.	Abbey 5215
IGE	Institution of Gas Engineers. 17, Grosvenor Crescent, S.W.1.	Sloane 8266

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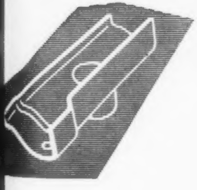

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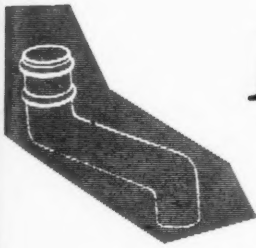

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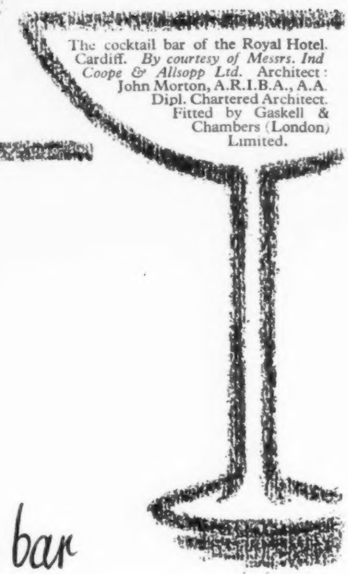

The cocktail bar of the Royal Hotel. Cardiff. *By courtesy of Messrs. Ind Coope & Allsopp Ltd.* Architect: John Morton, A.R.I.B.A., A.A. Dipl. Chartered Architect. Fitted by Gaskell & Chambers (London) Limited.

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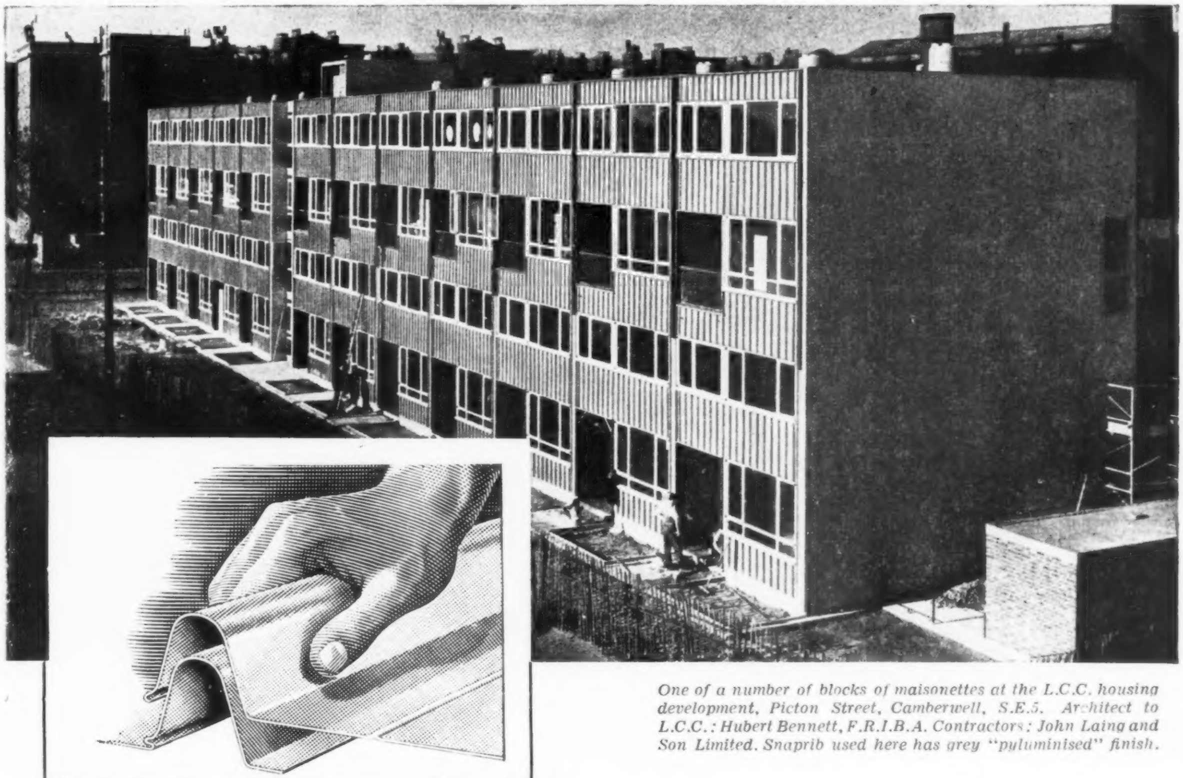

One of a number of blocks of maisonettes at the L.C.C. housing development, Picton Street, Camberwell, S.E.5. Architect to L.C.C.: Hubert Bennett, F.R.I.B.A. Contractors: John Laing and Son Limited. Snaprib used here has grey "puluminised" finish.

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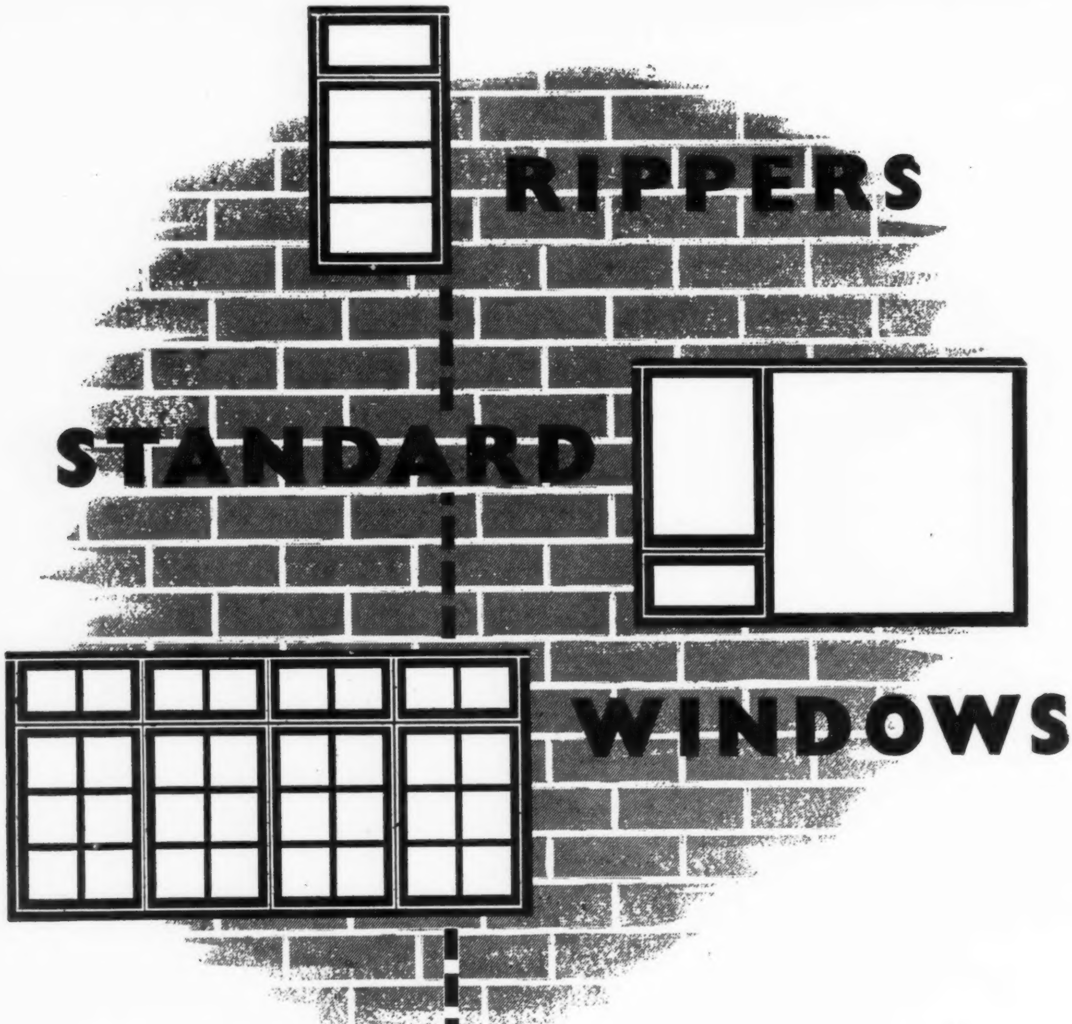
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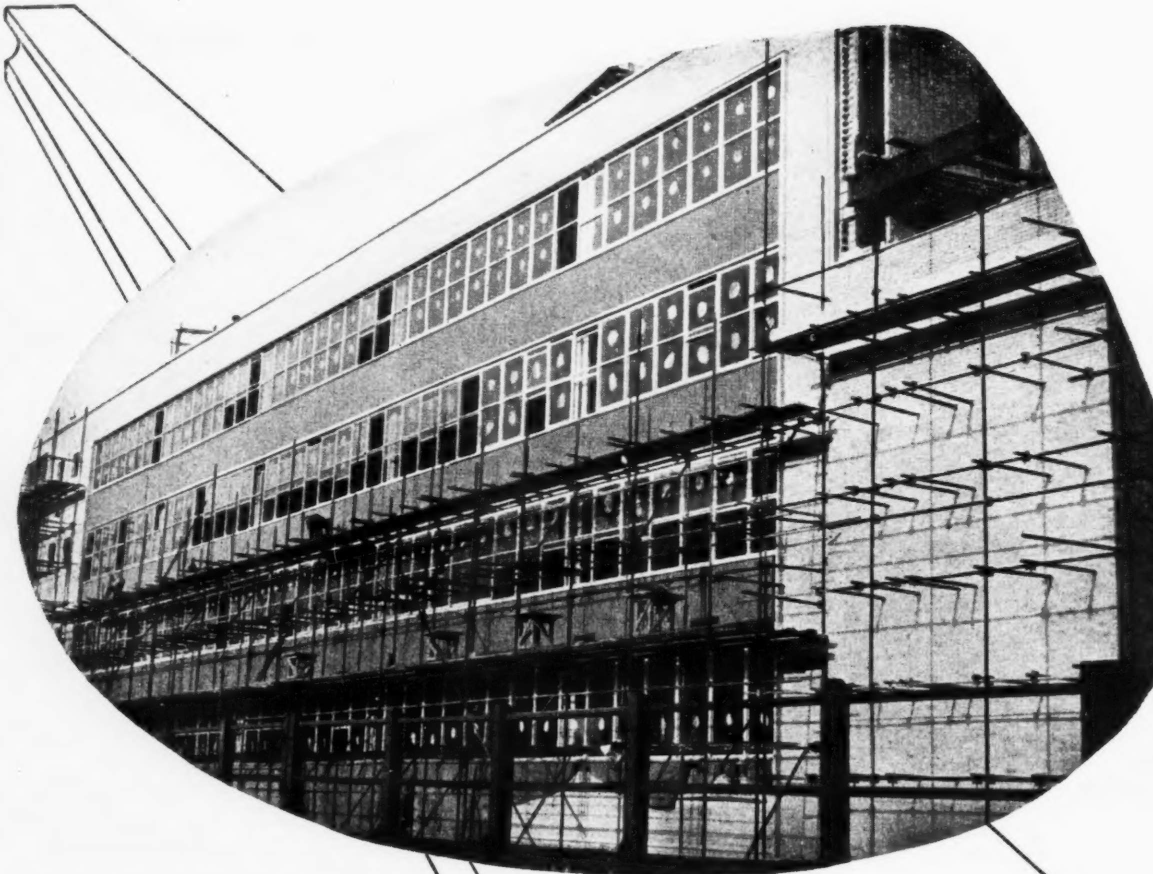

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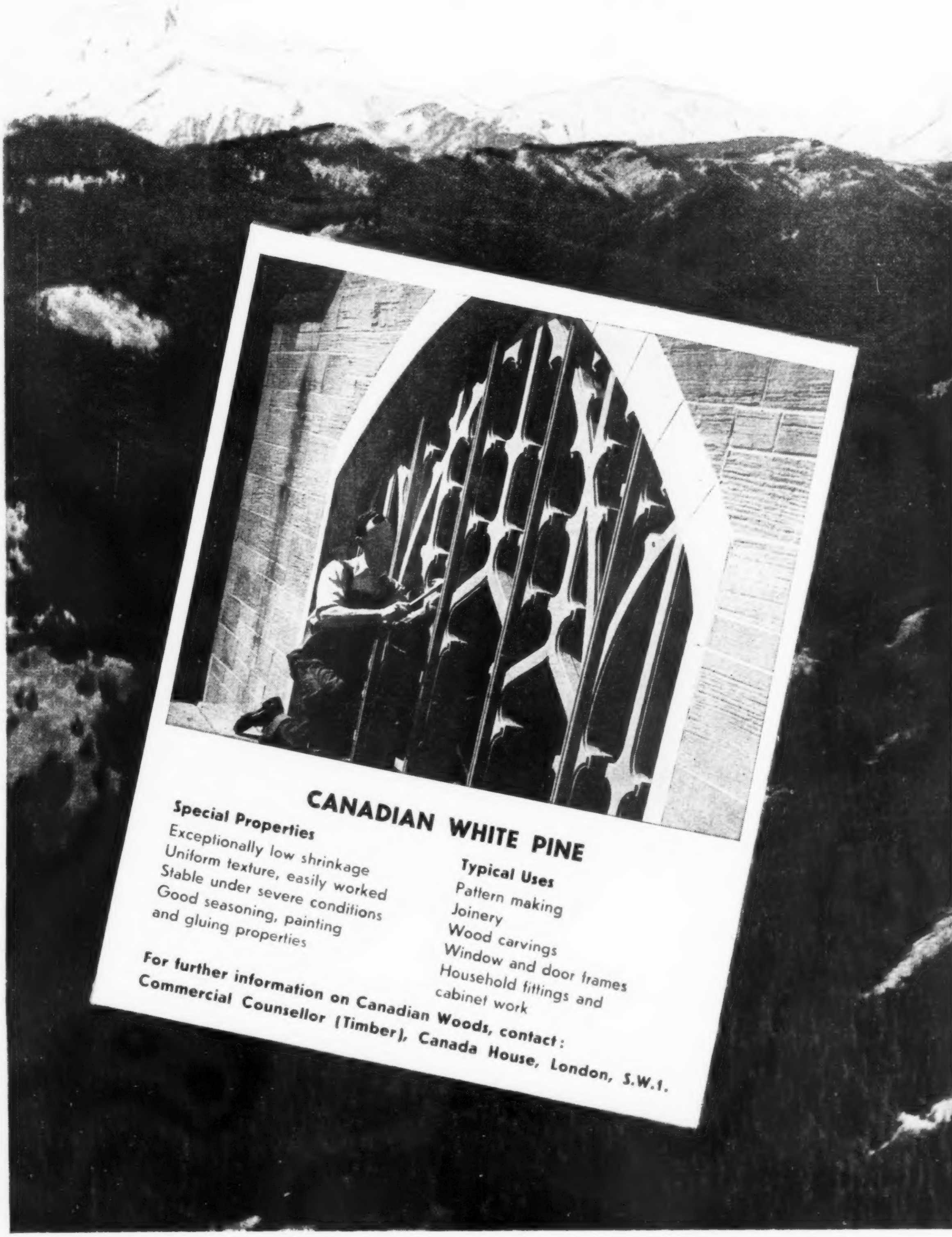

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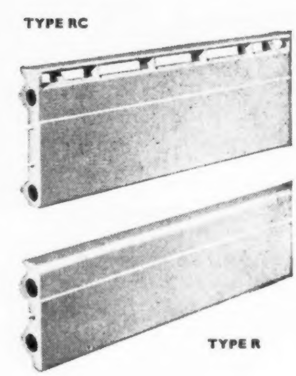

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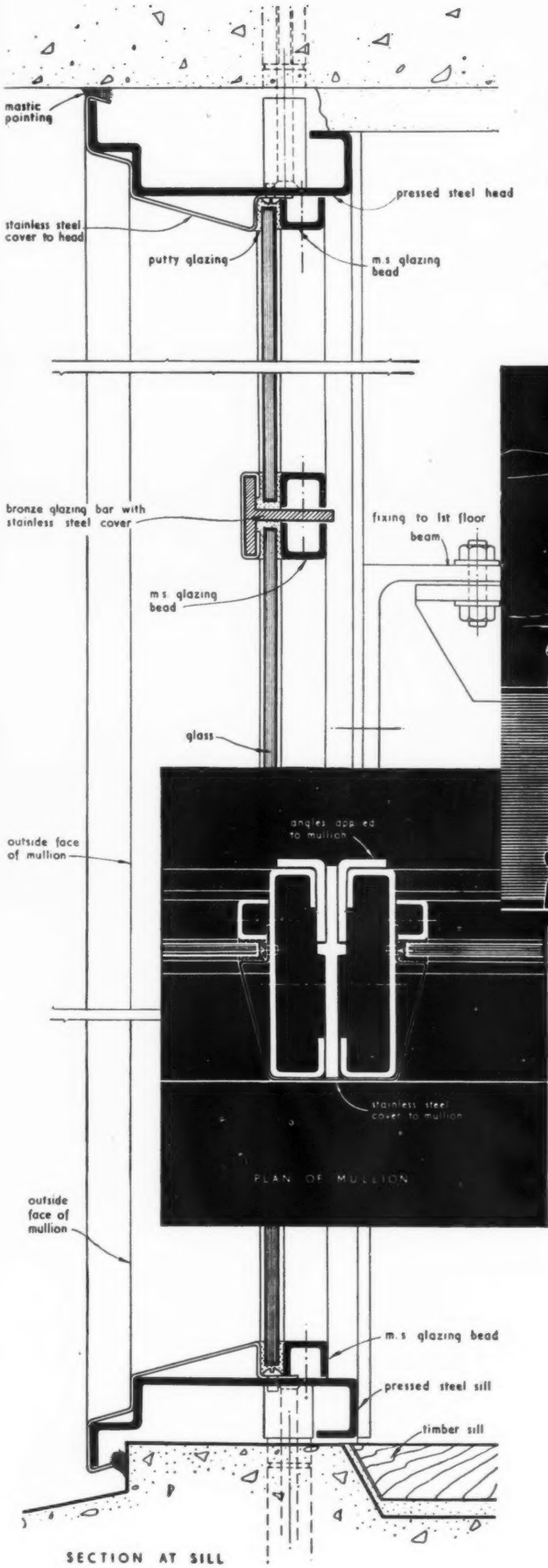

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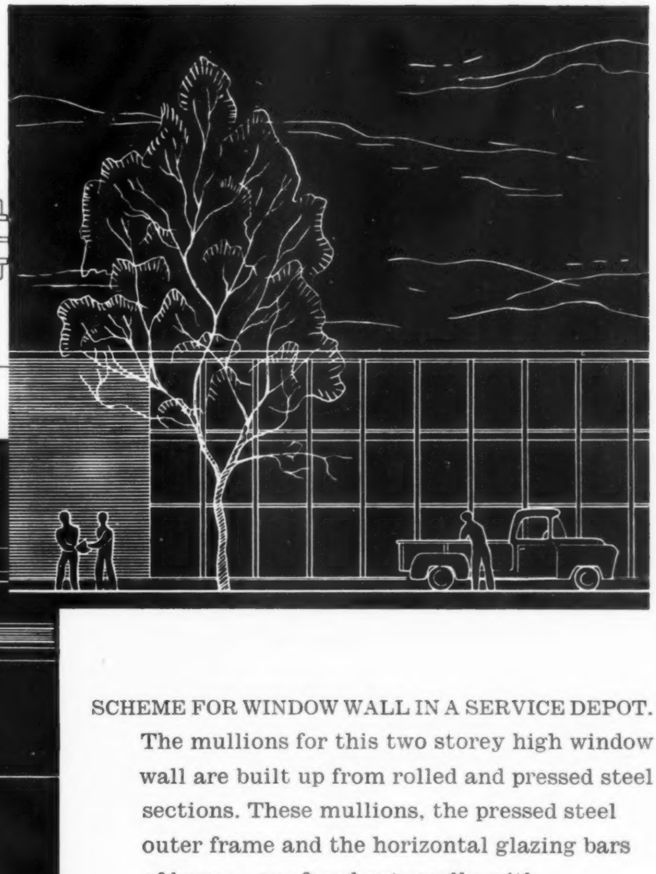

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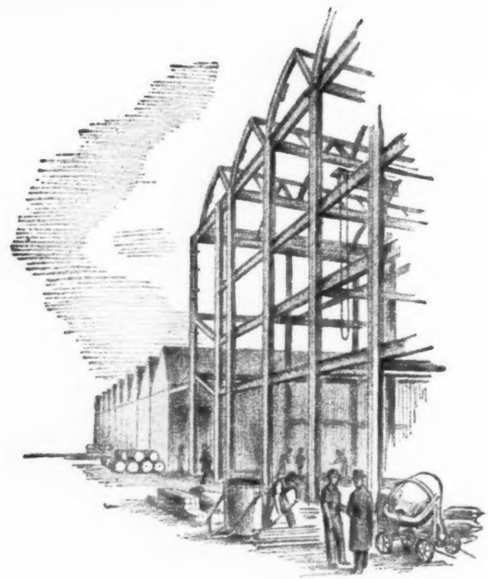

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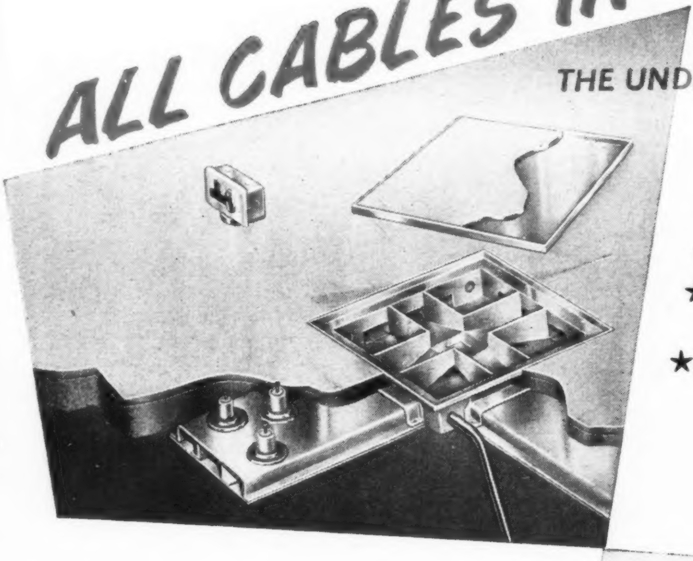

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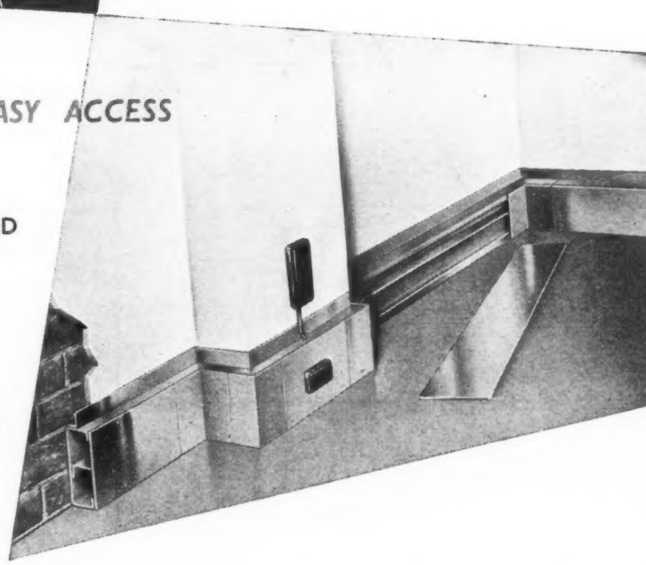

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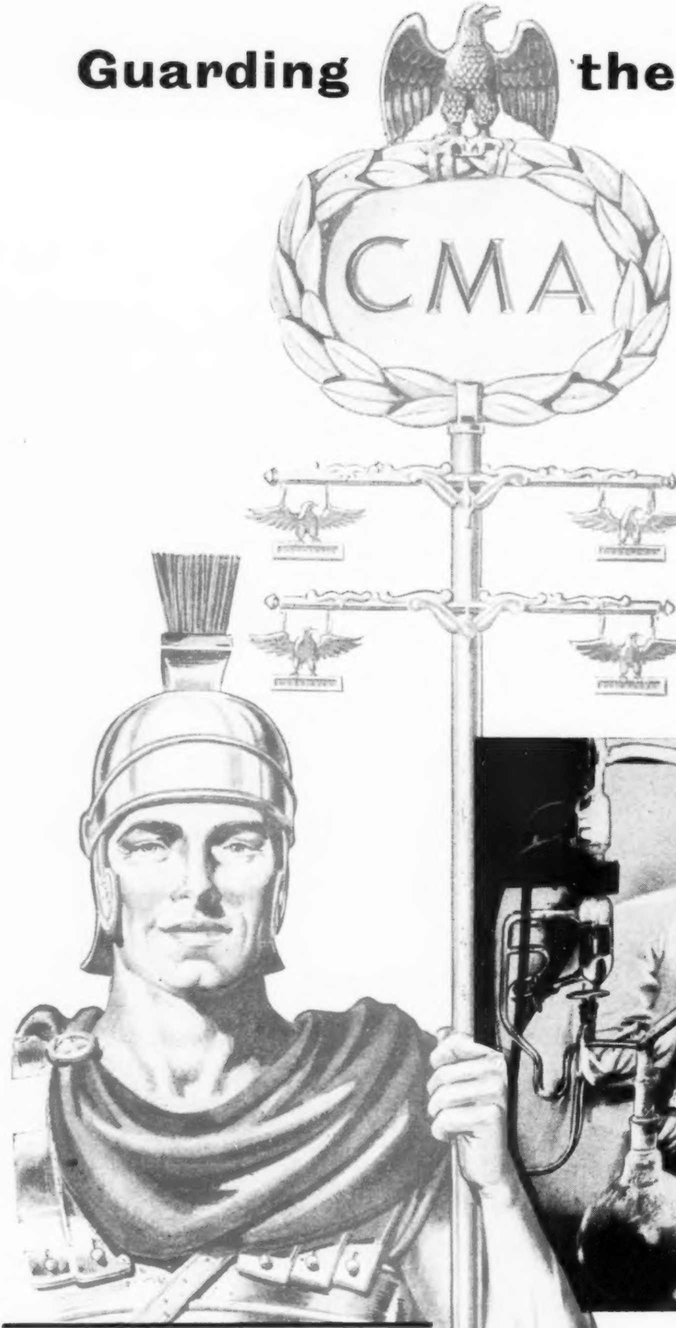

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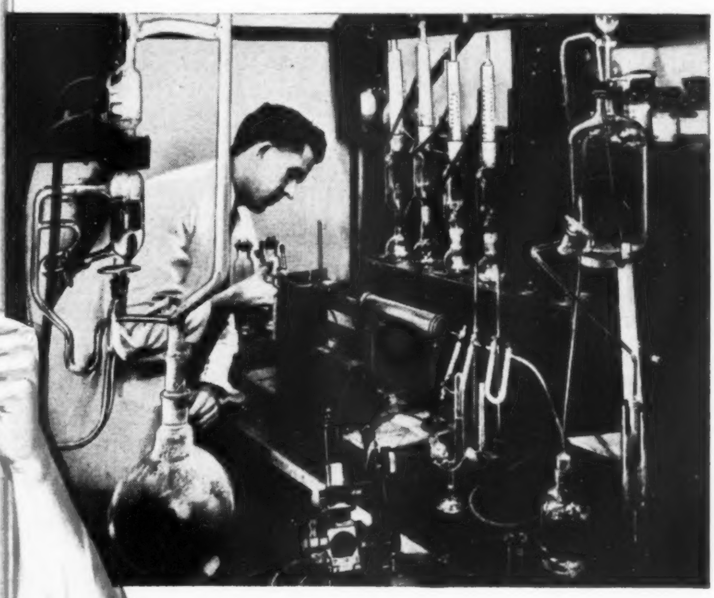

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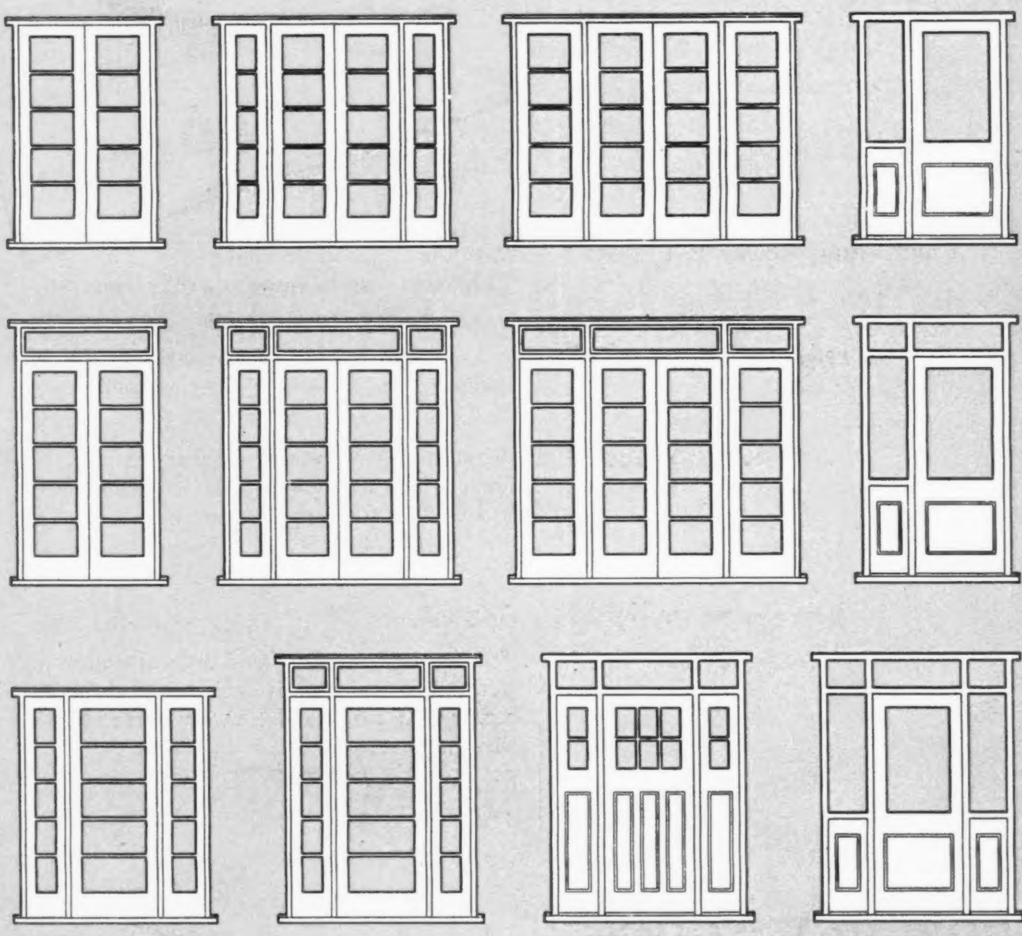

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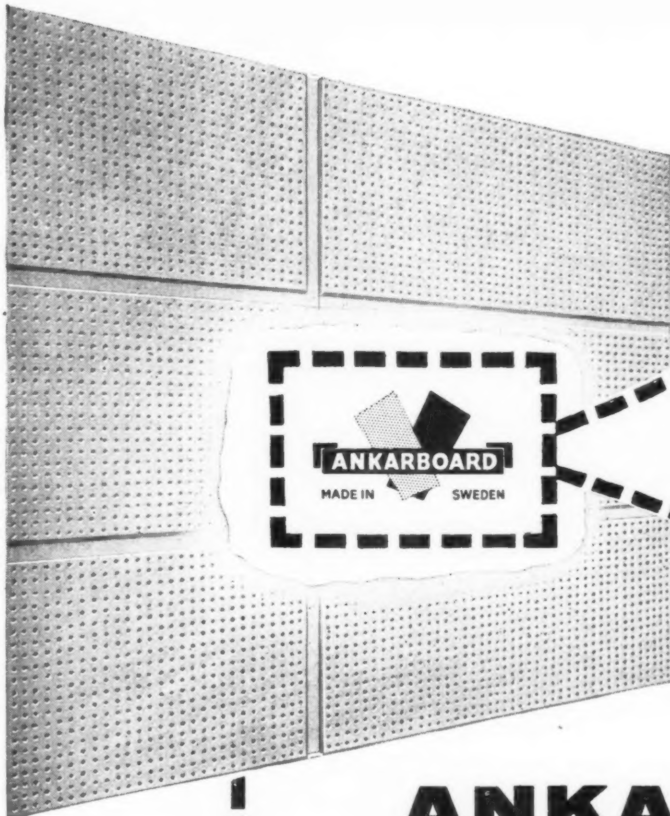

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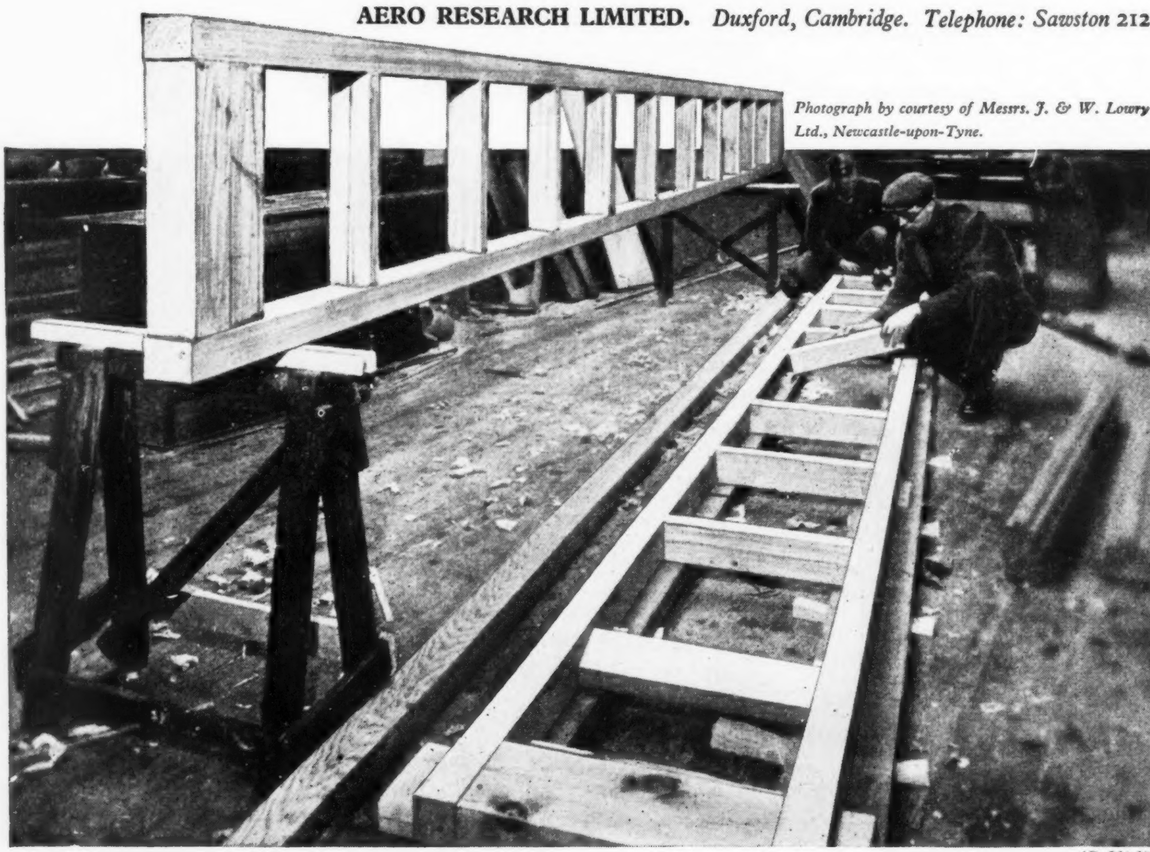

Photograph by courtesy of Messrs. J. & W. Lowry Ltd., Newcastle-upon-Tyne.

AP. 264-197

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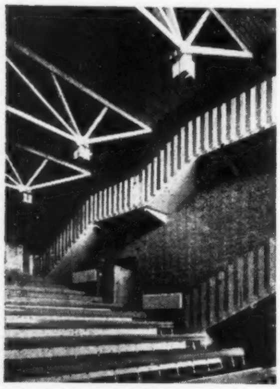
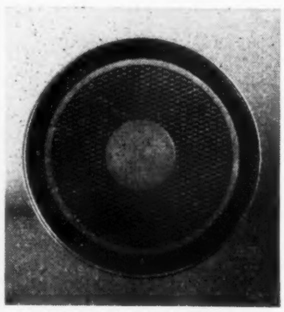
FINLAND
PLYMOUTH BARBICAN
ANTISUBTOPIAN

Finland will be in the news in April and so the REVIEW will publish a study of the rise of Modern Finnish architecture and Aalto's relation to it—the relationship of **The One and the Few**—by Reyner Banham, and an extensive survey of recent Finnish buildings. In the same issue, Gordon Cullen considers the plight of the **Plymouth Barbican,** a live neighbourhood-centre that local planning powers-that-be seem determined to destroy by a subtopian combination of rule-of-thumb demolitions and preservations. At the small-scale end of urban design, Nicolete Gray contributes a first essay on the character and function of **Street-Lettering,** and Robert Maguire completes his survey of paving materials in *Skill*. A revolutionary electric fire is described, and buildings illustrated include factories by Ove Arup and Partners, and W. S. Milburn and Partners, while a never-completed dream, **Sir John Soane's Triumphal Bridge,** is discussed by Dorothy Stroud. Lastly, but by no means least, April will see the inauguration of the ARCHITECTURAL REVIEW's **Counter Attack Bureau,** whose first case-study will be the replacement by Semi-dets. of terrace housing at Princetown.


School at Kulosaari, by Jorma Jarvi.


Electric fire, by Kenneth Browne.

AMERICA

A *personnage* assembled from scraps of American advertisements and spitting ticker-tape on the cover of the May ARCHITECTURAL REVIEW will announce the theme of a special issue on **Machine Made America,** compiled explained and assessed by the REVIEW's executive editor, Ian McCallum, whose previous foray into the American scene caused raised eyebrows and raised voices when its results appeared in print as a special issue of the REVIEW under the title *Man Made America,* this new survey, based on a study of architecture rather than the wider scene of land- and townscape, will scrutinise the aesthetics and the technics of the curtain wall as an example of what happens to one of the cherished dreams of the Modern Movement when it finally becomes commercially practicable, and becomes part of the available *syntax* of architecture. After this it will survey the diverse, original stimulating and experimental work of individuals and individualists from Coast to Coast, a body of work that is the *genetrix* of architectonic ideas without which the industrial contribution may prove sterile and short-lived.


The Seagram Building, New York.

Machine Made America will conclude by attempting to fit both industrialist and individualist into the *matrix* of the wider scene of world architectural development in this century and of American culture in the age of mass-production.


Concrete shell church by J. Johansen.

COUNTER ATTACK
GROTESQUE
OLIVETTI

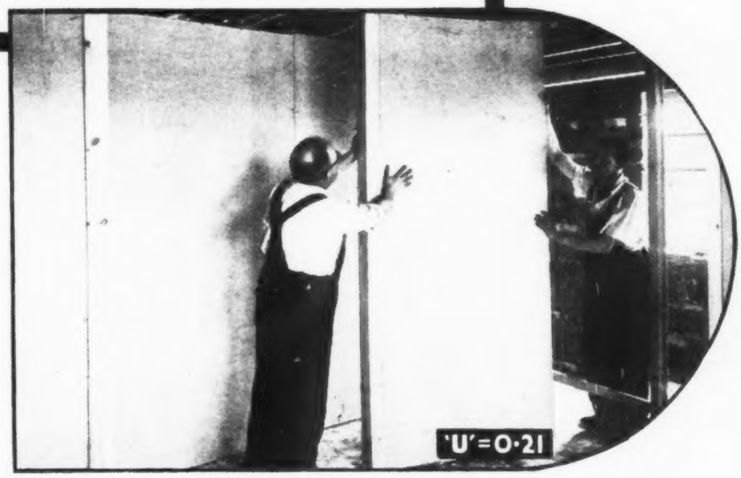
Ian Nairn, of *Outrage* fame, will contribute a first essay on the aims and objectives of the newly-formed **Counter-Attack Bureau,** to the June issue of the ARCHITECTURAL REVIEW, and make proposals for positive anti-Outrage policies for the threatened suburban village-centres of Ewell, Colnbrook and Huyton. Two widely diverse Italian subjects to be discussed in the same issue will be the grotesque statuary and architecture of the Orsini garden at **Bomarzo,** considered iconographically by Dr. S. Lang, and the impressive and intelligent record of patronage in architecture, the arts, and design, of **Adriano Olivetti,** considered biographically by Georgina Masson. New buildings in this issue will be as different in type and place as the **Golden Lane** development by Chamberlin, Powell and Bon, and the **Museum at Accra** by Drake and Lasdun; the old buildings of the month will be **Balmes House,** Hackney, a forgotten, but representative piece of artisan mannerism which will be described and discussed by Priscilla Metcalf, and those in **Halifax Street,** Sydenham, another threatened area that comes within *Counter-Attack*'s purview. *Skill* features of the month include a broad survey of food-preparation equipment, and in *Miscellany* Robert Melville contributes, as usual, his column of off-beat opinions on the world of art-galleries and exhibitions.


Subtopian Mess at Colnbrook.


Golden Lane, by Chamberlin, Powell and Bon.

PARTITIONING

Glazed or unglazed; permanent or temporary



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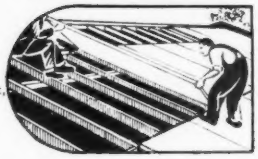
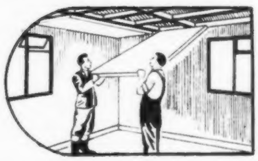
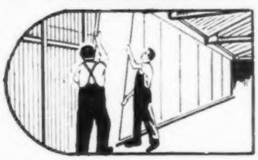
Under Sheet-metal (Traditional or Patent), Asbestos, Bituminous Felt, etc.



CEILINGS



WALL-LININGS



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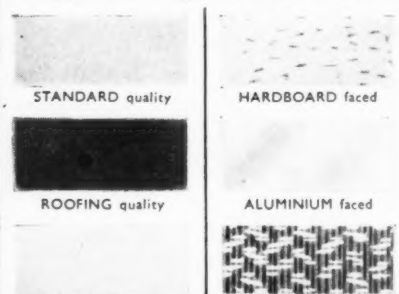

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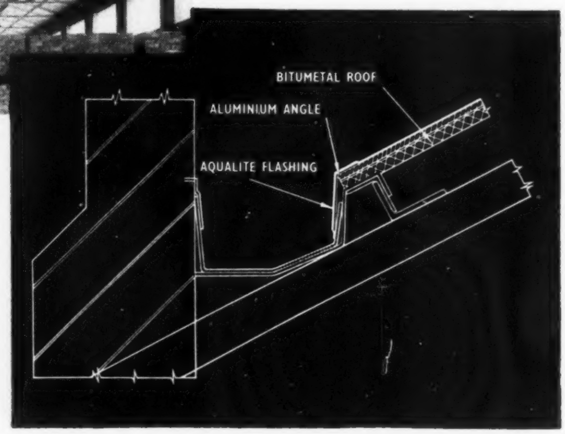

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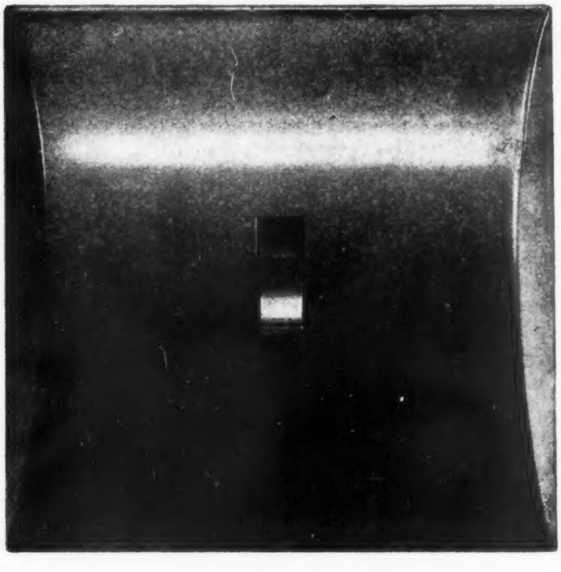
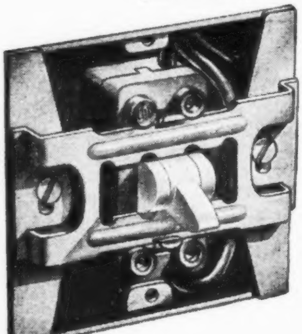


FALKS new switch makes all others obsolete

Here is a handsome new switch, modern in every respect and unique being without plate fixing screws.

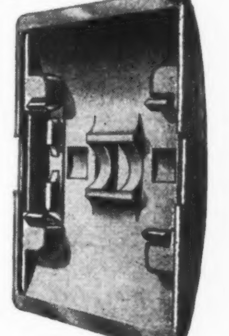
The design must appeal to every architect and its simplicity to the contractor in the saving of fixing time.

Note these special features—



The 'Snapfast' switch unit is fitted to the standard box by two screws. It is very readily wired and the box provides ample space for cable slack. Provision is also made within the switch assembly to correct "out of square" boxes.

The secret of the FALKS 'Snapfast' lies in the Spring steel inserts which register with the unit frame and securely hold the cover.



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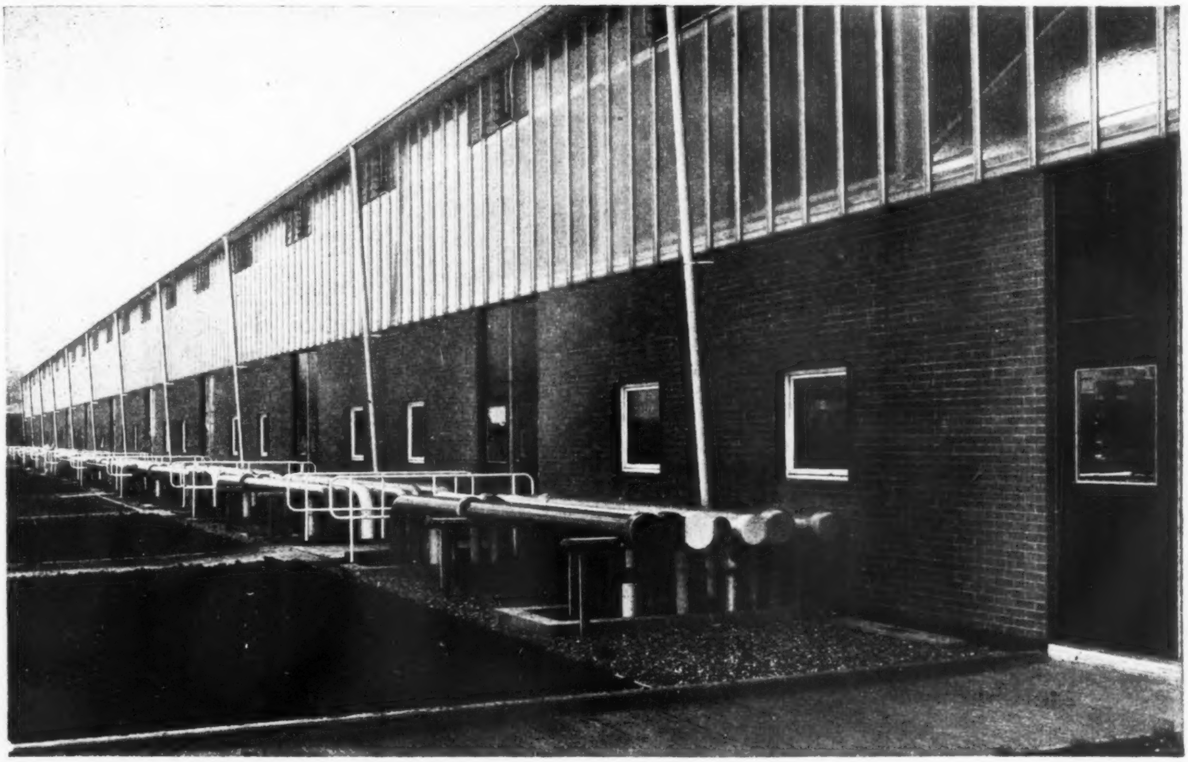

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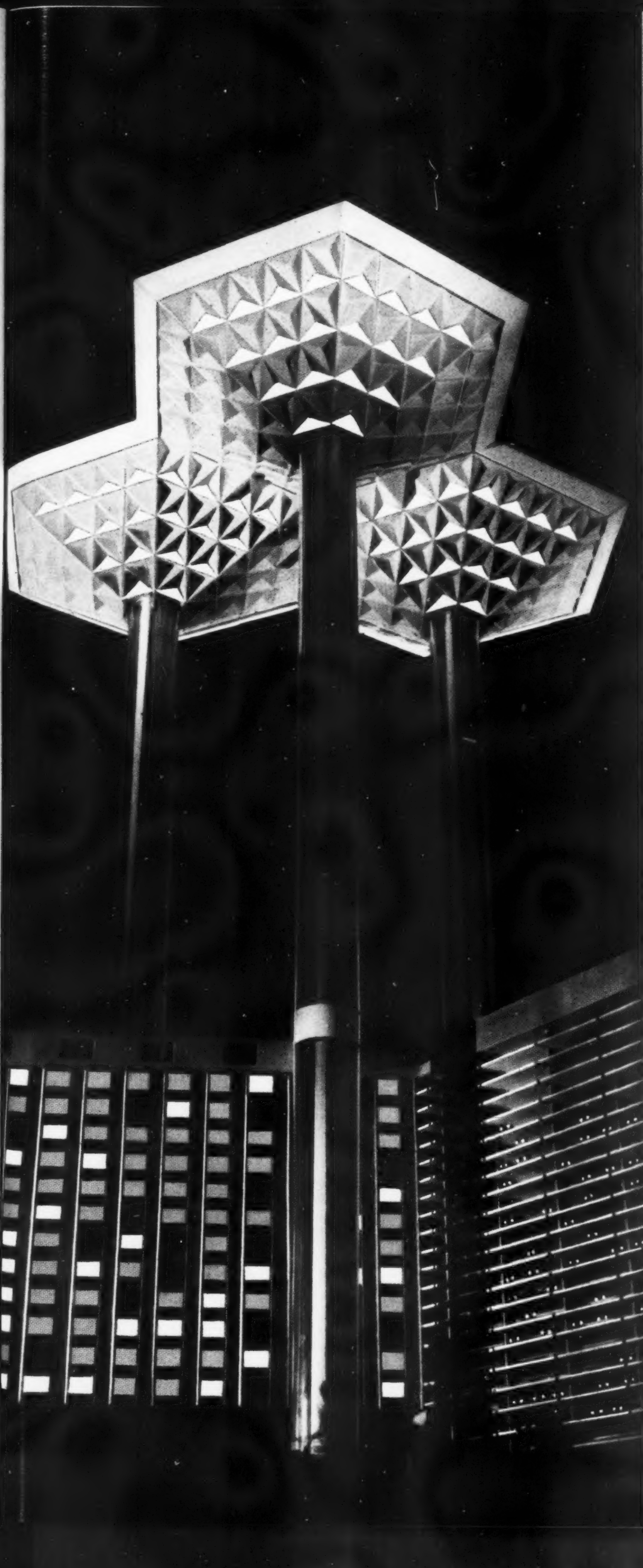

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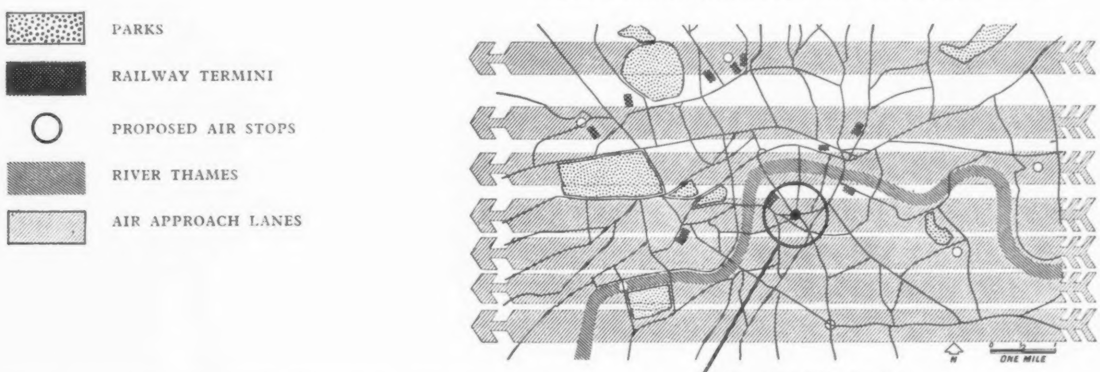
SKYPORT ONE

Basically SKYPORT ONE consists of a 500 ft. high landing deck supported by three shafts. In addition to providing all the necessary equipment and facilities needed for the handling of aircraft and passengers, this super-structure accommodates a restaurant for the general public. From its windows there would be unrivalled views across London. The shafts consist of a finned steel drum encased in an outer cylinder of glass, behind which the lifts serving the superstructure at the rate of one every 45 seconds, will be visible. These glass cylinders are cleaned by ring-shaped platforms which will ride up and down the exterior.

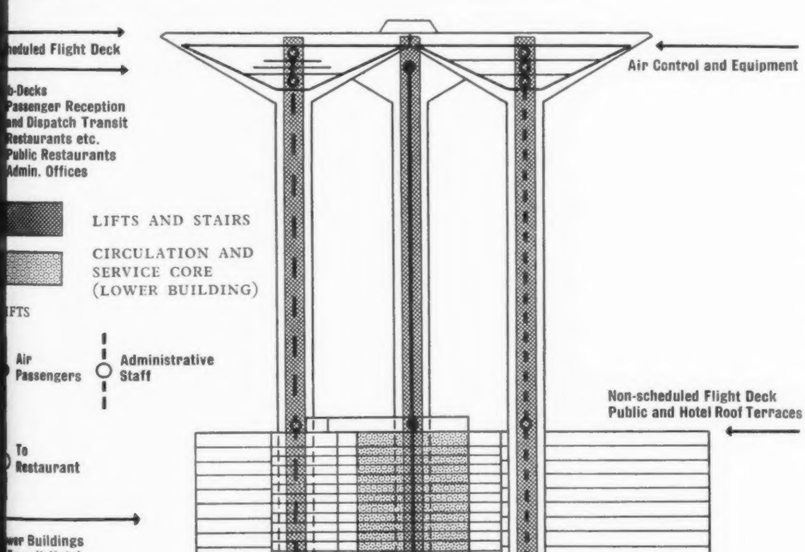
This diagram shows how SKYPORT ONE on the St. George's Circus site would fit into the pattern of London air transport. The air approach lanes, which would be half a mile wide, would run from East to West into the prevailing wind. SKYPORT ONE would serve the heart of London; and there would be subsidiary airstops adjacent to the main railway termini, the docks and so on. In addition to these city-centre operating sites the system would include bases outside the built-up area. These would be used for maintenance and hangaring, and would also serve as "sit-down" sites, on which aircraft could wait, when necessary, their turn to land in the city-centre stops. There would also be special freight stops.

MAJOR LONDON AIR STOPS AND APPROACH LANES

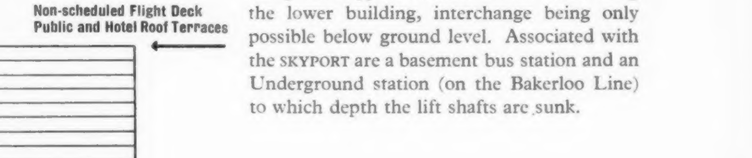


ST. GEORGE'S CIRCUS

DIAGRAMMATIC SECTION SHOWING VERTICAL CIRCULATION



The three vertical shafts straddle a triple-wing building, with a subsidiary landing deck on its roof for the use of private aircraft and non-scheduled flights. The wings of the building could be readily adapted to many purposes, and in the case of SKYPORT ONE they are used as (i) a transit hotel, (ii) an office block and (iii) a multi-storey park for private aircraft and cars. The circulation of air passengers is kept separate from that of the general public using the Skyport restaurant and those using the lower building, interchange being only possible below ground level. Associated with the SKYPORT are a basement bus station and an Underground station (on the Bakerloo Line) to which depth the lift shafts are sunk.



COMPARATIVE HEIGHTS OF ST. PAUL'S CATHEDRAL AND SKYPORT ONE

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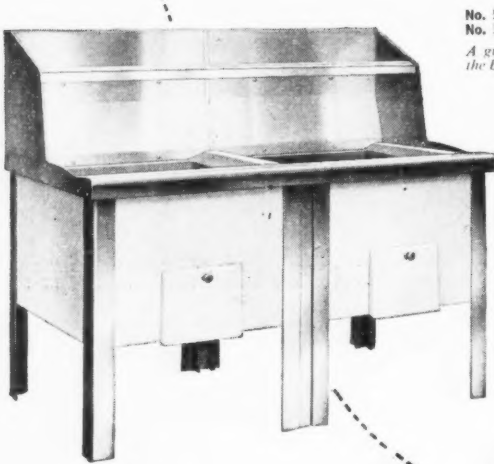

The **KINGFISHER FRYER** for deep fat frying is constructed on the unit principle and so is easy to install singly or in any number. Units are available with pans 24" or 18" wide. The fat temperature in either model is thermostatically controlled. Finish includes vitreous enamel and stainless steel.

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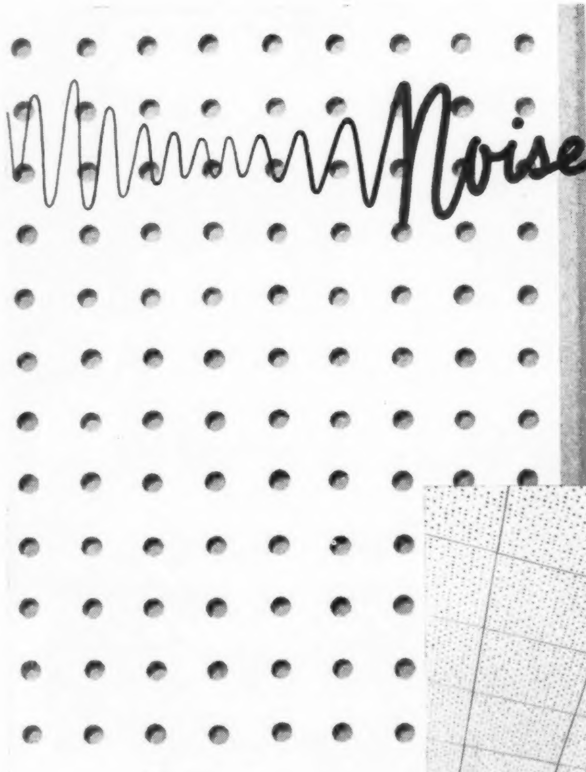

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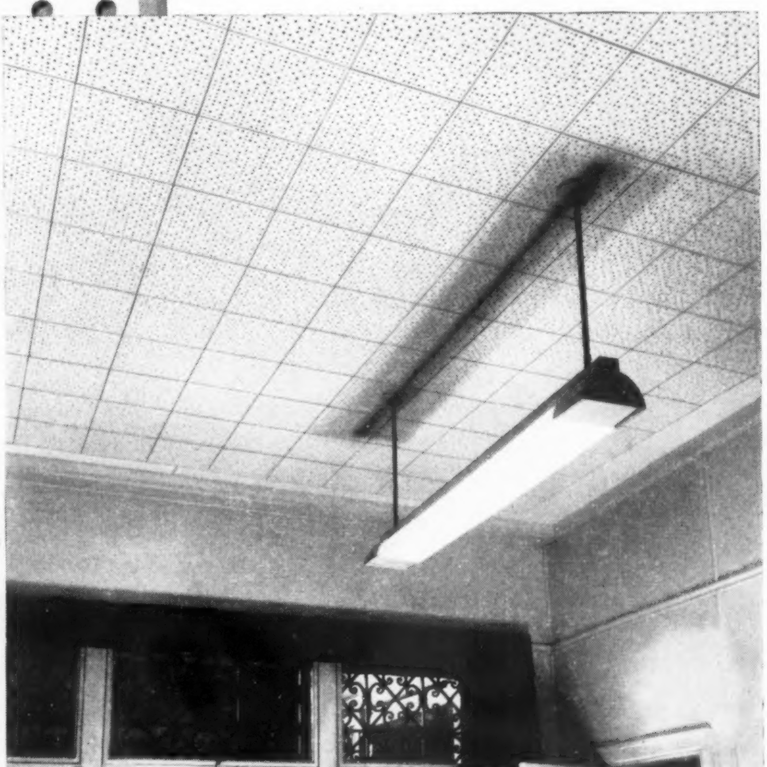
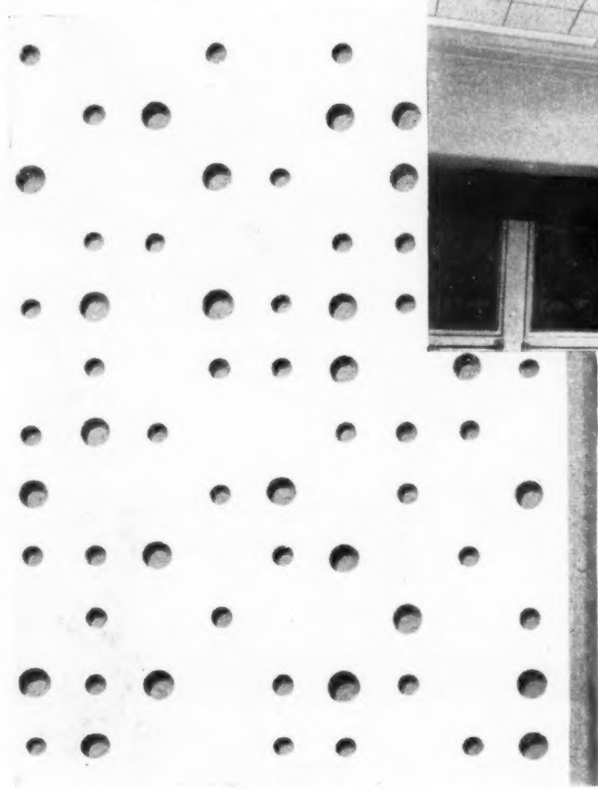


Illustrations show Standard and Random patterns and a view of an office ceiling which demonstrates the decorative effect of Armstrong Acoustic Tile.



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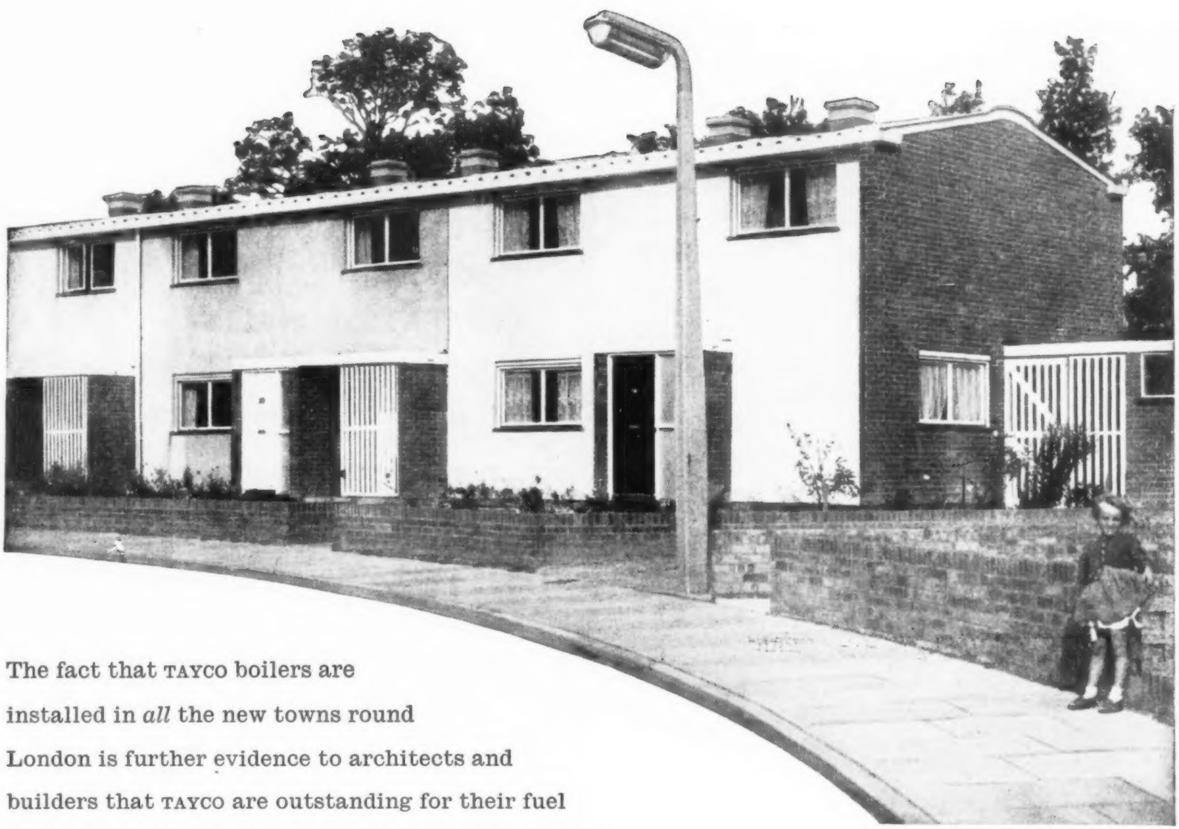

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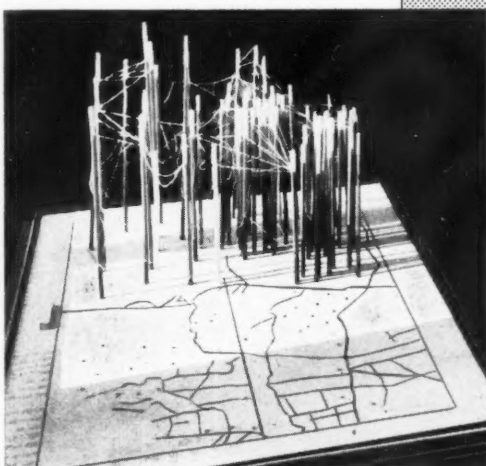

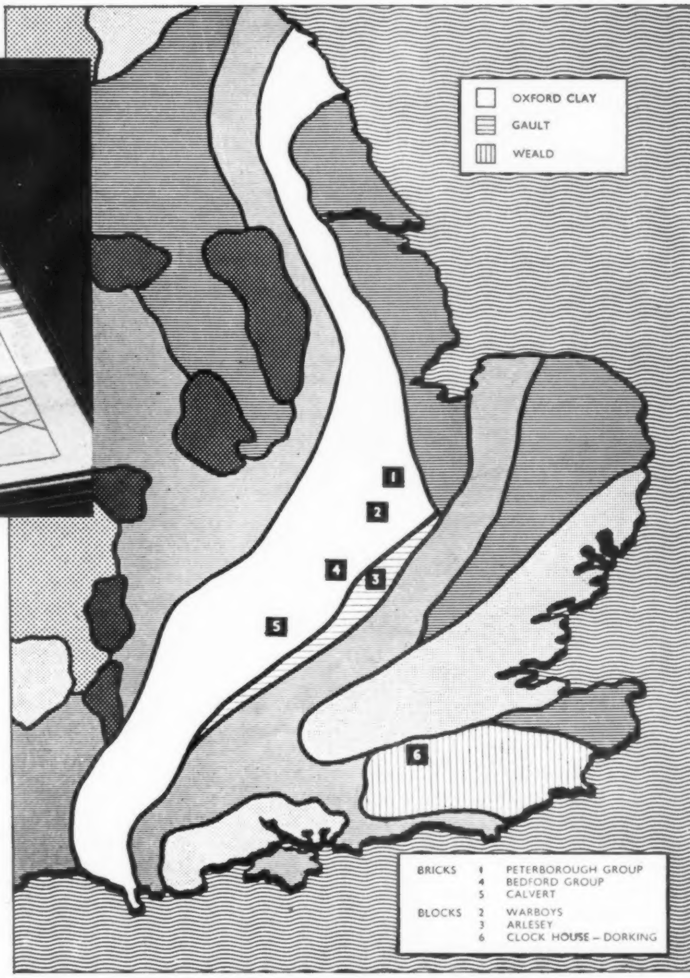

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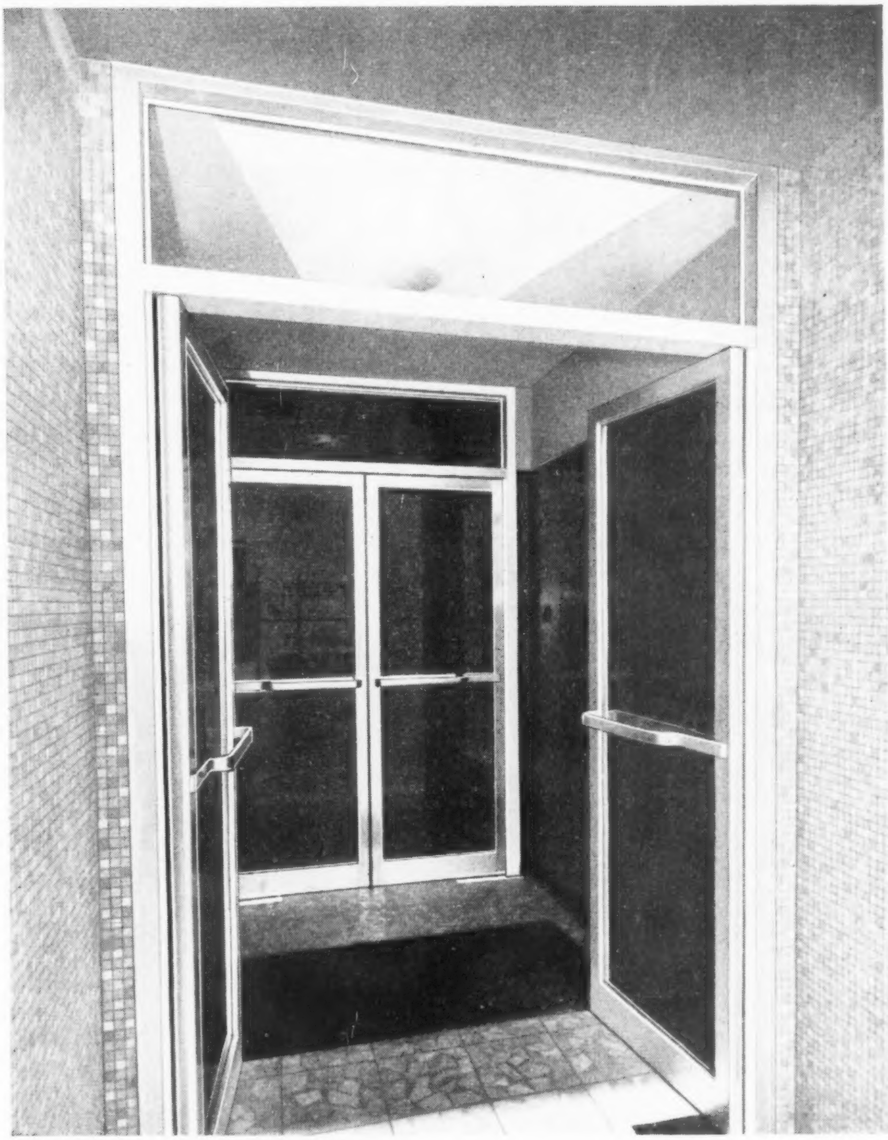

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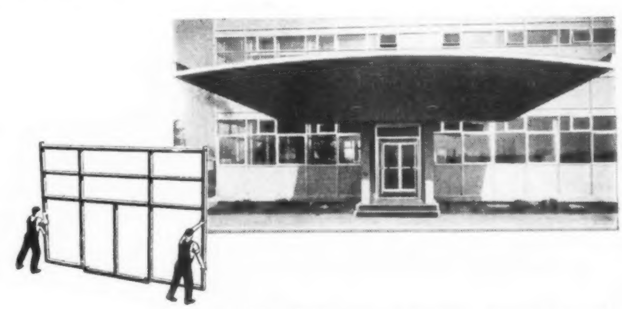

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3

Application of Asphalt No 1. **ROOFING** **Reprinted by permission of N.A.M.A.**

APPLICATION OF "NAMASTIC" STANDARD ROOFING ASPHALT

"NAMASTIC" Asphalt is applied as an unbroken homogeneous mass to protect buildings against the penetration of water. "NAMASTIC" Asphalt can be applied to form a continous waterproof covering over any curved or irregular surface, such as a dome or pediment, and can be formed to any shape as required. When laid on concrete, either horizontally or on slopes up to 10°, "NAMASTIC" Asphalt is laid in two coats breaking joint, to a minimum thickness of $\frac{3}{4}$ in. An underlay of Black Sheathing Felt is used, applied loose with 2-in. lapped joints.

On vertical surfaces or slopes of more than 10°, the surface should be slightly roughened to form a key for the Asphalt, which will be laid in two or three coats as required.

On wood boarding, horizontal or slopes up to 10°, the Asphalt is applied as for concrete above.

When wood boarding is sloped more than 10°, a layer of Black Sheathing Felt is nailed to the board surface and expanded metal lathing fastened at 6-in. centres with galvanised clout nails, to form a key for the Asphalt which should be applied in three coats. In all cases where the finished Asphalt is horizontal or sloped up to 10°, it should be rubbed evenly while hot with clean sharp sand.

FINISHES

Various finishes, such as skirtings, fascias, check rolls, gutters and risers for change of levels, are applied to form a continuous homogeneous mass of roof covering. Some details are shown in the drawings on this page.

FALLS

If it is desired that water shall clear, falls must be made in the concrete screed or boarded structure of not less than 1 in 80, *i.e.*, 1½ inches in 10 feet.

HEAT INSULATION

Insulation can be obtained by applying a layer of insulating material below the Asphalt.

Cork is recommended immediately under the Asphalt (Fig. 2). It is supplied in boards 1-in. and 2-in. in thickness and should be fixed by the Asphalter by bedding on to the roof screed with hot bitumen, and quickly covered with Asphalt. The Asphalt is laid on an underlay of Black Sheathing Felt. The edges of the cork must at all times be protected against water. $\frac{3}{4}$-in. Asphalt, together with a layer of Black Sheathing Felt, 2 in. of cork and 6 in. of concrete has a "U" value of 0·13.

REFLECTIVITY

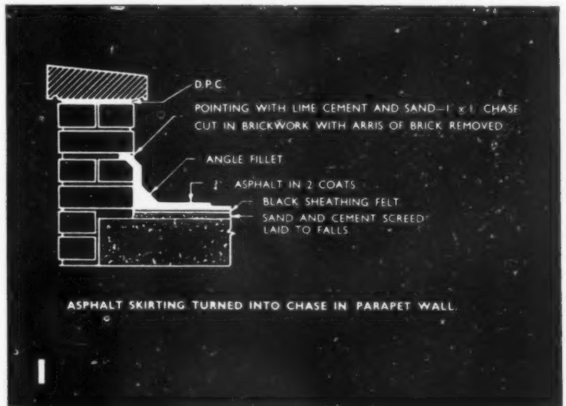
The absorption of heat into the roof structure can be reduced by embedding white or light coloured chippings into the surface of the Asphalt or by fixing the chippings in a coating of bituminous compound after all building operations are completed.

SPECIFICATION

It is recommended that the following be inserted in any Bills of Quantities for Roofing Asphalt:—

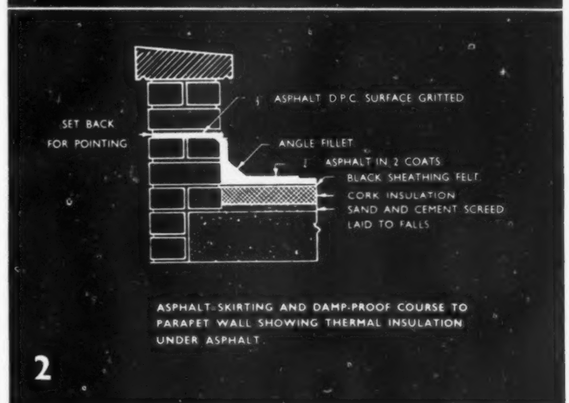
"*All Asphalt to be used for Roofing of this contract shall be manufactured to the Standard Specification of the NATIONAL ASSOCIATION OF MASTER ASPHALTERS by a licensed manufacturer and the blocks shall be branded 'NAMASTIC R'. The Asphalt shall be laid by a member of the Association.*"

The Technical Committee of the Association will be pleased to give advice on all waterproofing problems and offers its services, free of charge, in connection with all matters relating to examination of materials or inspection of Asphalt work.



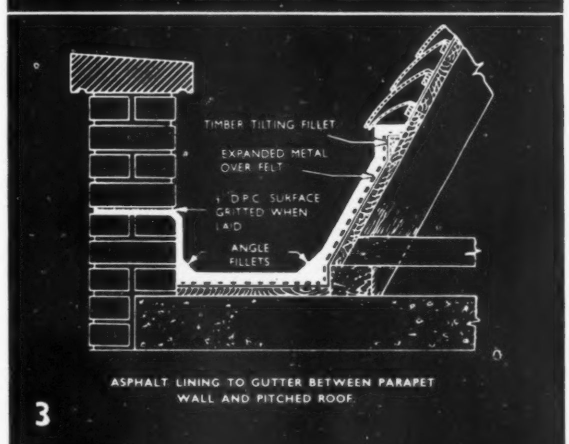
ASPHALT SKIRTING TURNED INTO CHASE IN PARAPET WALL.

1



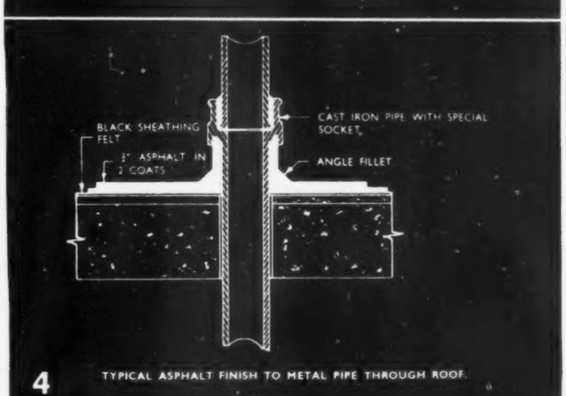
ASPHALT SKIRTING AND DAMP-PROOF COURSE TO PARAPET WALL SHOWING THERMAL INSULATION UNDER ASPHALT.

2



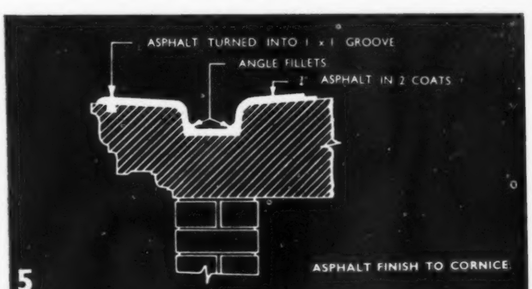
ASPHALT LINING TO GUTTER BETWEEN PARAPET WALL AND PITCHED ROOF.

3



TYPICAL ASPHALT FINISH TO METAL PIPE THROUGH ROOF.

4

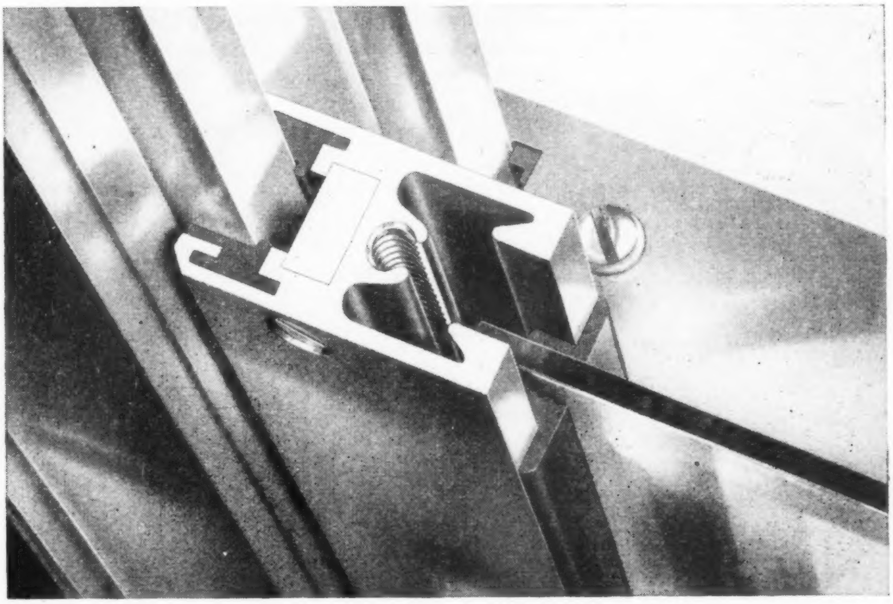


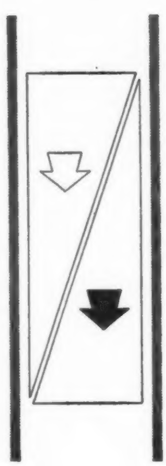
ASPHALT FINISH TO CORNICE.

5

A new design aluminium double-hung window

at a new low price





Pressure on top wedge (white arrow) binds wedges together in channel, locks device in position. Pressure on bottom wedge (black arrow) permits free downward movement. The converse is true for upward movement. This is the principle on which the 'Alomega' suspension works. The wedges are accommodated in the jambs of the moving sash, and the whole mechanism is completely enclosed.

Wedge-and-wedge suspension in place of sashlines-and-weights

• *This, we believe, is a complete and challenging innovation.*

As the diagram shows, the 'Alomega' suspension, though exceedingly ingenious, is very simple. The components have a theoretical life of well over 200 years. The tests were by no means exhausted by then, but to carry them further, it was felt, would be unnecessary.

The advantages of aluminium double-hung windows have been well-known for some years, and it has probably been the desire of many architects to use them. The only difficulty has been the price.

Now, Williams & Williams have changed all that. These new windows compete in price with wood, and so can offer their advantages for nothing.

Price example for comparison : £6.0.7d. for window 3′ 8⅜″ x 1′ 11½″

This low price (the example quoted here applies to quantities over 48) is possible for two main reasons: first, because there is no expensive counterbalancing mechanism; and secondly because the jamb sections of the window can in consequence be much slimmer, which saves considerably on the amount of aluminium used.

The 'Alomega' window is completely prefabricated, assembled *and glazed* at the works. Site-costs are saved in three ways:

1 Because no painting is required—construction is entirely of aluminium.

2 Because no glazing is required—windows are despatched ready-glazed *ex works.*

3 Because next-to-no building-in is required—mounting is by wood-screws set in Rawlplugs set direct into the masonry—no sub-frame required.

The appeal to the architect and building-owner is of course considerable: appearance is excellent, and there is a heartening NIL against maintenance costs.

Standard sizes or Purpose-Made

'Alomega' Windows are available for inspection at any Williams and Williams Area Office or merchant stockist, and are made in the following standard sizes:

TYPE 14, 3′ 8⅜″ x 1′ 2½″	**TYPE 24, 3′ 8⅜″ x 1′ 11½″**
TYPE 34, 3′ 8⅜″ x 2′ 8½″	**TYPE 44, 3′ 8⅜″ x 3′ 5½″**
TYPE 15, 4′ 8⅜″ x 1′ 2½″	**TYPE 25, 4′ 8⅜″ x 1′ 11½″**
TYPE 35, 4′ 8⅜″ x 2′ 8½″	**TYPE 45, 4′ 8⅜″ x 3′ 5½″**
TYPE 16, 5′ 8⅜″ x 1′ 2½″	**TYPE 26, 5′ 8⅜″ x 1′ 11½″**
TYPE 36, 5′ 8⅜″ x 2′ 8½″	**TYPE 46, 5′ 8⅜″ x 3′ 5½″**

Owing to the method of construction, purpose-made sizes present no difficulty and are available up to a maximum of 6 ft. x 4 ft., at approximately pro rata prices—although, of course, there will be a certain delay.

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NOT QUITE ARCHITECTURE

TUBE-TEST DECOR
"Not a Home" Says Mother of Six

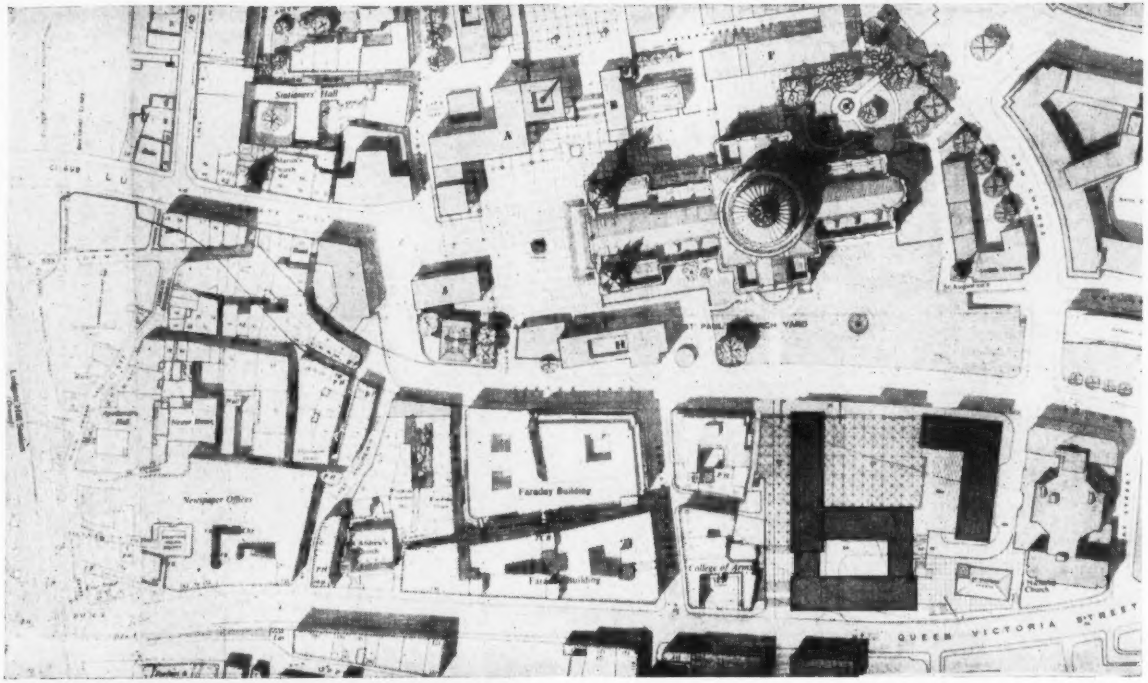
In the exhibition corner at Charing Cross tube station two rooms have been furnished by Lady Casson and Misha Black. In one room they have "mounted a furnishing scheme conceived with care and discrimination." They have contrasted this with "a room where, as so often happens, good furnishings have not been considered in relation to each other, and bad use has been made of space, so that the room looks overcrowded and unrestful." The exhibition has been arranged jointly by the Design and Industries Association and the *Sunday Times* to show the public what makes and what mars a decoration scheme —and the public has been invited to record its comments.

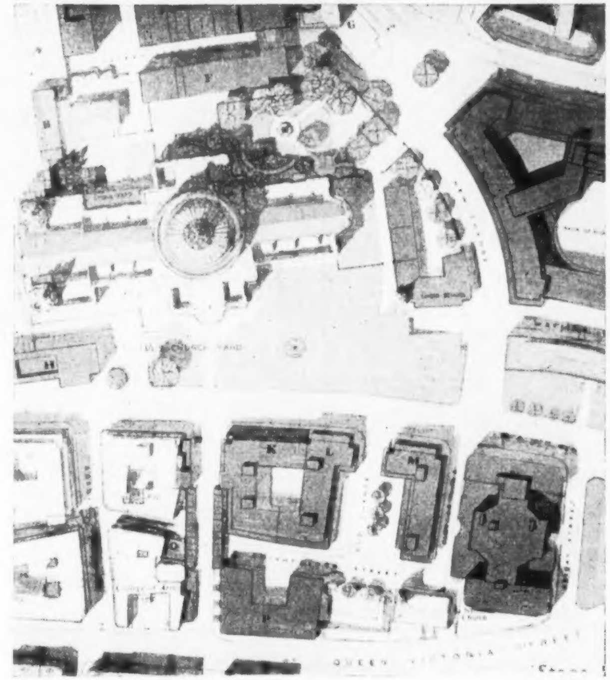
*

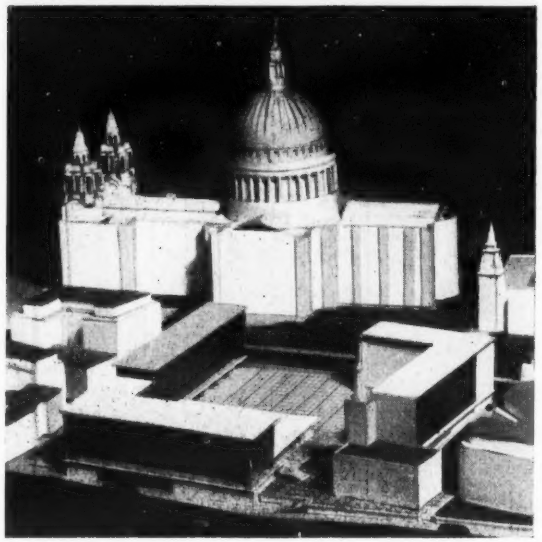
Within two days of the exhibition's opening the world and his wife had dutifully paused to appraise, and the four exercise books provided by the DIA were filling up nicely with the lively views of what is called a representative section of the community. Mother of Six (Dentist's Assistant) said, "I would not call the best one home"; Aged Twelve and A.R.I.B.A. both thought the furniture "too bitty"; an Interior Decorator left his address and an offer "to make a good job of both rooms," and M.I.C.E., anxious not to be mistaken for one of the Don't Knows of this quiz-dizzy world, began his comment with an emphatically-written "Yes."

*

The rudest view came from An Old Designer of Many Years and Architect: "These people," he said, "are only amateurs. Learn first how to construct." The most plaintive remark came from a Lodger ("I like them both"), and the Angry-Young-Mannest remark bristled from a pen which was obviously addressing itself to the notorious They. "Certainly you don't cater for the Working Class. You cannot be ordinary. I suppose you wear a beard."







Climax or Anti-climax?

In the manner in which the LCC have published their joint recommendations, with the City Corporation, for the treatment of the area around St. Paul's they have diverted attention, no doubt innocently, from a fundamental change in Sir William Holford's original design. The LCC's model, left, shows the latest proposals for the treatment of the south side of the cathedral precinct. What it does not show, and what the plan, above left, only faintly indicates, is the radical change in the approach to the west front of the cathedral. Holford's original plan shows traffic driving to the top of Ludgate Hill with the south tower of the cathedral as a focal point. Then, just as the climax of west front and piazza comes magnificently into view, the traffic is turned through seventy-five degrees and then turned again to move along the south side of the cathedral. In the latest proposal, to which, somewhat surprisingly, Sir William Holford has apparently agreed, traffic is diverted to the right half-way up the hill, into a new, 70-ft. wide road, leading into Carter Lane (the road on the south of the cathedral). This slightly curving route, indicated by a superimposed line on the plan, above left, is considered "more satisfactory . . . from a traffic point of view." Even if it is, the great climax of driving right up to St. Paul's along a narrow, built-up street has been abandoned, the entrance to the precinct sterilized of traffic and the contrast between quiet precinct and city bustle lost. In fact, the advantages of these smooth curves to motor traffic will be slight: cars will be negotiating four right-angle turns at the proposed round-about at Ludgate Circus and there are many speed-limiting crossings in Cannon Street, so two more turns before the City's greatest building, will be a mere trifle, if not, indeed, a pleasure to the more visually perceptive motorist. The latest proposals for a more "open layout" on the south of the cathedral (see model, left) are, in fact, slightly more enclosed than in the earlier model illustrated in the JOURNAL of March 22 and 29, 1956. They should be compared with the original plan which Holford submitted to the City Corporation (above right). This he had already modified when the first model was prepared. In this second plan the LCC propose an open pedestrian area linking the church of St. Nicholas (foreground) with the cathedral.

Clean-shaven Lady Casson and Misha Black were also attacked for their "remarkable example of smugness in design for living," and one sober-minded scribe wrote of the "prevailing modern tendency to make a fetish out of the superficial trappings of life." He went further. "Whatever conclusions are drawn by people when analysing these rooms, they must be forgotten in face of the more vital things of life." *More vital things?* Come now! Didn't a *bon viveur* take one look at the dining arrangements and explode with, "Who on earth would drink G——'s?" And didn't a man of culture, rightly troubled by the too-hazardous pedestrian ways between furniture, ask, "How does one get to the television set?" More vital forsooth! Is it possible that the stern observer of "superficial trappings" failed to notice the casually-unopened copy of the *Sunday Times* in the "good" room, or the groups of books lovingly displayed in just the right number per shelf, and beautifully preserved in their unfingered dust-jackets? Presumably the carper who said that "rooms need individuality to make them into homes" was sighing, in his bourgeois way, for the sight of a torn, green-backed Penguin or a copy or two of books picked up second-hand—books with no real colour-value at all. This is the sort of man who would probably take three newspapers, a habit which could, incidentally, solve the problem of another carper. "There is not enough light," this one moaned, "for more than three people to read a newspaper in comfort."

*

I know that most readers like a few statistics, so let me say that up to April 17 something like fifty to ninety per cent. of the comments recorded in the DIA's books favoured the "good" scheme. Something between six and seven people said they couldn't bring up their children in either room, and one in three of the three architects who had signed the book was clearly not a reader of the glossy magazines. ("Why *black* as decoration?" he asked.) Of the two people who said "Neither is very nice" in so many words, fifty per cent. said so in French "*Pastiches—tous les deux.*" Only one person was so shaken as to lose count of the number of schemes exhibited ("*All* the rooms are terrible"), and only one woman had the perception to see that if all that dust collected in the rooms on Charing Cross station, "what on earth would they look like when they were lived in?"

*

Well, there you are: I hope this survey will be of some use to you, even if (I quote again) "the scheme is only relevant to a small minority of people who probably don't travel by tube anyway." And as you approach the exhibition, your taste-buds twittering with apprehension, remember the Man of Few Words who Knew What he Liked. "Every man to his taste," he wrote. "I like them both."

KENNETH J. ROBINSON.

The Editors

RICS COST RESEARCH PROGRESS

AT the recent exhibition at the Brixton School of Building, the RICS Cost Research Panel showed, in their display (see page 601), a detailed questionnaire form on which members of the RICS will be asked to provide cost information about schemes of housing and flats. The RICS is doing this in response to a challenge thrown out by the former Minister of Housing, Duncan Sandys. The questionnaire corresponds more or less to the MOE-AJ type of cost analysis. The differences are that each element heading is divided into types of construction or material—for ease of classifying results—and the elements are called "techniques" and the techniques "components." In their display the RICS also showed a method of cost planning which was used by the Sheffield City Architect, J. L. Womersley, for the Park Hill scheme. This follows the MOE method of setting cost "targets" for each element, except that the targets were based on approximate estimates.

We congratulate the RICS Panel on its implicit approval of cost planning (advocated by the JOURNAL since 1955) and on its forthright effort to collect the cost facts about houses and flats. These indications of official policy and action could be the beginning of a gradual transformation in the quantity surveyor's role—from passive preparer of bills to creative cost adviser; provided the surveyor keeps in close touch with the architect. This point is vital, for the present display gives little sign that the RICS Panel are collaborating with the RIBA Cost Research Committee in formulating the objectives of their work. The Panel also mention the founding of a costs library. This would be immensely useful. But as it is the architect who has to make the significant cost decisions, he *must* have a say on the form in which cost information is presented.

NEW STREET FURNITURE

The impending end of petrol rationing, even if it still lingers on more dead than alive, has brought back the traffic jams and all the other joys of the petrol age. These are soon to be increased, if the Minister of Transport approves the proposals of the Westminster City Council, by the erection along four miles of Mayfair's streets of 667 parking meters. There will be one meter for each parking bay, and the bays will vary from 15 to 22 feet. The designs have not been settled, but the meters will have some kind of a clock face, and will be mounted on posts which according to the Westminster City Council may be as much as five feet high. When this scheme is extended, as it undoubtedly will be, to other parts of London and to the centres of provincial cities, thousands or tens of thousands of these mute sentries will line our streets at 20-feet intervals (or 40 feet if two meters are mounted on each post).

*

Whatever its effect on traffic, this will add a vast proliferation of eyesores to the mass of street furniture which already afflicts the eye. Must this really be accepted as the inevitable prize of progress? Is it impossible to plan and to build for motor traffic? An enormous amount of trouble and expense could certainly be saved if more motorists could be persuaded to leave their cars at home: but parking meters seem likely to prove an ugly way of doing it.

THE "STAR" AND THE LCC

The *Star's* contortions reached their climax (and, one suspects, their end) when the paper headlined the debate in the LCC on an opposition motion calling for an inquiry into damp on LCC estates "A Victory for the *Star*." It declared that it had been vindicated (not a word about its headline "London's Shame") although in fact the debate confirmed to the hilt the JOURNAL'S report that the LCC and the Building Research Station have been thoroughly investigating the problem and applying remedial measures with some success for two years. The *Star*, it may be noted, did not report the fact that the total number of claims for damages on account of damp, since the war, is exactly three. This does not mean, of course, that no problem exists: it does, and it is to be hoped that the LCC will make the results of all its investigations available.

NALGO IGNORES US

ASTRAGAL'S blood began to boil when he received a cutting from *Public Service*, the organ of the National and Local Government Officers' Association. It described a series of film strips being made by NALGO on the work of municipal officers, to illustrate lectures to schools, adult organizations and new entrants in the local government service. What really got under ASTRAGAL'S skin was a description of the film strip devoted to the work of the 2,000 municipal engineers. They were responsible, it said, for the erection and maintenance of nearly three million houses. The film strip shows a meeting of the housing and planning committee, a surveyor examining and charting the site, draughtsmen producing scale drawings, and the engineers' assistants making a scale model of the estate. No architect, please note, because the film-strip was made in Croydon. Although Croydon is a County Borough of 250,000 inhabitants which, according to the Municipal Year Book has "a large programme of improvements including two new swimming baths, new Central Fire Station, a Transport Maintenance Depot, new Children's Homes, and several new Homes for welfare purposes," it has no Architect's Department. Its architects are all in the Borough Engineer's Department.

*

To add insult to injury, the lecture notes which accompany the film strip make it clear, according to *Public Service*, that "some engineers do only some of the jobs shown on the strip, the work being shared among other officers such as city architects, housing managers, cleansing superintendents." This sent ASTRAGAL rushing to the telephone, to tell NALGO what he thought of them. Apparently he is not alone in his complaint. The City and Borough Architects' Society, and a lot of other architects in local offices have complained, too. NALGO accepts their point, and the lecture notes are to be amended to eliminate the suggestion that normally the engineer is responsible for architecture.

*

NALGO seems unwilling, however, to take up the suggestion that has been put to it, that a film strip exclusively devoted to the work of an Architect's department should be made. NALGO is apparently willing to handle such a film strip, but thinks that the architectural bodies ought to make it.

COSTS EXHIBITION

ASTRAGAL finds exhibitions confusing, he always misses that vital arrow pinned to the edge of a door and discovers (too late) that he is touring the exhibition backwards.

*

The recent MOW exhibition at Brixton—in different rooms at different levels—was no exception. But having found his bearings, ASTRAGAL was a bit puzzled by the number of aspects crammed in—from the MOE panels on cost planning (crisp and witty presentation) to the work of Brixton craft students (exercises, embodying—there is no other word for it—every kind of ornamental and rubbed brickwork that was going out of fashion in Edward VII's day). This anachronism was unexpectedly confirmed by another exhibit which, it seemed, had the opposite intention, a design competition for a pedestrian bridge. In this "sandwich" course architect, builder, engineer and quantity surveyor students collaborated to produce designs that might as well have come from our most insular school of architecture. Competitors' reports had a *separate* heading: "æsthetics." Need I go on?

Elsewhere there were models to show how much steel can be saved by use of the plastic theory, panels to show single-stack plumbing, tower cranes, power tools and pre-stressed concrete. ASTRAGAL was spellbound by a diorama with programme chart and model of half-completed building, both of which (by trick lighting) "progressed" before your very eyes. He was struck by the suggestion of "open air" boilers (why build a boiler house?) and noticed that the RICS Cost Research Panel's exhibit had evidently been presented, to put it kindly, without the aid of an architect. He hopes that this is not an omen for their future work.

CLIMBING ON TO THE TIMBER WAGON

At the timber symposium at the RIBA (a very good one, by the way) ASTRAGAL had to pinch himself more than once to make sure that he was not at a Press conference organized by the TDA. Architects were jumping up from all corners of the room to say why they were using more timber, and most of the few words of warning seemed to come from members of the trade. What is it that works these changes in the architect-heart?

*

ASTRAGAL has always been brought up to the idea that architects only really like what is expensive. But it may well be that nowadays they like what is good for them, and that at the back of their emotive selves is a sort of unconscious computer which endlessly studies cost analyses while they sleep and guides their taste towards what is cheap and in plentiful supply. Certainly in these respects the tide is flowing in favour of timber and against steel and concrete. Structural timber can be got in four to six weeks where steel will take three to six months. For trusses over 50 ft. span it can be the cheapest and, most important of all, it has shown itself to be most amenable to prefabrication. From being the last, regretted, stronghold of hand craftsmanship, it is by way of becoming the most hopeful raw material for engineering.

*

Fearful perhaps that the architects present would be too hopelessly beguiled by the picture which they themselves were so eager to build up, A. C. Oliver of the TDA hastened to put on the screen a series of coloured slides showing the rapid mortality of even the best clear finishes. Colour photography, which is always being held up as the architect's friend, is unquestionably the timber varnisher's enemy. Seen in the other-earthly light which it provides, woods treated with even the most effective varnishes—the alkyds and phenolic resins—and exposed to the least corrosive atmospheres turn slime grey in three years, while those rubbed with linseed turn black almost from the word go.

These two rooms, furnished by Lady Casson and Misha Black, are on view in the "Make or Mar" exhibition which the Design in Industries Association and the Sunday Times *are putting on at Charing Cross Underground station. The cost of each room is about the same, but by using an extravagant amount of colour and pattern in one room, and by placing in it inappropriate items in inappropriate places, the designers have created a jarring, restless effect. The public is invited to comment on the two schemes, and a report of some of the criticisms made when the exhibition opened appears on page* 595.

TAKE A SUB TO BLEWCOAT

The old Blewcoat School in Caxton Street now houses the membership department of the National Trust. By holding his press conference there recently, Sir Harold Nicolson, the vice-president of the Trust, was able not only to dispense hospitality in delightful surroundings, but also to put on show a sample, as it were, of the work of preservation that the Trust is doing. The Trust, in fact, does its work so well that one is inclined to take it for granted, and to assume that it has ample funds with which to look after and improve its properties and to buy new ones.

*

This is far from being so: inflation has hit the Trust as it hits everybody else. Its endowments continue to shrink in value; it lacks the funds to modernize its 440 farms and 2,000 cottages, and it needs £100,000 a year to make unendowed properties self-supporting. It has to refuse offers or bequests of properties which ought to be preserved, unless they are endowed, and every property refused is liable to be a property neglected or even demolished. Sir Harold's appeal for 100,000 members (there are now 60,000) should not go unheard among architects. Few firms or individuals would notice the loss of £1 a year, which entitles the member to free admission to National Trust properties. ASTRAGAL strongly recommends a personal visit to the Blewcoat School to pay the sub, as it is well worth seeing: but the National Trust, no doubt, finds postal orders equally acceptable.

PLASTIC TOWER

The *Evening News* has been running a series on London in the year 1999 (a tactful choice of date that leaves 2000 clear for Pilkingtons' Glass Age committee). Apparently 1999 is going to be plastic, not glass, for the second article in the series was about a 100-storey plastic tower to be erected in one corner of Buckingham Palace gardens. The project is the work of architect Geoffrey Holroyd, and consists of flats that bear some resemblance to the Smithson's House of the Future, to be air-lifted with helicopters and dropped into place one on top of the other. No independent structural frame is indicated, the astronomical crushing loads on the plastic walls of the lower flats being mopped up by gamma-radiating the plastic to boost its strength.

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ASTRAGAL cautiously rang up a not-very eminent scientist for an opinion about this. "It could work," he said, "but there would still be a lot of structural redundancy in the upper storeys, and the lower parts would probably be terribly brittle. One good nudge from a helicopter out of control . . . I see, by the way, that they are expecting helicopter pilots to commit suicide, wreck their kites and drop their cargoes, through having to fly within about nine inches of an adjoining tower. Turbulence, you know."

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We shall have to take his word for that, but you can take my word that, technical improbabilities apart, the text of this piece, by Felix Barker, is a very shrewd example of how to sell advanced ideas to half-timbered readers, and deserves the study of all design-propagandists.

ASTRAGAL

The problem of damp from condensation in post-war housing, which was the subject of sensational reports in the London Star, *and of an article in the* JOURNAL *on April 4, has aroused considerable interest. In this article George Fairweather argues that with present-day building practice and intermittent heating the "U" value of insulation has little relevance to the problem of condensation, and urges the need for insulation linings on the inner surfaces.*

THE PROBLEM OF CONDENSATION

By George Fairweather

Evidence of nuisance from dampness in new housing schemes is mounting, and whereas the conditions may not be so bad as is suggested by reports in recent editions of the London *Star*, it is obvious that something is wrong in these buildings, and that their construction is not providing a suitable environment for the average requirements of domestic comfort and convenience.

Reports of this nuisance suggest that it may be more common in flats than in houses, and that it is more pronounced when the flats are occupied and heated intermittently. It seems, too, that the nuisance occurs even where improved standards of insulation have been provided, and that it persists long after the building has presumably dried out.

There can be little doubt that condensation is the main cause for this nuisance, and although its manifestations may vary with the habits of tenants, it must be obvious that there is something about the construction of the buildings and maybe in the layout of services that introduces a susceptibility to condensation.

Condensation is influenced primarily by the effect of heat on the capacity of air to support moisture, and if heat is lost rapidly from air, excess moisture will be deposited in the form of water. Heat may be lost from the air of a room by contact with cold materials in floor, ceiling and wall surfaces, and if these materials have a large capacity for heat and relatively high conductivity, their cooling influence may be sufficient to cause condensation in humidities commonly experienced in domestic buildings.

The increasing use of steel and dense concrete in preference to timber for the construction of floors and roofs in domestic buildings, particularly when arranged in blocks of flats, must obviously increase the heat absorbing potential of construction to a considerable degree.

Similarly, the present-day practice of running water mains and distributing pipes within the insulated envelope of domestic buildings brings a powerful system of condensers into conflict with internal heating, and adds still more to the heat absorbing potential of the buildings.

In a sense, this heat-absorbing potential of a building may have an overall influence on the incidence of condensation by forming a "cooling" load (used in the same sense as "fire" load is used in relation to fire hazard) and so determine the level of insulation necessary to check heat transfer from room air to the structure and other cooling features.

The measure of insulation generally applied in the design of walls, floors and roofs is primarily concerned with the overall resistance provided by these structures to the transfer of heat from the air on one side to the air on the other, and is stated in "U" values.

Whereas the rate and amount of heat transfer necessary for the warming of materials is a factor included in the assessment of "U" values, it is not separately identified for purposes of design. The "U" value of insulation is in fact concerned only with overall transmittance losses of heat, and has little or no meaning in relation to the problems of condensation.

The fact, therefore, that improved insulation standards are generally embodied in the construction of walls, floors and roofs of domestic buildings does not mean that any positive steps have been taken to check the initial stages of heat transfer to the cold materials of construction.

In present-day practice, insulation is frequently provided in the form of a membrane placed on the outer side of the main structure, and in this way a large mass of "cold" material may be exposed to the influences of room temperatures and humidities.

The warming of this large mass of "cold" material by transfer of heat from the air of a room may promote condensation during the early stages of heating. Insulation on the outer side will shorten the period of heating-up, and will help to maintain the temperature of the material when it is warm.

If, however, a large mass of "cold" material is exposed to intermittent heating in a room, the conditions liable to promote condensation during the early stages of heating will be recurrent, and little if any benefit will be gained by insulation on the outer side.

To be effective as a deterrent to condensation, insulation treatment must aim to check the intake of heat to surfacing materials. It should, therefore, be embodied on the inner rather than on the outer side of the main structure, and ideally as a lining structure of low thermal capacity.

In addition to their usefulness as a deterrent to condensation, low thermal capacity linings add appreciably to personal comfort in room heating by diminishing heat loss from the body by radiation. They also help to reduce fuel costs when heating is intermittent by offering a quick and favourable response to heat when it is introduced.

By relying on air-to-air transmittance or "U" values of structural insulation, the attention of designers is diverted from the more immediate problems of condensation and heat comfort, and although a great deal is already known about the performance of materials and their surfaces in relation to heating, very little has so far ben done to translate this knowledge into terms and values offering a comprehensive guide to structural insulation.

It should not be necessary to relieve condensation in high flats by means of central heating, and it is unreasonable to blame the habits of families for causing condensation when it need not arise if suitable methods of insulation are used for construction.

There is a useful field for research in this direction, and more guidance on the subject of structural insulation is urgently required by local housing authorities and their architects if this nuisance of condensation is to be effectively curtailed.

N E W S

RICS

Costs Exhibition

At the recent exhibition organized by the MOW and the Brixton School of Building (mentioned by ASTRAGAL this week), the RICS Cost Research Committee had an exhibit which served both as a progress report and as a statement of their plans.

The first section showed the RICS's response to the challenge thrown out by Duncan Sandys when, as Minister of Housing, he asked them to help discover why flats cost more than houses. They propose to send out a fairly detailed questionnaire to members, for cost and technical information, which, when analysed with the help of BRS punched card machines, should show where the money goes and why.

As a preamble to the display of the questionnaire form, the Panel criticised (by implication) the elemental breakdown—based on function—used by the MOE and the AJ, on the ground that function and actual type of construction do not always coincide. For example, "frame" would perform the function of a partition in a cross-wall structure but not in a column and beam structure. This would make comparison of frame costs difficult. Hence the Panel have arrived at a breakdown by what they call "techniques"—an ambiguous title probably chosen in an effort to avoid the MOE term, elements. It appears to correspond to grouped MOE elements, for instance "structure" would contain floors, frame, external walls and internal non-load-bearing partitions.

The questionnaire form has three parts: Part A is for names, dates, tender prices, type of contract and so forth. B is for particulars of site, density and site works costs. And part C refers to single blocks or houses in a scheme and has space to fill in the schedule of accommodation, type of access, type of structure, areas of roof, basement, ground floor, upper floors and ceiling height. Then follows the list of "techniques," with sub-divisions of "components"—*e.g.*, under structure there are RC columns and beams; RC cross-walls; steel columns and beams; concrete casing to steel.

The Panel propose to circulate the form both in this country and abroad. The returned cost analyses will then be weighted so that costs all refer to the level of building costs at the same date. They regard the form as provisional and experimental but they say ". . . it will contribute to establishing a standard method of analysis throughout the profession . . ." and suggest that ". . . it will be possible to maintain a permanent record of building costs . . . that could be used for the foundation of a library of cost information."*

The second part of the Cost Research Panel's exhibition may perhaps be taken as a further indication of their approach. It was an account of the cost control technique used for the Park Hill scheme at Sheffield; architect, J. L. Womersley; quantity surveyor, Cyril Sweett (chairman of the CRP). The method was this: after the preliminary design stage an approximate estimate per dwelling was made, broken down into some eleven elements totalling £2.200 and based on the quantity surveyor's own records.

Later, a detailed approximate estimate, based on a "three-storey unit," was made, giving prices of alternative methods and materials—an estimate which led to "major variations from the sketch plan" and provided the basis for choice of cost targets, within which the working drawings were prepared.

The next phase was a "total approximated cost," broken down into over 40 headings, broadly corresponding to MOE elements, except that builders' work in connection with specialists' work was kept separate. The total was £2,134 per dwelling, or 90s. per sq. ft. of *habitable room* floor area. This would correspond to 59s. 6d. for the whole area.

This approach—the setting of a number of cost targets as a guide for the constructional design, is, of course, the same in principle as "cost planning" on the MOE method.

The bill of quantities prepared for the job differed from conventional practice in that repetitive items were separately billed as "supplements" to the main bill. For example, each window type was measured in detail, the number off given, and scale drawings shown so that estimators could allow for the economies of quantity production. *In situ* concrete work was similarly treated—with isometric drawings in the bill pages so that re-use of shuttering could be precisely assessed.

If allowance for changes subsequent to the cost plan is made, the winning tender (Sheffield Public Works Department) and the approximated cost were very close.

* see editorial comment on page 597

RIBA

Advice on Art Education

The RIBA will be represented on a Council for Art Education, if proposals made by the National Advisory Committee on Art Examinations in its report are carried out by the Government. The Committee recommends that the Ministry of Education cease to be directly responsible for conducting art examinations. The Council for Art Education would advise the Minister of general questions concerning art in general education, and take charge of a new art examination system.

The Committee considers that the present national examination system restricts initiative and originality in planning courses and in teaching at the art schools. Under the new proposals the larger schools would be given freedom to plan their own courses and hold their own examinations with a minimum of outside control: the proposed Council would decide which schools could be exempted from the central examination, which it would retain in a modified form for those schools which were not exempted. The proposed council would have 28 members.

TCPA

Annual Report

The annual report of the executive committee of the Town and Country Planning Association stresses the need for greater use being made of the Town Development Act and for the building of more new towns. Points from the report are:

The agreements so far made and under negotiation for the reception of overspill are quite inadequate to permit of rapid progress of slum clearance and central redevelopment on satisfactory standards of rehousing and open space. The Executive have been in close contact with authorities at both ends of the dispersal process, and have been convinced that marginal improvements of the terms offered by the Government or by the larger authorities, or both, to receiving authorities, would facilitate many more agreements under the Town Development Act. But the measure of the necessary dispersal is such that further new towns are also required, and we have therefore continued to press for both methods to be more energetically used.

The economic situation of the country undoubtedly calls for emphasis in city redevelopment on industrial efficiency, which involves the modernization of factories and much rebuilding as well as re-equipment. City congestion is a great obstruction to efficiency, and attempts to redevelop the cities without reducing their excessive concentration must involve wasteful capital expenditure in high-density housing and on transport extensions, involving heavy cost or concealed subsidies.

The success of the existing new towns is, of course, a tremendous asset in our campaign. The revenue on the 14 new towns has nearly overtaken the outgoings and in 1955-56 six of the towns had a surplus. As compared with high density central rehousing the housing in new towns has probably saved £40 to £50 million of capital expenditure and £2 to £2½ million a year in housing subsidies.

While it has to be recognized that the extreme pressure on housing in central areas has compelled the building of many multi-storey flats, the number of these is already out of proportion to public preference. The more rehousing can be switched to new towns (and country town extensions) the greater will be the saving in capital expenditure and subsidies, and the better the social environment that will be produced, both inside and outside the big cities.

BIRMINGHAM'S NEW TOWN

The Minister Says "No"

The Minister of Housing and Local Government, Henry Brooke, has rejected a proposal by Birmingham Corporation that the Government should build a new town in the south-west Midlands to receive Birmingham's overspill population. Mr. Brooke has suggested that the corporation might consider building a new town.

MOW

New Booklets on Building

MOW have just published the first three of a series of seven booklets on new developments in building technique. This venture has been partly financed by funds made available under the Conditional Aid scheme set up by the US Government to promote productivity in industry. The first titles are *Simplified Plumbing, Polythene Tubes for Cold Water Services* and *The Importance of Thermal Insulation in Building.* Though the opening words of *Simplified Plumbing* are "This booklet is addressed principally to architects and other professional people in the building industry," the information it gives shows no advance on BS.CP. 304 or BRS Digests 48 and 49 (and if architects pay no attention to these, why should they take any notice of a MOW 6d. leaflet?). These publications seem more suitable for the layman or for the small builder readership served by MOW's admirable advisory leaflets. In the circumstances, would not the money have been better spent in promoting research?

(*Continued on page* 605)

ALVAR AALTO GIVES FIRST RIBA "DISCOURSE"

Alvar Aalto, the RIBA gold medallist, delivered the first Annual discourse on April 10. Dr. J. Leslie Martin, who presided, said that if he were to draw any line, it would be a horizontal and not a vertical one: above this horizontal line he would choose to place the creative work of the great designers, and below it, the rest. The thing that would strike him, when he looked again at Alvar Aalto's work, was a new series of distinctions, not between the work of creative designers, but between his kind of architecture, which was ordered controlled, worked for and not just accidental; his kind of detail, which was the result of the completeness of a great idea and not just a trivial end in itself; the kind of architecture he produced, which looked well in itself and was only appreciated when it was seen, and not merely something which looked well on the drawing board. Mr. Aalto said (in part):

The main thing is not to make a difference of different personalities, different countries and different conditions. There is still that old thing—good and ill, good and bad. Our time is full of enthusiasm for and interest in architecture because of the architectural revolution which has taken place during the last decade. There is a very small percentage of good and human construction in the world today. Cultural creation is too small in every country, and not only in my own country. I think that the percentage is the same in all the countries of Europe.

I think that probably Dr. Martin's words will go down in history as describing the way in which the activities of the architect should be pushed on the side of increasing the amount of good, reasonably good, construction and planning for humanity—for more than two or three per cent. in a country.

The architectural revolution is still going on, but it is like all revolutions: it starts with enthusiasm and it stops with some sort of dictatorship. It runs off the track. There is one good thing that we still have today; we have all over the world, maybe in Uruguay, maybe in Scandinavia, maybe in England, maybe in South Africa—in all these countries—well-organized groups of creative people calling themselves architects, with a new (what should I say?) direction for the world. Slowly, from being formerly artists, they have moved over into a new field; today they are the *garde d'honneur*, the hard-fighting squadron for humanizing technique in our time. With a client in Paris, a few days ago, I had a discussion about just such a simple thing as ventilation. He said, "Technique *sans esprit* is the worst thing in the world"—which it is.

Let us see how we do this work. Are we doing it rightly? Let us take two poles. If I step down from the New York Central Station, or a station in Chicago, and some of the young architects are there, the first question—if they do not know me—is, "Are you old-fashioned or modern?" I have heard these questions in all civilized lands—and lastly in Portugal, in Estoril. I think this is probably the most naïve but the most-used formula—"Are you old-fashioned or modern?" If we look deeper into this question, we see just why it is nonsense and nothing more.

There are only two things in art: humanity or form. The mere form, some detail, does not create good humanity. We have today enough of superficial and rather bad architecture which is modern. It would be hard to find any architect able to design a Gothic or a Georgian building today.

Let us take some capital city. Of course, all the houses are modern. But you can find very few houses which really give human beings the feeling of real physical life. Let us take the other pole. A few months ago an Indian architect went to snow-covered Finland, the first thing he asked was "What is the module of this office?" I did not know the answer, so I did not answer him. One of my chief lieutenants answered "One millimetre or less."

There are these two poles, first the pendulum of the most popular force of discussion, and then this last one, this nonsense No. 1—this seeking of a module which should cover all the world. This represents at the same time the dictatorship which finishes the revolution, the slavery of human beings to technical futilities which in themselves do not contain any piece of real humanity.

How should we carry on our fight? In what way? What inter-communion should there be among all the architects of the world, and what should we tell the people? I think we should go back to Dr. Martin's horizontal line. The Institute of Finnish Architects, a few days ago, sent to the Union International de l'Architecture a suggestion that we should state the obstacles which keep the good product back, why so few cities are well planned, why so many good city plans are turned down, why there is so small a percentage of good housing, and why in our time we almost lack official buildings which are symbols of the social life, symbols of what may be called democracy—the building owned by everybody.

The reasons which really stop culture at the line of two per cent., four per cent., or five per cent. of the whole are, of course, deep and very difficult to analyse. That is the question of our time; it is a question of the deeper meaning of civilization and culture, a question of the movement from, let us say, the society of the 17th century to our industrialism. Every piece today is made by different methods from those used before. Our life has taken on a completely different form. This must, of course, hurt; it cannot be a peaceful movement. But there are obstacles to a larger amount of good products which can be eliminated by good will, and if we study them I think we should get a larger amount of good things for all in this democracy of today.

There is today a tendency which is not very nice. There are exhibitions of architecture, of industrial arts or of art. The journalists say, "Today Sweden is leading in glass, another country is leading in pottery, Brazil is leading in coloured facades." I do not think this is a correct way. We should put all the cards on the table and speak together, plan together, and openly speak of our weaknesses. We should not be like dolls and say, "Yes, we are leading in glass today"—just like puppets.

Let us remember that there was a great era of liberalism, the time of Rousseau, or even longer. You have Bernard Shaw; there are Strindberg and Anatole France. What was the glory of these men? It was criticism, and at the same time it was the highest class of art, and at the same time there was fight. You could not think about Bernard Shaw without at the same time thinking of him as a fighting man. In their deepest meaning I think that fighting and the highest class of art conform, and in their deepest meanings they belong together. It may be that there never existed a high class of art without this mysterious combination.

I think that architectural ideas and concepts and our speech to the public should be of the same sort as with those literary men. Of course, architecture and literature are very, very far from each other; the distance sometimes sounds immense.

What are the main obstacles which are stopping us from getting 100 per cent. production? I cannot take them all, but I pick up a few things which might be of the sort that could be eliminated.

First of all, there is the enormous difficulty of educating people to architecture. It requires an unusually high cultural standard before you can get a response and get people to understand. I was once very proud when I saw here in England a little book for schools giving preliminary education in architecture. It was for very little children in an elementary school. I think it is good to do that, but I am afraid that architecture which covers all the formal and structural world that is around us is too complicated to be an educational thing on the children's level.

However, we could, on the upper level, do quite good education, but I think it should not go the same way as ordinary art criticism. We may lose our horizontal line if it goes that way. The art critic is today 100 years old. The habit of writing critical articles about single artists may not be much older. It is growing in the Press and it will continue in the same way. It will be just criticism of individual houses, and the real line will be lost. The real line is to plan and to build for the little man, for his benefit.

We may find that the best methods are real examples. For instance, we should have laboratory cities, with good forms of houses, as experiments, and let people see them. We are working in a very unfortunate field in the sense that we do not first have laboratory experiments and then build. We are the only ones in the modern industrial world who have to have the design, and directly build it. There should be a laboratory period between those two things. Every civilised country should always have a programme of experimental cities and experimental buildings. I do not think we can really educate people on how they should live without having that sort of thing.

Let us take as the second thing the mechanization, the standardization, in our time. You all know of the mechanization of all our lives; it is part of democracy. It is the only way to give more people more things. But we know that at the same time mechanization and standarization often brings down the quality. This means that biologically democracy is a very difficult process. We cannot give to everybody the same quality as we can give to a few people, as was done in the past.

But there are possibilities of using standardization and rationalization for the benefit of human beings. The question is, what should we rationalize and what should we standardize? We could make standards which raise the level and not only have the mean standard. One very important thing would be if we could create an elastic standardization, a standardization which did not command us, but one which we would command.

Slowly there is more and more mechanical dictatorship over us. We cling to philosophical methods, and in this case, if we would command—the architect as well as anyone else—the method, we could create a standardization which would have human qualities. We could try things which give more to human beings. It does not matter how much electric cables or the wheels of motorcars are standardized; but when we come to the human home, to the things which are close to us, the matter is different—it becomes a question of the spirit.

I will take up one thing more; it is that we are working always with very large subjects. Everything we do must be a big thing. Civic planning probably is the biggest. Simply to change the traffic is today such an expensive thing that people cannot politically get to the point of changing it. We know today that the little man on the street has automobiles all around him. Every minute, even in the smaller towns, hundreds of motor machines are passing the pedestrian, the little man. Our streets and cities were designed for completely different purposes, for horse traffic, a few horses here and there. Now they are full of automobiles, and we know that they are putting out a very dangerous gas which lies on the streets. Almost all of my friends in the higher medical world now think that today we are paying a very high price for our inability to build a new traffic system in which pedestrians and automobiles are far away from one another, not to speak of housing and living. The result is accidents. The price that we pay for our streets is to be found in the enormous hospitals all over the world today.

Then there is our old enemy, the speculator in real estate. That is the enemy No. 1 of the architect. But there are other enemies too who may be even more difficult to defeat. For instance, we have in my country—and there are other forms in other countries, for in this matter we are all on the same level—the sort of attitude which says, "What form of house is most economical?" If we have, let us say, a 5-floor, a 6-floor, an 8-floor block of flats, there is the question, "How thick should it be? What is the cheapest way we could give people the badly needed dwelling-houses?"

Of course, this may be called science. But it is not. The answer is very, very simple—the thickest house is the cheapest. That is clear. Of course, one can go further and say that the most expensive light that we have is daylight—let us keep that out, and then we get a cheaper house. The most expensive thing is fresh air, because it is not only a question of ventilation, but also a question of city planning. Fresh air for human people costs acres of ground and good gardens and forests and traffic and meadows.

Real building economy cannot be achieved in this ridiculous way. The real building economy is how much of the good things, at how cheap a cost, we can give. But we should never forget that we are building for human beings. It is the same in all economics—the relationship between the quality of the product and the price of the product. But if you leave out the quality of the product, the whole economy is nonsensical in every field, and it is the same in architecture.

Let me take something more of these groups. I jump from the economic consideration to the question of decoration. We all know that there is an independent industrial art in the world. There is industrial art which has no relationship to architecture. It is decoration that you can put everywhere.

The wrong rationalization is a very comical thing—rationalization made anti-human being, the wrong use of the word "economic" and decoration: these are three things that go together. A week ago in Switzerland I saw large lines of buildings made to a mechanical standard without any spirit, but in good marriage with the decoration. The decoration was there to cover the things which otherwise would look too hard and too inhuman.

But this triangular activity leads to an uncultured society and non-cultural buildings—this combination of three things which do not belong together. We get an unorganic society. We should work for simple, good, undecorated things, but things which are in harmony with the human being and organically fitted to the little man in the street.

Mr. Aalto then showed a number of slides to show, as he said, a few functions in his own buildings and not for aesthetic purposes. His first slides, of a small town in Finland, illustrated his view that main streets should always be lower than the housing because exhaust fumes are heavy gases. Four to five metres above the road level there were far less fumes. If possible, the traffic should be kept lower, and the human beings higher. The piazza shown was about 4 metres higher than the surrounding traffic.

In the National Pensions Institution in Helsinki where there are 800 workers, there is a large piazza three and a half to four metres higher than the motorised level. The restaurant is in the garden, separated as far as possible from the motor traffic. Mr. Aalto also touched on the problem of harmonising new buildings with old ones: we should at least try, he said, to be tactful to past periods. "It is possible to do that in some way. I do not think a rough contrast in any city is the right solution, because it does not include tact. The architecture is not a question of imitating forms. We should use exactly the rationalised forms that we can today. We could not be tactful without doing that."

Vote of thanks

J. M. Richards, in proposing a vote of thanks, said: This has been a truly memorable occasion. There are very few architects we in England admire as much as we do Aalto, and I do not think there is one we admire so exclusively because of his buildings. So many of the great names of modern architecture are great names because of theories they have propagated or principles they stand for, or attitudes they exemplify; but Aalto is not concerned with upholding any theories and he does not strike attitudes—he simply builds; and paradoxically, when he speaks as a fighting man, as he has done this evening, he does so with even more authority on that account. But since he builds according to no settled rules, what he will build next is always unpredictable. That is one of the things that makes his work so fascinating and stimulating to his fellow architects. Nevertheless, unpredictable though they are, we always know that his buildings will have a combination of certain qualities.

I speak as someone who had the privilege not only of visiting Finland before the war and seeing some of his early buildings—they were the buildings that led the revolution he has spoken about this evening—but I also had the privilege of being there a month or two back and seeing some of his latest ones, which I may say are among the buildings that give us encouragement that we are finding a way of avoiding the dictatorship that he said revolutions often lead to.

These qualities, I feel, are first of all that vivid plastic imagination that makes his work unmistakeably his own. Then there is the existence in every instance of a basic idea of the building which nothing is ever allowed to confuse or overlay. Then there is the appropriateness of structure, which often means originality of structure, though never originality for its own sake. Finally, there is most fertile invention when it comes to details, which are always personal to him, yet spring directly from his deep understanding of materials, and his determination, if I may define it like that, to make the material serve his purpose as an artist by intensifying, as it were, their natural characteristics.

Beyond all that there is his basic humanity, and that, of course, has been the theme really of his Discourse this evening. And hearing his talk, in his delightful, spontaneous way, about his buildings and the elements of his buildings, I for one felt that I had been given an insight into the magical process by which science and humanity are merged in his work. That, I think, is the great lesson we can draw from him. So many architects are bothered by the conflict, there seems to be between the industrial techniques of our time and the building as a natural intuitive process, a conflict which Aalto's genius has somehow managed to resolve. I am sure it is this which makes us value his work so very highly, and makes us feel that, besides the fact, of course, that he is the author of so many excellent buildings, makes us feel that, as someone (I forget who) recently said, he is the kind of architect that all architects would like to be.

This is the first of a series of annual discourses, and I think we shall be fortunate if subsequent discourses are as engrossing and as inspiring and as truly personal to the giver of them as this one has been.

DIARY

Mark II Series of British New Towns. Talk by Prof. H. Wentworth Eldredge of Dartmouth College, U.S.A. At the AA, 34, Bedford Square, W.C.1. 8 p.m.
APRIL 25

Recent Housing Developments in Birmingham. Talk by A. G. Sheppard Fidler, City Architect, Birmingham. At the HC, 13 Suffolk Street, S.W.1. 6 p.m.
APRIL 30

Exhibition of Finnish Architecture. At the RIBA, 66, Portland Place, W.1. Monday to Friday 10 a.m.-7 p.m. Saturday 10 a.m.-5 p.m.
UNTIL MAY 2

Make or Mar. Exhibition of modern furnishing, sponsored by the DIA and *The Sunday Times.* At Charing Cross Underground Station. Daily, 10 a.m.—10 p.m.
UNTIL MAY 4

Cost Control in Building. Course at the Regent Street Polytechnic School of Architecture, in collaboration with the AJ. 1, *The Need for Cost Control,* by J. M. Austin Smith, A.R.I.B.A. (April 30). 2, *Cost Analysis,* by James Nisbet, A.R.I.C.S. (May 7). 3, *The Elemental Bill of Quantities,* by Clifford Nott, A.R.I.C.S., and Ivan Tomlin, A.I.B.E. (May 14). *Cost Planning I,* by G. Grenfell Baines, A.R.I.B.A., A.M.T.P.I (May 28). 5, *Cost Planning II,* by John Wilkinson, A.R.I.B.A., and Arnold Towler, A.R.I.C.S. (June 4). 6, *Symposium,* with all speakers (June 18). All lectures start at 6.30 p.m. and will be held at the Portland Hall, Polytechnic Extension, Little Titchfield Street, W.1. Applications (enclosing 11s. registration fee) to the Registrar, The Polytechnic, 309, Regent Street, W.1.

The Rent Bill, 1957. Talk by R. E. Megarry, Q.C., M.A., LL.B. At the RICS, 12, Great George Street, S.W.1. 5.45 p.m.
MAY 6

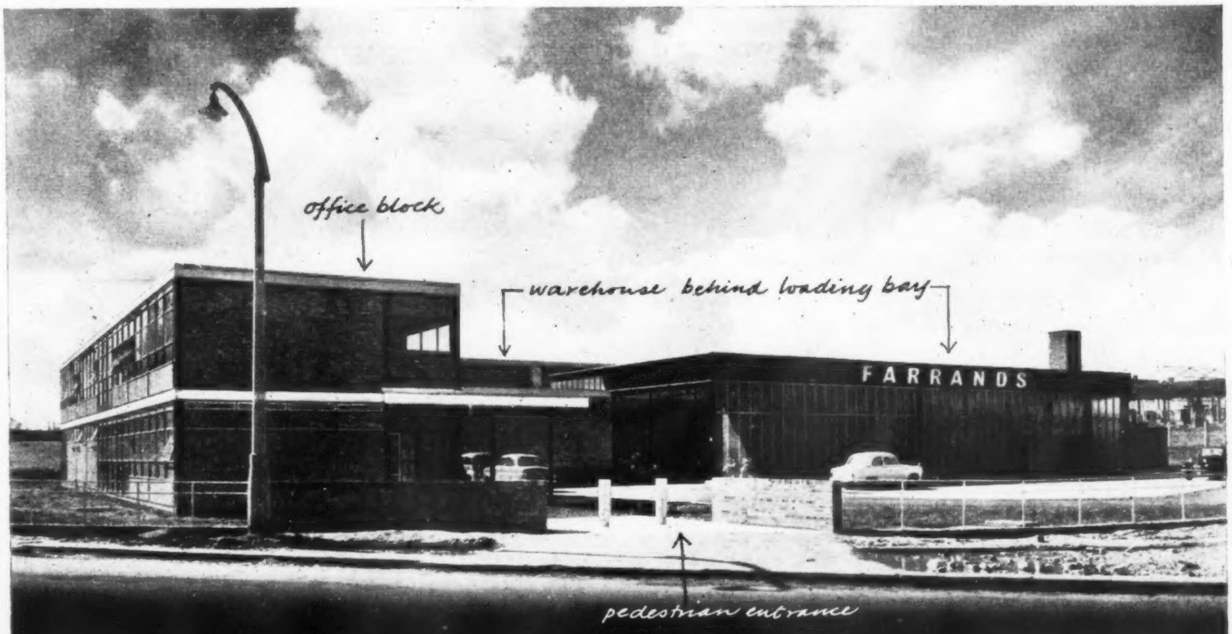
CRITICISM

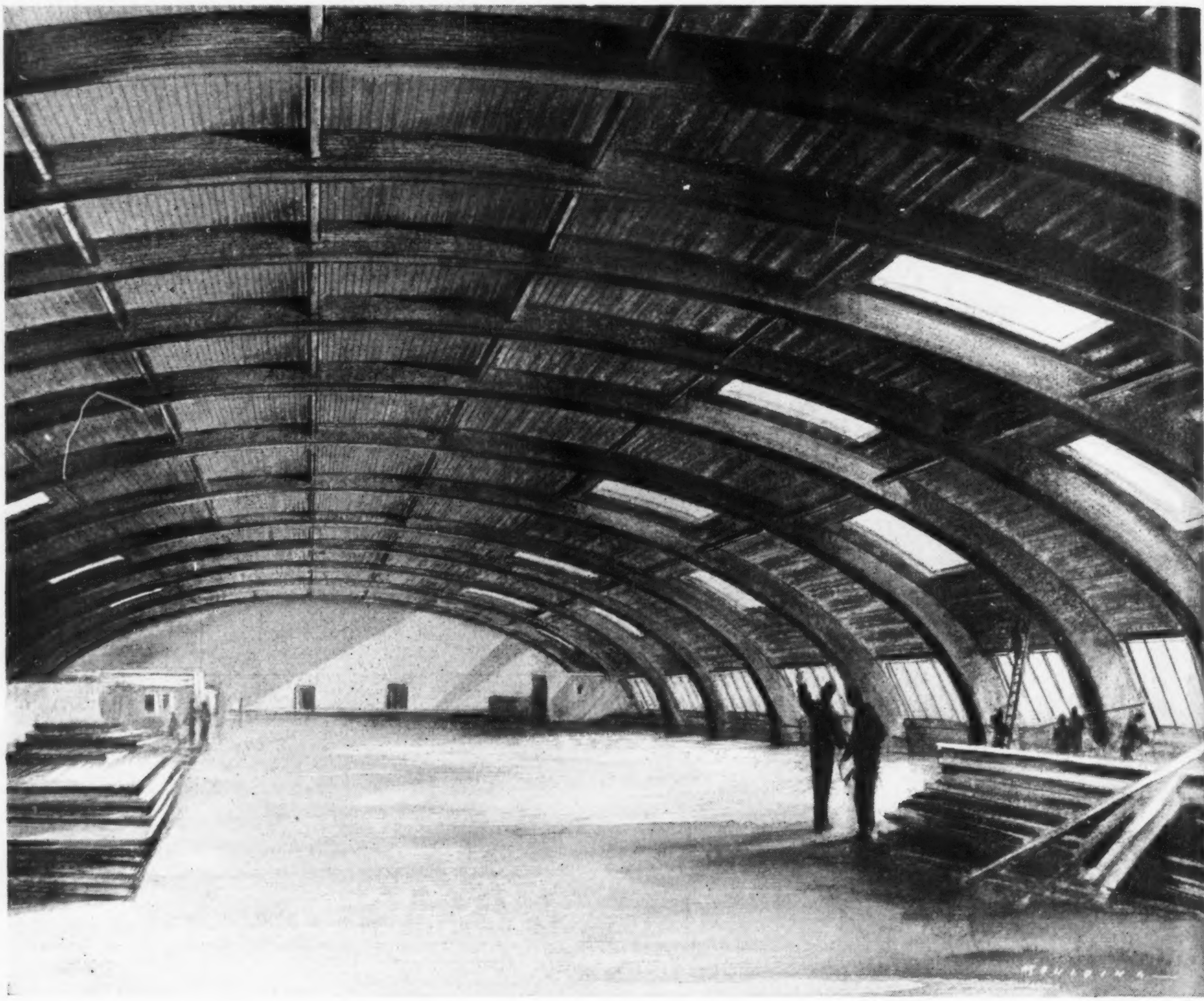
The architect replies

J. M. Austin-Smith and Partners, the architects for the offices and warehouse at Nottingham which were criticized by J. M. Richards in last week's JOURNAL, have written this reply.

We are very largely in agreement with the points about our building which Mr. Richards criticizes.
The description of the grouping and planning of the whole complex has been made expertly concise and accurate. Circulation was indeed the most important determining factor in planning the group of buildings. Of the other factors which we also took into consideration, one which we gave considerable attention to was the necessity to phase the design of the whole building.
The warehouse, being the simplest portion, was settled by the clients at an early stage, and steel orders were put in hand. The total floor area of the office block was then determined and reinforcement steel immediately ordered, the actual design of this element coming later. The canopy and staircase, the only two major outstanding items, were designed later as simple bolted steel elements, and the small amounts of steel required were obtained later without much difficulty. Another factor which we took into account was the possibility of obtaining views of the building from two sides. Lambourne Drive along the side of the office block is to be developed in due course, and though the trees may have to go this view can be enhanced by judicious planting. The placing of the office block at right angles to the frontage was thus largely determined by circulation, but confirmed as a distinct architectural possibility by the existence of this double viewpoint.
Mr. Richards correctly answers one of his own criticisms about the warehouse staff walking past the glass wall of the reception office on their way to work. Whilst this answer is in fact correct, we feel that this is not really the justification for such planning. If architectural prominence is to be given to the warehouse instead of hiding it behind a veneer of offices, then the workpeople cannot be relegated to back entrances. Whilst it would be impractical to allow them to use the main entrance every effort has been made to let them share to the maximum the effects of the main office entrance by placing their entrance within its sphere of architectural influence.
Mr. Richards wonders why we have imprisoned the workers in the canteen, and not provided them with a door so that they can stroll out on to the grass. Unfortunately such obviously pleasant ideas were not possible from a security aspect. The new road is shortly to run within fifteen feet of this side of the building so that the feeling of seclusion which now exists outside the canteen will largely disappear.
Mr. Richards has quite rightly asked whether the second entrance to the office block could not have been used for office space. At the initial planning

The north side of the buildings, taken from the road.





stage it was felt that many visitors might arrive on foot, and that an entrance at this point was considered advisable. This has already proved to be wrong, and the possibility of including the space in the office layout is already being investigated.

Regarding the criticisms of the exterior of the building, we completely agree with Mr. Richards about the aluminium capping to the roof, and the flashing to the canopy. We are not worried about the casing to the external pipes, neither do we feel that the clerestory light to the loading dock confuses the lines of the structure. This later point was given some considerable thought, and the decision taken is felt to be correct. A solid fascia all round might have produced a much too solid effect.

Mr. Richards mentions the view through the staircase hall. We were able to learn two very useful facts about the transparency of glass, the full comprehension of which is difficult in the early planning stages. The entrance and staircase hall although shielded by the canopy has proved to be lighter and more successful than anticipated, the rough-cast wired glass of the loading bay, however, has proved much more opaque than we thought.

The choice of the correct facing bricks gave us some concern. We made the mistake of choosing the dark bricks from three samples instead of seeing a panel, with the result that many of the bricks were much lighter than the three samples, and the overall effect had less texture than we would have liked. In apportioning the expenditure amongst the various elements it is usually too easy to make the adjustments necessary to obtain a balanced budget of expenditure by reducing the standard of facing bricks. It is something we always regret and always resolve never to let happen again.

News continued from page 601

ILA

Forests in the Landscape

The policy of the Forestry Commission is helping to recreate the beauty of the countryside, said C. A. J. Barrington, conservator of forests, in an address to the Institute of Landscape Architects last week. After arguing the economic case for forestry, Mr. Barrington said: Conditions at home are very favourable to the growth of trees at a much more rapid rate than in most other European countries. For example Scots Pine grows two and a half times quicker in this country than it does in Sweden, and Norway Spruce (the Christmas Tree) twice as fast. And there is in this country a considerable area of land which, because it is of a low order of production, is most suitable for planting.

I do not support the contention that a large conifer forest will always be a blot on the landscape. I have for a long time studied the reaction of the public to our work, and admittedly it has sometimes created a great hullabaloo, but I am convinced that it is the sudden change which is brought about when a new forest is created more than anything else that people object to. They do not realise that, whether you are building a new cathedral or planting a new forest, you will make a sudden change in the appearance of the land on which you are working, and beauty is not made overnight. But if we, as a nation, are not prepared for any changes, and quick changes if necessary, we shall stagnate.

There can be no disputing the fact that forestry, just exactly like agriculture, is normal land use. Timber is just as much a crop as is wheat. Many people do not realise this. And the argument that forests are not natural to the landscape of Britain is of course untrue. It is the thousands of acres of bare land which man has created by centuries of forest destruction which are not natural. Reafforesting some of our bare land gives us the chance of re-creating the beauty which we destroyed generations ago—especially during the industrial revolution. It also gives us the chance of adding to the wealth of our country a much needed natural resource for which there is a very rapidly increasing world demand. In doing this we not only stop the depopulation of the countryside which I mentioned earlier on, but in fact we reverse the trend.

What we must do is so to design these new forests that they fit in with the scenery. That is not impossible. A forest will certainly bring in a rather smaller financial return if attention is given to aesthetic considerations. But does that matter within reason? And there will be an enormous indirect gain by the pleasure afforded to the community if amenity is taken into consideration: if edges are softened; if hard, geometrical lines are avoided; if informal outlines are created; if dense forest is made to merge naturally by groups and isolated trees into farm land; if viewpoints are left unplanted; if species are mixed whenever possible; if the forester looks ahead—and thinks.

Provided care is taken and common sense used, so that some of the admittedly awful mistakes of the twenties and early thirties are not repeated, the beauty of our scenery will not be imperilled by forestry.

HC

Max Lock on the Middle East

A talk on "Housing and Town Planning in the Middle East," given by Max Lock at the Housing Centre recently, was illustrated by photographs, and by drawings of the proposals made by his team for the improvement of some of the most important centres in the area. He said that it had been interesting and heartening to find that in spite of their rich traditions in building, there was a remarkable absence of prejudice against modern architecture and design among the people of the Middle East, who today were ready to welcome the most advanced ideas.

Amman, the capital of Jordan, had increased in population during the last 20 years from 30,000 to 200,000 jostling one above the other on the hillsides. A ring road was essential, but in such hilly country viaducts would be expensive. The plan proposed that traffic bridges be built on the roofs of housing blocks, which would add something to the cost of the houses, but would make the bridges appreciably cheaper.

After referring to his proposals for Aqaba and Um Qasr, on the Persian Gulf, Mr. Lock described his work in Basrah, in Iraq. Though it hardly merited the title of "Venice of the East" it was full of canals and the first task of the planners was to make the city flood free. This was done in conjunction with a Dutch firm of engineers. There were a great many charming buildings in Basrah, but also many that needed replacement. The magnificent mosque, for example, was hemmed in by poor buildings and needed to be opened up.

Basrah consisted of two cities, the port, Ashar, and Old Basrah situated on higher ground two miles back from the river, linked by the Ashar Creek with a causeway on either side. With the development of industrial activity Old Basrah was left high and dry, and had become largely a housing area. It had some lovely buildings, and it was important to preserve as much of it as possible. There were wonderful examples of iron work and carved wood panelling which were of particular value as craftsmanship was dying out in the Middle East as elsewhere. Some of the narrow streets in Old Basrah were cool and comparatively clean. They were quiet because they were too narrow for traffic, and the wooden projecting windows of the upper storey helped to keep them cool. Wooden screens round the roofs tended to become very neglected, and sometimes fell into the streets. Brick was the only natural building material in Iraq. There were three varieties. Baghdad brick was the best and Basrah brick the worst; it could only be used for internal partitions.

In considering the future of Basrah, the planners had used the "civic surgery" approach advocated by Sir Patrick Geddes, and as a starting point had made a systematic series of surveys. In the Master Plan, the Ashar creek became the main spine of the city with boulevards on either side from which fanned out new residential neighbourhoods separated by long wedges of green open space, irrigated by lateral creeks draining the building land. These green wedges would act as buffers between neighbourhoods, and would provide sites for schools and other communal facilities.

In all housing schemes it was intended to retain the traditional courtyard planning, which was suited to the way of life of the people. Often groups of related families lived together in rooms opening off a common courtyard. Another courtyard gave access to the kitchen quarters, and a third to the large guest room, to which there must be access from the street. The layout for a residential area provided for small squares with trees, and arched streets which in the hot season could be covered with matting to keep them cool. Roads must be sited to take advantage of a cooling wind from the north.

technical section

THE INDUSTRY

Brian Grant describes a new automatic boiler, another communal TV aerial, a washbasin, and double-skin roofing.

AUTOMATIC BOILERS

Most readers should be familiar with the Watts range of automatic boilers, which have now been on the market for a number of years. The latest version, shown at the Ideal Home, is model 45A, which has an output of 45,000 B.Th.U. per hour and burns anthracite grains from $\frac{3}{16}$ to $\frac{1}{8}$ in. size. It is suitable for both central heating and hot water supply, though for the latter, as with all boilers of this kind, an indirect cylinder is necessary.

Air for combustion is supplied by a thermostatically-controlled fan, and no attention is needed as long as the hopper is kept filled, though clinker has to be removed when about three quarters of a hopper of fuel has been used. This time may be anything between 12 hours and several days. The price of the boiler has been fixed provisionally at £85, and it should prove a very useful piece of equipment for the medium priced house. (*Watts Factors Ltd., High St., Lydney, Glos.*)

COMMUNAL AERIAL SYSTEMS

Further to a previous note on way of avoiding a tangled TV skyline in flat blocks, it is worth adding that Messrs. Aerialite have recently issued a data sheet on their multipoint communal aerial system. A single suitably placed aerial provides reception of BBC and ITV programmes, as well as VHF radio, for any reasonable number of receivers, and is connected through amplifying units to the receiver feeding system. Each feeder consists of a single coaxial screened cable which ends in a flush socket outlet to which the receiver is connected. Distribution between the amplifier and the sockets can be in surface runs, plaster or conduit, but it is important to avoid sharp bends, and a minimum radius should be 1 in. Cable runs should also be as short as possible to avoid attenuation.

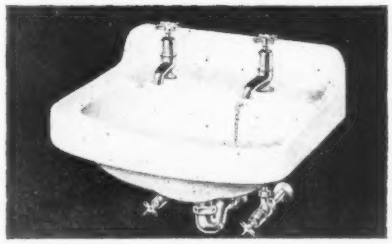
The same firm has recently introduced a range of floor warming cables. These have a central conductor in high resistance copper alloy, insulated with a polychloroprene compound which does not move relatively to the conductor with temperature changes. The overall sheath is a special heat resisting grade of p.v.c., and both the insulation and the covering are virtually unaffected by oils, solvents and the alkalis found in concrete construction. (*Aerialite Ltd., Castle Works, Stalybridge, Cheshire.*)

NEW SMALL WASHBASIN

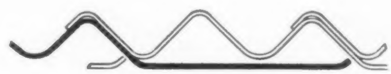
There is now a new small washbasin in the Armitage range which has an overall size of only 18 in. by 15 in., so that it should be very suitable for installation in cloak rooms, or as an extra basin in the bathroom. The basin is known as the Canadex (Model 4122) and is shown in the illustration on the right with a pair of pillar taps, but it can also be supplied punched for a mixer unit fitting and a pop up waste. It is made either in vitreous china or earthenware, and in white or a range of colours. (*Edward Johns & Co. Ltd., Armitage, Rugeley, Staffs.*)

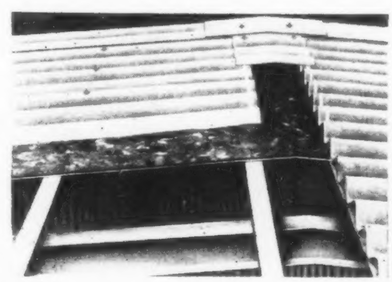
FACTORY ROOFING

Since the fate of the majority of Private Member's bills is more than a little uncertain, one is entitled to doubt whether Mr. Gerald Nabarro's attempt to compel the insulation of all new factories will ever reach the Statute Book. That, however, does not alter the fact that the idea is inherently sound, and should save an enormous amount of money. How much? Official statistics give factory completions and extensions at about 45 million sq. ft. a year, and this applies to jobs of 5,000 feet and over. Add about half for the area of the smaller jobs, and another 10 per cent. to allow for the pitch of the roof, and the total is about 70 million feet. Single skin roofing can lose about 6d. per sq. ft. in terms of fuel during the average heating season, or about £3½ million. All this of course can't be saved, but the 6d. can be reduced to 1d. without too much difficulty, so there is a possible saving of about £3 million in round figures, and that doesn't take into account the heat lost through walling.



Above: the Canadex (model 4122) washbasin. Below: details of the Turners' combined insulating roofing sheets.





There are signs that not only the insulation board makers but the roofers as well are trying to produce reasonably economical answers, one of the latest being Turners, who have produced large span combined sheets which provide a double skin and reduce the single skin heat loss by about 60 per cent. The sheets consist of three corrugations plus a flat of equal width, and they are laid with the corrugations of one sheet over the flat of the next, thus providing a series of triangular air spaces. This reduces the U figure from 1·4 for single skin to 0·52, while the addition of an inch of glass fibre mat brings it down to 0·17. Turners claim that the extra cost of the double skin is paid off in six years, while the glass fibre pays off in a year. The sheets are designed for purlin spacings of 7 ft. 6 in. maximum, and the weight as laid, is 1,048 lb. per square. Roof pitches may be as low as 5 degrees if the laps are sealed with a jointing strip, and the necessary ridges, barge boards and flashing pieces are produced to go with the sheeting. (*Turners Asbestos Cement Co. Ltd., Trafford Park, Manchester 17.*)


I knew it when
it was a tree . . .
Not seeing things are you Sir?
Yes, George, I am. I'm seeing that fancy wall up there. Maybe I cut down the trees that made it.
Would it be wood, then, Sir?
Wood that's been through the Bowater Board Mill, George—wood dressed up and with plenty of places to go. Here's looking at you, George, and your Bowater Reeded Hardboard. Long may you decorate this bar.
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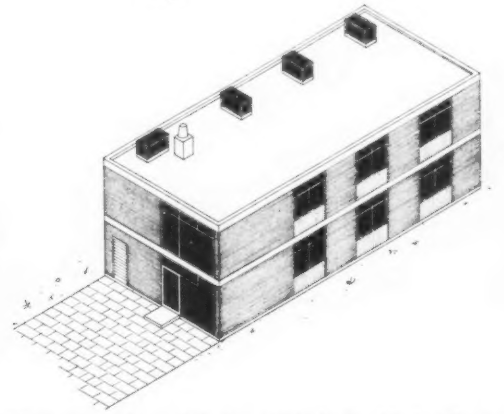
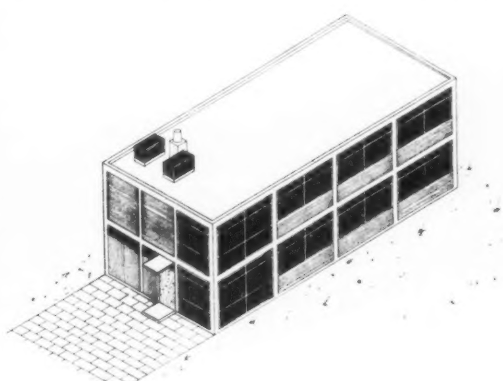
building illustrated

9 DESIGN: GENERAL
cost study: part 3, framed construction

Below we give the third part of the comparative cost study, part 1 of which appeared on October 25, 1956, and part 2 on January 24, 1957. These represented what might be termed " traditional " and " fire-resisting " constructions respectively, whereas this week's study is of a framed version of the same small office building. Part 2 cost about 12 per cent. more than part 1 (mostly in windows, first floor, stairs and roof). Part 3 is 20 per cent. more than part 1, just over half of this being due to the difference between frame plus solid and glazed infill panels (part 3), and external cavity walling plus windows (part 1).



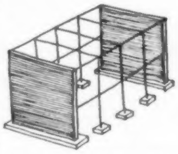
The three versions of the hypothetical office block. Top, part I design (published in the AJ for October 25, 1956); above, part II design (AJ, January 24, 1957); below, part III design. Note: the part II design should show 5 rooflights.



Stillman and Eastwick-Field, architects
Harry Trinick and Partners, quantity surveyors

We have already shown that our building in simple domestic construction cost *£5,186* and that the substitution of a heavier type of construction—reinforced concrete first floor, roof and stairs, etc.—increased the cost to *£5,805*.

In the earlier schemes it was found economical to use beams across the 21-ft. width of the building to reduce to 12 ft. the span of the first floor and roof constructions. If larger windows were required it would be a logical development to use steel or reinforced concrete columns instead of loadbearing brick piers. This might in the first instance suggest a mixed construction in which perhaps the end walls were brick and only the sides framed.



Such an arrangement although most likely cheaper than a completely framed building is however open to objections—the brick walls would rest on a strip foundation and the columns on individual bases so that there would be a possibility of unequal settlement. Also, it is difficult to tie in satisfactorily the ends of beams at their junction with loadbearing walls. In this study, therefore, only complete frames have been considered. Although perhaps hard to justify for a small office, because of the extra cost, framed buildings are frequently employed for one- or two-storey schools of a similar span where extra large windows are though necessary. As already mentioned, the main advantage of a frame for low buildings is that it permits large areas of glazing. In addition, however, it enables partitions to be planned with greater freedom, and altered if necessary after the building has been completed. Frames also form the basis of most systems of prefabricated building, and when used in this way enable the work on the site to be completed quicker than would otherwise be possible. It would be fair to expect that light non-loadbearing panel walls would be much cheaper than a brick and block cavity wall so that frame and panel construction would not be dearer than loadbearing walls, but such walls are invariably as expensive as cavity walls, if not more so.

For buildings over three-or four-storeys high frames are used mainly to avoid having to build very thick loadbearing walls. Brick panel walls are then often

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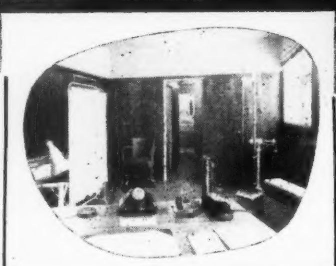
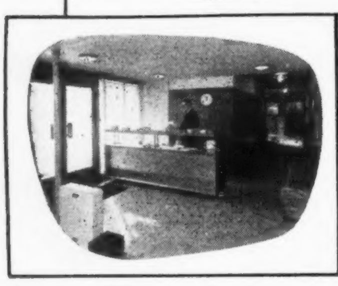


Medical Officer's Suite. Sound proofed and double glazed.



Main foyer and corridor

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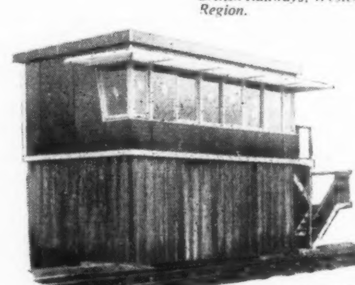

A temporary Signal Box at Stratford—For British Railways, Eastern Region.

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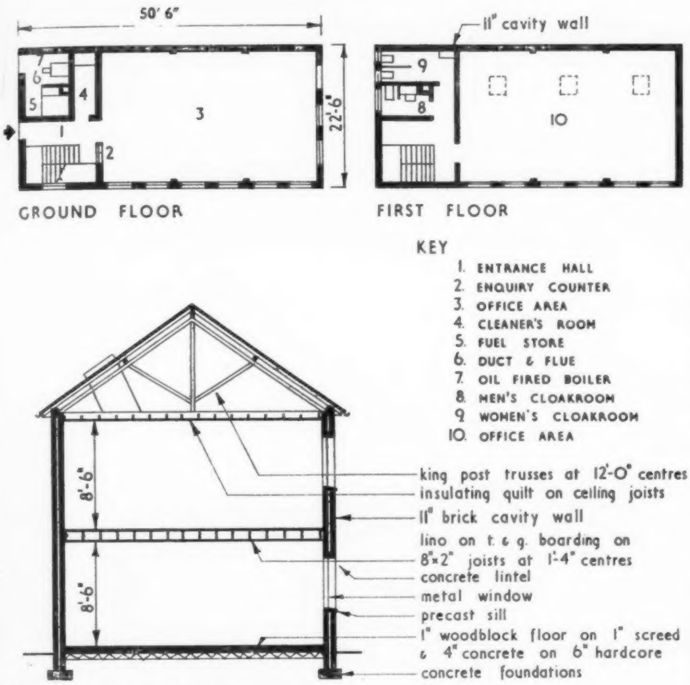
technical section

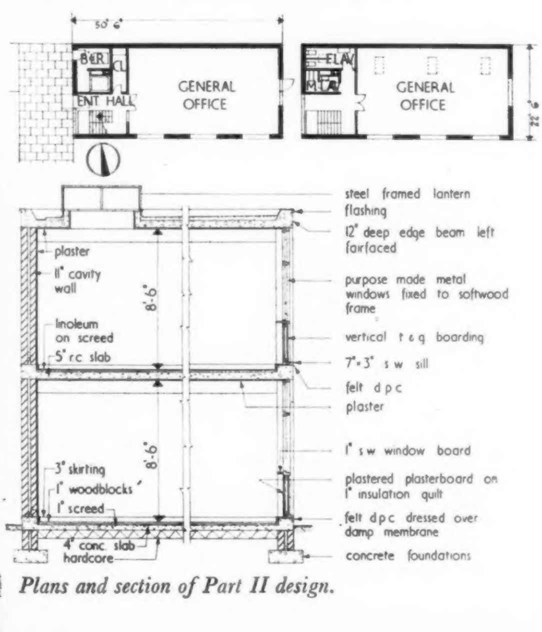


Plans and section of Part I design.

Floor area: 2,000 *sq. ft.*

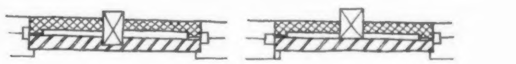
Ratios:	*Part I*	*Part II*	*Part III*
Enclosing wall / *Floor area*	1.295 / 1	1.295 / 1	1.295 / 1
Solid wall / *Floor area*	1.155 / 1	1.033 / 1	0.825 / 1
Windows and ext. doors / *Floor area*	0.142 / 1	0.262 / 1	0.470 / 1
Roof / *Floor area*	0.745 / 1	0.5 / 1	0.5 / 1
Cost of basic scheme	£5,186	£5,805	£6,261
Cost per sq. ft. of floor area	51*s.* 10*d.*	58*s.* 0*d.*	62*s.* 8*d.*

Prices based on wages and materials at September, 1956.



Plans and section of Part II design.

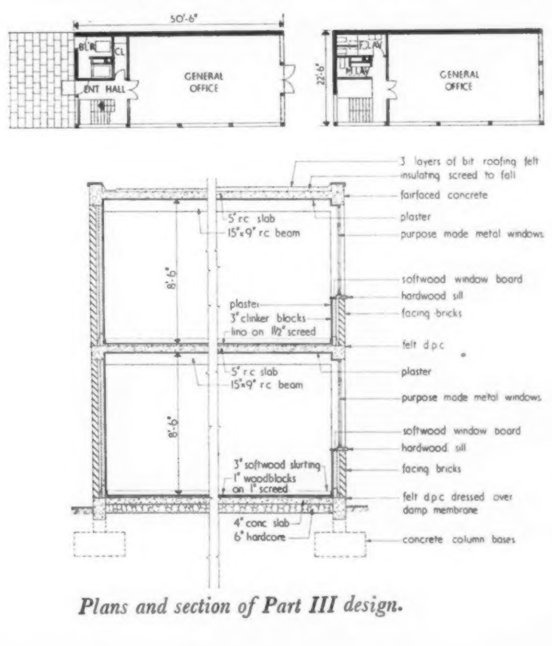
used to conceal the frame and are punctuated with small windows as though the building were a load-bearing structure.



Whatever the merits of this system, it would be pointless in the building under consideration, since the enclosing walls would probably be strong enough to support the first floor and roof, making the frame redundant.

This study is therefore confined to frame and panel constructions which take advantage of the frame to allow for greater areas of glazing. The problems which arise are those which architects are having to solve in many contemporary buildings, and for which there is little precedent or established practice. Decisions have to be made, for instance, as to whether exposed reinforced concrete beams and columns are better painted or left "natural" or indeed whether they should be protected by facing slabs or rendering. Readers may consider that some of the details suggested are less than good practice. To this the authors would answer that the study is about the economy of building and that a wide range of methods should be included, including the cheapest. In their opinion all the systems shown would be satisfactory provided that the workmanship was good, particularly in respect of the concrete. They do not, however, recommend any of the systems, nor do they suggest that the designs shown are more than diagrammatic. One final reservation: panel wall designs frequently conflict with building byelaws and fire regulations and special waivers for these may therefore have to be obtained.

No changes have been made to the size or planning of the building considered in Parts 1 and 2. The construc-



Plans and section of Part III design.

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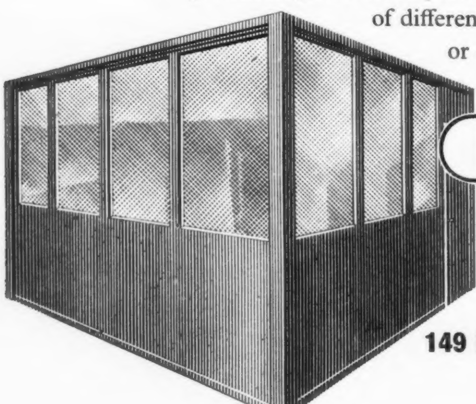

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technical section

tion is now the same as Part 2 (basic) with only the alterations necessary to convert it into a framed building.

These are:

- *(a) Foundations* — Column bases and ground beams instead of strip foundations.
- *(b) Enclosing walls and windows* — Frame and panels with glazing instead of loadbearing walls. The intermediate and edge beams in the 1st floor and roof are now included in the cost of the frame.
- *(c) Roof lights* — Three roof lights over 1st floor office are not considered necessary with increased wall glazing.
- *(d) Heating* — A heating installation of greater output is required to compensate for heat loss through larger areas of glazing. Annual running costs have been calculated. Using light fuel oil the figures would be:
  Schemes 1 and 2: 790 galls, £62 10s.
  Schemes 3 with single glazing: 870 galls., £68 17s. 6d.
  Scheme 3 with double glazing: 735 galls, £58 3s. 9d.
- *(e) Blinds* — Add Venetian blinds to office windows.

Cost comparisons of alternative methods of construction: part 3

The first item in each element is the basic scheme, to which alternatives relate independently of each other. Materials and labour prices are those ruling at September, 1956. For ease of comparison the basic price of each element of Parts 1 and 2 are also shown.

Element	Price in £s
1 Foundations (flat site assumed)	**196**
(Part 1 £178)	
(Part 2 £178)	
Work up to ground floor level (excluding ground floor construction) based on bottom of foundations 3 ft. 6 in. below ground floor level and ground floor level 6 in. above existing ground. No. 14 column bases 3 ft. × 3 ft. × 1 ft. 6 in. with 9 in. × 15 in. lightly reinforced ground beams to carry cill walls.	
2 Ground floor construction and finishings	**358**
(Part 1 £358)	
(Part 2 £358)	
4-in. concrete bed on 6-in. hardcore bed, 1-in. screed and 1-in. wood blocks to office area, 1¼-in. screed and quarry tile paving to remainder.	
3 External walls and facings*	
(Part 1 £925)	
(Part 2 £712)	
Note: External walls and facings are superseded by the following elements: Structural Frame, Solid and glazed infilling panels	
Structural frame (excluding ground beams) Reinforced concrete frame of No. 10-9 in. × 9 in. and No. 4-6 in. × 9 in. columns, 9 in. × 15 in. beams to first floor and roof and 9 in. × 10 in. and 9 in. × 15 in. edge beams to first floor and roof. Concrete finished fair externally and undecorated.	**498**
Alternatives to frame	
(*a*) Steel cased in concrete	+302
(*b*) Steel uncased, and painted 3 coats oil colour.	+106
Alternative finishes to concrete (external faces)	
(*c*) Two coats cement paint	+10

* For comparison between the 3 schemes, elements should be grouped; e.g. for Parts 1 and 2 add Walls and facings to Windows and external door; for Part 3 add Frame, solid and glazed infil panels.

Element (continued)	Price in £s
(*d*) Two coats chlorinated rubber paint.	+26
(*e*) Bush hammered finish.	+70
(*f*) ⅝ in. rendering.	+16
(*g*) Casing in 1-in. slabs:	
(i) precast concrete	+118
(ii) artificial stone	+160
(iii) Portland stone	+390
(iv) Polished granite	+1725
(v) Slate	+728
Solid infilling panels to north and west walls	**340**
9½-in. cavity walls with 4½-in. outer skin in hand-made facing bricks (P.C. 320 s. per thousand), 2-in. cavity, and 3-in. clinker block inner skin, and plaster and two coats of emulsion paint internally.	
(*a*) Flint lime facing bricks instead of hand-made bricks.	−17
(*b*) 3-in. precast concrete facing slabs with exposed aggregate finish as outer casing fixed with cramps across 2-in. cavity to 4½-in. Fletton brick inner casing, and plaster and two coats of emulsion paint internally.	+120
(*c*) 9-in. hollow clay blocks finished externally with self-coloured waterproof rendering, with plaster and two coats of emulsion paint internally.	−96
Glazed infilling panels and undercill panels Purpose made galvanized steel casements glazed in 32-oz. sheet glass, 50% opening lights. 9½-in. Cill walls with 4½-in. outer casing in hand-made facing bricks, 2-in. cavity, 3-in. clinker block	**1046**

technical section

Element (continued)	Price in £s
inner casing and plaster and two coats of emulsion paint internally.	
(*a*) Glaze large lights in ¼-in. polished plate glass.	+186
(*b*) Glaze all lights in patent double glass units.	+925
(*c*) Windows with 3 mullions to each bay (instead of 1) to reduce sizes of glass and opening lights.	−5
(*d*) Top lights in windows operated by patent opening gear instead of long arm.	+230
(*e*) Columns recessed 2-in. and steel casements extended in front of columns and glazed in ¼-in. patent coloured cast glass. Undercill panels of 4½-in. brick faced with 1-in. Western Red Cedar shiplap weatherboarding backed with waterproof building paper on 2-in. × 1-in. battens, 1½-in. wood-wool slabs and plaster and two coats of emulsion paint internally.	+51
(*f*) Steel casements extended to storey height and undercill panels glazed in ¼-in. patent coloured cast glass. Undercill panels in offices of 4-in. lightweight insulating partition blocks and plaster and two coats of emulsion paint internally.	+140
(*g*) Patent curtain walling system, 50% opening lights, with cill panels glazed in ¼-in. patent coloured cast glass backed with 4-in. lightweight insulating partition blocks and plaster and two coats of emulsion paint internally.	+825
(*h*) Casements in softwood with frames extended to storey height with undercill panels of 1-in. Western Red Cedar weatherboarding backed with waterproofed building paper, 4-in. lightweight insulating partition blocks and plaster and two coats of emulsion paint internally.	−196
(*j*) Patent double glazed casements (2 sashes) in softwood, all to open for cleaning, with frames extending to storey height with cill panels of 1-in. Western Red Cedar weatherboarding backed with building paper, 4-in. blocks, plaster and 2 coats emulsion paint internally.	+286
Venetian blinds	**140**
To all windows in offices.	
4 First floor construction and finishings	**408**
(Part 1 £404)	
(Part 2 £508)	
(Designed to take 50 lb. per sq. ft. superimposed load.)	
5-in. in situ reinforced concrete floor, 1½-in. screed and linoleum. (Cross and edge beams included with structural frame.)	
5 Staircase	**217**
(Part 1 £122)	
(Part 2 £217)	
Reinforced concrete construction screeded and finished with linoleum with rubber nosings. Balustrade of mild steel rods with core rail and mahogany handrail with wreathed junctions.	

Element (continued)	Price in £s
6 Roof construction	**462**
(Part 1 £475)	
(Part 2 £567)	
(Designed to take 20 lb. per sq. ft. superimposed load and point load of 220 lb. on any one place.)	
In situ reinforced concrete roof slab, 2-in. minimum vermiculite screed laid to falls and 3-layer built-up bituminous roofing finished with mineral chippings. (Cross and edge beams included with structural frame.)	
7 Rooflights	**90**
Part 1 £77. (7 No. 3-ft. × 2-ft. lights in tile roof)	
Part 2 £224. (5 No. 4-ft. × 2-ft. lanterns)	
No. 2, 4-ft. × 2-ft. galvanized steel lanterns with ventilation louvres in vertical face mounted on 6-in. upstands to roof slab.	
8 Windows and casement door	
(Part 1 £304)	
(Part 2 £609)	
(Windows to Part 3 are superseded by the element for glazed infilling panels and undercill panels.)	
9 Front and boilerhouse doors	
(Part 1 £57)	**63**
(Part 2 £63)	
Front door in galvanized pressed steel sheet fully glazed and hung direct to metal frame. Boilerhouse louvred door and frame in painted softwood.	
10 Canopy over front door	**13**
(Part 1 £13)	
(Part 2 £13)	
Two layers bituminous roofing on ¾-in. boarding, 4 in. × 3 in. bearers and 1 in. × 3 in. fascia.	
11 Internal partitions	**161**
(Part 1 £161)	
(Part 2 £161)	
4½-in. Fletton brick walls (except stud partition between w.c's.) plaster and two coats of emulsion paint both sides.	
12 Internal doors	**80**
(Part 1 £80)	
(Part 2 £80)	
1⅜-in. Standard softwood flush doors with B.M.A. furniture. Three coats oil paint	
13 Ceiling finishes	
(Part 1 £140)	
(Part 2 £125)	**125**
Two coats plaster on concrete soffite and two coats of emulsion paint.	
14 Soil drainage	**73**
(Part 1 £73)	
(Part 2 £73)	
40 ft. of 4-in. stoneware drain, manhole and intercepting chamber and connection to sewer.	

technical section

Element (continued)	Price in £s
15 Rainwater goods and drainage	**83**
(Part 1 £71)	
(Part 2 £83)	
Gutter formed along rear edge of roof slab behind upstand; lined with roof covering and discharging into No. 2 painted cast iron down pipes inside the building. 4-in. drains to No. 2 soakaways.	
16 Plumbing	**270**
(Part 1 £270)	
(Part 2 £270)	
Complete sanitary installation using one pipe system internally. Hot and cold water services in copper with capillary fittings.	
17 Electrical installation	**197**
(Part 1 £197)	
(Part 2 £197)	
Wiring in P.V.C. with conduit in vertical wall chases only with surface fittings.	
18. Heating and hot water installation	**566**
(Part 1 £516)	
(Part 2 £516)	
Complete heating installation by low-pressure hot water, cast-iron hospital radiators to provide 60 deg. F. with two air changes (external temperature 32 deg. F.).	

Element (continued)	Price in £s
Boiler with vaporizing type oil burner and 250-gallon oil storage tank.	
Electric hot water heater for lavatory basins. All builders' work in connection with installations.	
(*a*) Reduce heating capacity if infilling panels in double glazed units	−86
19 External pavings	**56**
(Part 1 £56)	
(Part 2 £56)	
Paved area in 2-in. precast concrete slabs on hardcore and ashes with granolithic finished concrete step to front door.	
Add	
Contingency provision	**150**
Foreman, plant, water, insurances, etc. (usually priced in preliminary Bill or on Summary).	
Say 12½ % on £5354	**669**

	Part I			*Part II*			*Part III*		
Total estimated cost of basic scheme	**£**	**s.**	**d.**	**£**	**s.**	**d.**	**£**	**s.**	**d.**
	5186	**0**	**0**	**5805**	**0**	**0**	**6261**	**0**	**0**
Price per foot cube		**3**	**9**		**4**	**8**		**5**	**0**
Price per foot super floor area		**51**	**10**		**58**	**0**		**62**	**8**

The Gas Council on Domestic Space Heating

On the opposite page is a supplement on domestic space heating which is sponsored by the Gas Council. This is the second of a series of supplements which have as their object to give a full technical description for architects of the different uses to which gas and coke can be put. Like Information Sheets, these supplements are a journalistic hybrid: they are " advertisements " in the sense that the space they occupy is paid for by the sponsors and that their ultimate object is to foster the greater use of gas: but they are " editorial " to the extent that the means chosen is to provide as much reliable information as possible and that this information has in fact been " approved " by the JOURNAL'S *specialist editor for heating and ventilation. We hope that readers will extract and keep these supplements for future reference. For this purpose a special binder can be obtained, free of charge, on application to the Publicity Manager, Gas Council, 1 Grosvenor Place, S.W.1. Alternatively, readers may apply through the business reply folder at the back of this issue. The first supplement " Domestic Space* Heating *1. Fires and unit heaters," appeared in the* JOURNAL *for November 29, 1956.*

DOMESTIC SPACE HEATING
2 central heating by gas and coke

The supplement begins with a review of the heat requirements laid down in what has come to be known familiarly as "the Egerton Report" (Post War Building Study No. 19, *Heating and Ventilation of Dwellings*) and of the later modifications to these requirements suggested by the subsequent experiments in house heating carried out by BRS at Abbots Langley. The different heating systems are then discussed and an account is given of the different types of coke and gas boilers which can be used to fire them. The main supplement concludes with a note on thermostatic control and is followed by four important appendices. The first of these discusses in greater detail the question of warm air heating; the second gives design data on heating standards, on the calculation of heat loss and on the sizing of heating surfaces and boilers; the third provides notes on the layout of central heating systems for small houses; and the fourth describes overhead unit heaters. Though the main title of this supplement is *Domestic Space Heating*, reference is occasionally made in the text to other than domestic buildings.

Individual gas and coke heaters have been dealt with before central heating largely because changes in the way of life in this country since the war have increased the importance of flexibility in the design of heating installations. A well designed central heating boiler and radiator system, used to give whole house heating, will have a higher fuel and over-all efficiency than individual appliances when the premises are used continuously. Where, however, the family is out at work and school for 8 or 9 hours a day and asleep for perhaps 8 hours, the fuel consumption may well be high for the service enjoyed. From such a householder's point of view the installation is not economic. Again, the family may not wish, or at times be able to afford, continuous full house space heating. It is now, perhaps more than ever, impossible to make a rational decision between central heating and local heating units without consideration of the class of occupier likely to use the building throughout its life. A house with wholly centralized services and no flues may provide a poor standard of accommodation and produce little rent when it comes to be let out in one- or two-room units, which is quite a normal occurrence for the last third of the life of most urban domestic properties.

Heat requirements

Until the war the level of space heating required in buildings had not been investigated in any comprehensive research programme. Pieces of information gathered from innumerable unrelated sources had been put together by the writers of text books and, over the years, had become the accepted basis of design. This was reinforced by legal requirements of minimum temperatures for factories, schools, prisons and so on, but the heat requirements for houses—particularly smaller houses—were largely matters of personal opinion.

During the war, when the problems of post-war reconstruction were being considered, it was felt essential to review the whole field of domestic fuel supplies and heating, and as a result, in 1945, a committee, presided over by Doctor (later Sir) Alfred Egerton, laid down certain standards of heating and thermal insulation for domestic buildings which have been widely accepted as being sound both technically and economically. This report suggested an equivalent temperature of 65° F. for the living room, 60° F. for the kitchen, 50° to 55° F. for the halls and passages and 50° to 55° F. for the bedrooms. For this purpose Equivalent Temperature may be described as a unit of measurement of comfort conditions rather than of air temperature. Since the war the Building Research Station has been able to carry out at Abbots Langley the first comprehensive investigations on a group of tenanted and vacant houses. The results of these have, in the main, confirmed the suggestions of the Egerton Report. The ideal temperature of the living room is still suggested as 65° F.; the kitchen and dining space has been reduced to 50° to 55° F. and the bedroom to 45° to 50° F. Two comments should be made on this change: the first put forward by Sir Alfred Egerton is that this lower figure for the bedrooms will not remove all risk of condensation of atmospheric moisture under all weather conditions. The previous higher figure would have done so and one of the great advantages of adequate heating is the health and comfort derived from really dry clothing, bedding and surroundings. The second comment is that if the lower figures are accepted, then in houses in which the structure is insulated to the levels suggested in the Egerton Report, there will be no need for continuous heating in the upper floor since the casual heat transfer from rooms below through normal floor structures to bedrooms above will maintain these reduced temperatures so long as there is reasonably continuous heating below and Egerton Standard of structural insulation is maintained. If the living room is only heated intermittently, then background heating in the rooms above is needed. A local source of heat, preferably mainly radiant in character, is essential in the bedrooms for use in illness or when dressing, and to make it possible to use these rooms for such purposes as children's homework, sitting rooms for aged or infirm relatives and, when necessary, for lodgers. The provision of adequate space heating in bedrooms is well justified on the ground that it makes it possible to make use of more of the house for more of the time and for more purposes.

More recent work—notably by Dr. Bedford—has drawn attention to the importance of radiant heat if full comfort is to be obtained in the British climate. A further result of the Abbots Langley work has been to show that it is now somewhat cheaper to obtain the full heating standards of the Egerton Report by suitable forms of continuous full house heating based on solid fuel than by means of background heating with local topping up in all the living spaces and bedrooms. At the same time, it is fair to remark that if the house equipment is limited to central heating and some future occupier is unable to obtain or afford the fuel to operate such plant continuously, the heat service available will be very poor and the case for the provision of adequate localized sources of quickly available radiant heat such as gas fires in all habitable spaces, is very strong indeed. Such equipment will also overcome the increasingly common problem of houses which, because all the members of the family are at work or at school, are only occupied for very short periods of the day.

Heat loss calculations

Before the war some small central heating installations and many local appliance schemes were installed on a rule-of-thumb basis. It seems now that all installations should be calculated; fuels cost more and with higher heating standards, losses can be more extravagant. There is a wider variety in building methods and while some structures are now built to Egerton Standards of thermal insulation many are, unfortunately, as bad or worse than pre-war practice. Appliances can be more accurately controlled and so make it possible to design the installation with an accuracy which could not be achieved with pre-war equipment.

Methods of calculating heat losses and requirements are referred to in the Codes of Practice, more particularly in the *Guide to Current Practice* issued by the Institute of Heating and Ventilating Engineers. A note summarizing the more common heat requirements and explaining how to calculate heat requirements and boiler sizes is given in Appendix 2, pages 627-630.

It has been customary to design the central heating installation so that it can carry the whole space heating load in the coldest weather and to make no allowance for the local and casually used radiant heat appliances which were operated purely for amenity or sentiment. If the localized heat units are to be of sufficient capacity to provide a reasonable measure of comfort when the central heating cannot be used for any reason, then it may be worth economizing in first cost of the central heating plant, on the understanding that the local heating units will always be brought into use when the external temperature falls below 30°F. which is usually the basis temperature for design purposes in this country. The point is worth considering where the lowest possible first cost is essential.

Heating systems

The traditional system of central heating for domestic work is undoubtedly the low-pressure hot water system with cast-iron radiators, which are now more often substituted by steel. In individual houses, of, say, 1,000 to 1,500 sq. ft. area, it is now clear from the Abbots Langley results that too little allowance has been made in the past for the effect of stray heat that is transferred through the floor structure from living rooms below to bedrooms above. In houses built to Egerton Standards of insulation, bedroom temperatures of from 45° to 50°F. in cold weather can be maintained by transference from room to room without further heating. It is, therefore, possible to reduce or omit radiators in bedrooms over fully and continuously heated living rooms, provided gas fires are installed to give the extra heat needed in illness and at night and morning when dressing. However, pipework will have to be carefully detailed to obtain adequate circulation since all the cooling surfaces will be at about boiler level. The possibility of reducing the pipe sizes and, with the savings in cost, installing a circulating pump should be investigated in such cases. This is discussed under the paragraph on " small bore pipe heating."

gas supplement

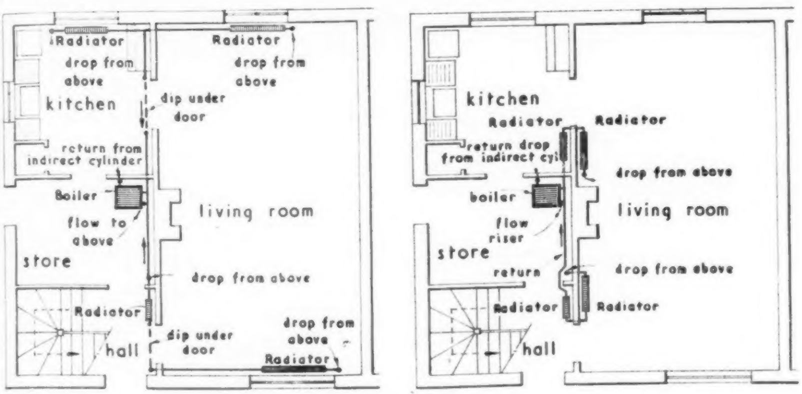

Fig. 1. Extreme left: typical ground floor plan with radiators placed under windows. Left: plan of the same house with radiators "close coupled." This gives a considerable saving in the length of pipe runs but results in some sacrifice in comfort and a risk of streaking the walls.

The positioning of radiators and heating surfaces in the rooms must be carefully considered if the scheme is to provide optimum comfort conditions free from draughts. This generally means that the main heating surfaces should be placed under windows and on the outer walls. Shorter pipe runs and, therefore, lower capital costs can be obtained by grouped close-coupled radiators on the spine wall. There will be some loss in comfort conditions and deflectors or shelves should be fitted over the radiators to reduce streaking of walls by warm air currents, but the savings may make the slight loss in comfort conditions acceptable (see Fig. 1).

Floor and ceiling heating—panel heating

Systems of floor and ceiling heating—generally referred to as panel heating—are now being increasingly used. Because they provide a uniform and partly radiant heat service they generally give a higher standard of thermal comfort than a conventional radiator system. They are, however, more expensive to instal and require considerable skill in design and constant supervision during installation. Once completed, however, they are trouble-free and invisible. For important buildings of all types, panel heating is nowadays the normal system. It is, of course, not particularly flexible and so is better adapted for continuous heating schemes or for use with day and night settings for regular cyclical changes of operating temperatures. Decorative surface finishes must be specified in co-operation with the heating engineer if difficulty is to be avoided. Boiler and circulating pump requirements are similar to those for any radiator system.

Small bore pipe heating

In order to reduce the initial cost of piped central heating there has been a good deal of investigation of the possibility of using smaller than normal bore pipes coupled with the use of pumps to give a higher rate of circulation than can be obtained with traditional thermo-syphonic or gravity schemes. Continental experience—incidentally with very small bore pipes indeed—goes back to the 1920's, if not earlier, and America has used $\frac{3}{8}$ in. and $\frac{1}{2}$ in. bore pipes fairly regularly for two or three decades. That the scheme has not become common here is largely due to difficulties with the pump and the temperature control mechanism. These are now almost completely overcome and suitable pumps are made here.

The advantages are:

1. Reduced cost of pipes and labour for installation.
2. Neat installation with little or no cutting away.
3. Pipes can be placed wherever desired—there is no problem when passing doors or stairs, or need to consider levels.
4. More accurate temperature control is possible and the small volume of water and metal gives quicker heating up or cooling down.
5. It is by far the simplest system for use in existing houses and for conversion schemes.
6. Properly installed there need be little streaking of decorations due to convection currents.
7. Either solid fuel or gas boilers can be used, but since flexibility of operation is one of the great advantages of the scheme gas fired boilers may be preferable.
8. No pipe work need be placed in the roof space or under the ground floor, which is generally essential with traditional schemes. Unrecoverable heat losses are, therefore, minimized.

The disadvantages are:

1. The success of the system depends on the pump which must be virtually silent and of long life and low power consumption. Unless this is satisfactory the system will be noisy and more expensive to run.
2. Regular supervision during installation may be more necessary than with conventional systems because of the lack of experience of contractors with small bore systems in this country.
3. There is more risk of blockage at sharp changes of direction than with larger pipes.

Heat distribution within the rooms can be by means of embedded coils in floors or ceilings or small gilled radiators in floor spaces, by skirting type radiators—the American baseboard unit—or by traditional radiator, provided types having a low volume to surface area ratio are chosen if flexibility is required.

For small house work, where it is usual to combine space and domestic hot water services by means of a

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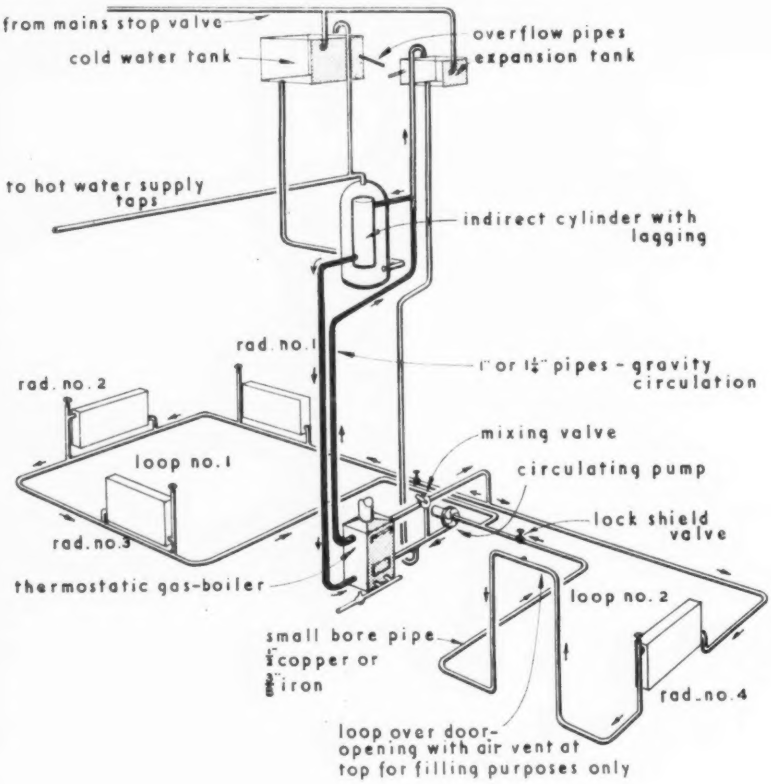

Fig. 2. Typical pipe layout for a "small pipe" forced circulation central heating system combined with hot water supply.

calorifier, it is usual to arrange the primary flow and return to the calorifier by gravity and with the usual pipe sizes. This reduces interference with the space heating control by the varying rate of hot water consumption. A typical pipe layout is shown in Fig. 2.

Automatic control based on inside/outside thermostats is normally used, controlling through a mixing valve rather than through a start and stop switch on the pump, which has been found to give too wide fluctuations of temperature. In most cases heat distribution has been by ⅜ in. I.D. steel screwed water pipe or by ½ in. O.D. copper pipe with capillary fittings.

While any solid fuel boiler having accurate thermostatic control is suitable, the quick response of a gas boiler would seem advantageous.

Warm air heating

A drawback to the hot water and radiator system is its inflexibility due to the time taken for the mass of steel, cast iron and water to warm up or, of course, to cool down. In America use has long been made of warm air directly circulated through the rooms by gravity or fans. The system is spreading to this country and many installations have recently been carried out here. It is far more flexible than hot water central heating and can provide excellent comfort conditions. Using gas as the heat source it would appear to be the most flexible of all possible systems and suitable for intermittent use. The system is dealt with in more detail on pages 624-7.

Combined heating and domestic hot water systems

In the case of small domestic heating schemes, it is normal to combine the domestic hot water and space heating with one single boiler when solid fuel is used. With gas as fuel a combination is still possible but where there is no summer heating load more economic running is perhaps obtainable with two separate heaters. When the total heat requirement exceeds 70,000 to 100,000 B.T.U's per hour separate boilers are more usual. Domestic hot water arrangements are to be considered in a later supplement.

Where it is desired to run one or two radiators off a small domestic boiler as a secondary duty to the supply of domestic hot water, use can be made of a special thermostatic radiator valve which ensures that the radiators are heated only after the domestic storage is satisfied. This valve and a typical circuit in which it is used are illustrated in Figs. 27 and 26 on page 631.

TYPES OF COKE-FIRED BOILER AVAILABLE

Small boilers

Broadly speaking, the heating and hot water requirements of a single family dwelling are unlikely to require a boiler of more than 125,000 to 150,000 B.Th.U's per hour heating rating and usually very much less. Such boilers are likely to be fitted within the dwelling and will, therefore, have to be of good

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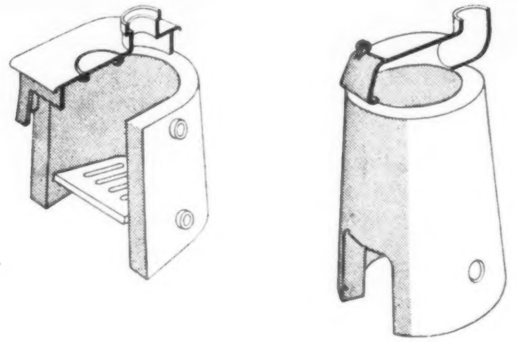


Fig. 3. Left: an open front domestic boiler. Right: a closed front domestic boiler.

appearance and as clean and dust-free in operation as possible. They are likely to be more expensive in first cost per 1,000 B.Th.U's for these reasons than larger boilers which will normally be fixed in a basement or separate boiler house, where appearance is of secondary consideration and insulation will not be included in the price of the boiler.

1. *Small cast-iron domestic boilers.* These are primarily for hot water supplies but are also capable of heating a few radiators. Ratings from 12,000 to 30,000 B.Th.U's per hour based on a rating of 6,000 B.Th.U's per hour per sq. ft. of boiler heating surface. Covered by BS 758:1955 *Small Domestic Hot Water Supply Boilers for Solid Fuel.* In practice the quoted ratings should be reduced by about half if they are to be used for space heating service only.

There are two main types (*a*) in which the front may be opened to give more radiation to the room and (*b*) with a closed front (see Fig. 3). The openable front boilers have a horseshoe shaped shell and must not be used on systems working with a static head exceeding 90 ft. of water. The closed type boiler has greater mechanical strength and can be used on services with up to 120 ft. head. Test bench efficiencies for the horseshoe type lie between 50 per cent. and 55 per cent. and for the closed type 60 per cent. and 65 per cent.

Where a small boiler of this class is required the fuel capacity should not be less than 0·6 cub. ft. and this size should only be used when low first cost is of supreme importance. Larger capacities will permit less frequent stoking and provide a more regular and controllable service. The grate areas should not be less than 25 sq. in. and 20 sq. in. for each sq. ft. of boiler heating surface for the open and the closed type boilers respectively. Combustion rate is usually taken as 6 lb. per sq. ft. of grate area, but may rise to 8 lb. Minimum combustion rates are about 0·8 to 1·0 lb. per sq. ft. per hr. Such boilers can be fitted with thermostatic control, most often operating on the primary air intake.

Since the war there has been a great deal of improvement in the design of what are still fundamentally the pre-war small pot boilers. It is now possible to have controlled combustion rates, accurate thermostatically controlled water flow temperatures, longer burning periods between fuelling and ashing and simple and dust-free operation. The costs of such boilers, which are usually fully insulated are, of course, higher than the pre-war small pot boiler, but the improvements in service and the saving in fuel consumption per unit of useful heat provided are so outstanding that the older type should only be used where low first cost is virtually the only consideration (see Fig. 4).

There are several makes now available, all with external casings to fit in with contemporary kitchen fittings and varying detail design of the grate bottom, thermostat and air control. A few, while similar in design to the old cast-iron pot boiler, are now, in fact, of welded steel construction.

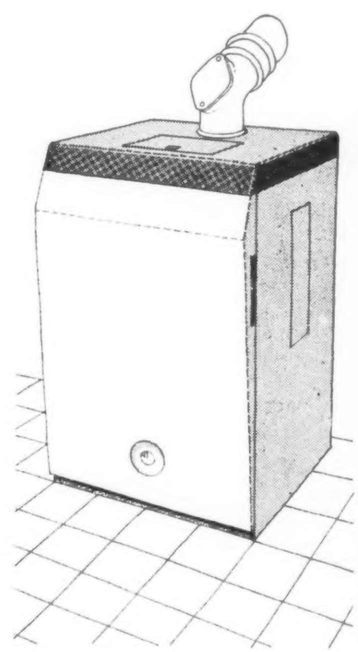
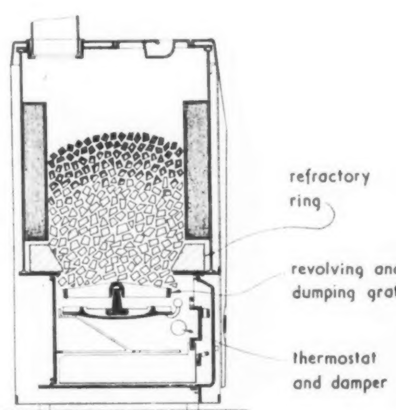


Fig. 4. Perspective sketch (above) and section (below) of an improved type closed stove.



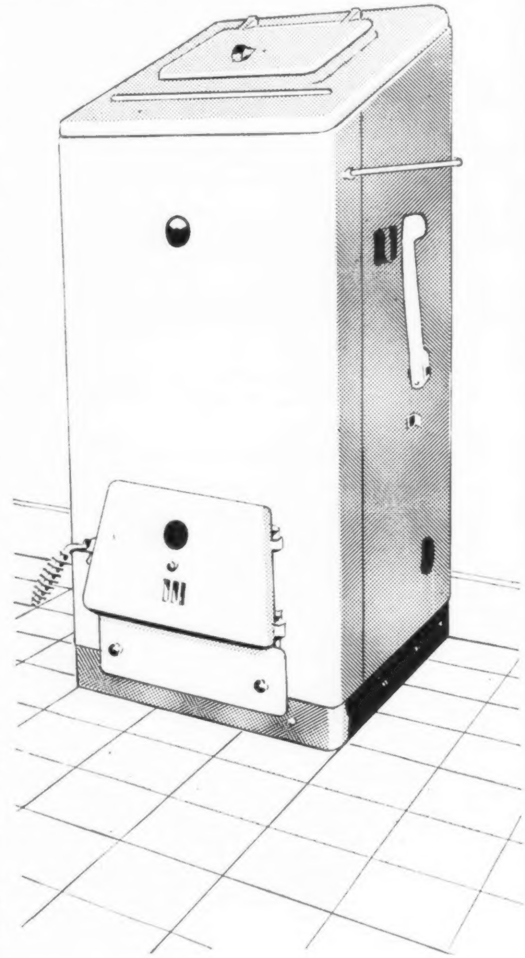
gas supplement

2. *Small Sectional Heating Boilers.* These cast-iron boilers were originally designed for space heating installations only, but are now often used for combined space and hot water installations with an indirect cylinder. They may have casings suitable for use in the kitchen or hall or may have plain galvanized insulated casings or plastic insulation for boiler house use. They are covered by BS 779: 1938, *Cast-Iron Boilers for Central Heating and Hot Water Supply.* Ratings run from 30,000 B.Th.U's per hour upwards; suitable for pressures up to 120 ft. head of water. Efficiencies on a test bench basis lie between 65 per cent. and 70 per cent. They are often fitted with thermostatic control of the primary air intake in the ashpit door, but flue damper controls are available. Balanced flue dampers will help to overcome variations in flue pull and greatly improve the control of combustion rates.

Fuel consumptions depend upon condition of service, but as a guide a 30,000 B.Th.U's per hour boiler serving a 40-gallon storage and 80-sq. ft. radiation surface requires 4½ tons of coke for a 50-week hot water and a 30-week heating season. A boiler of 150,000 B.Th.U's per hour serving a 60-gallon storage and 600 sq. ft. of radiating surface will require 16 tons for a 50-week hot water and 30-week heating season.

3. *Small Gravity-Feed Boilers.* These boilers, several of which have been developed since the war, provide automatic temperature control and fuel feed to the fire. Fuel flows by gravity from the hopper through a constant width throat to the burning zone; as a result there is a constant fire bed depth and very high thermal efficiencies. The smaller models are designed for use in the kitchen, although the larger sizes may have to be placed in a boiler room. All are of steel welded construction and may be used with working pressures up to 150 ft. head (see Fig. 5).

In most types the primary air for combustion is fed at high velocity to the burning zone by a fan or by induced natural draught and is controlled by an on/off thermostat. In use the high-velocity blast causes ash fusion. This type of boiler usually contains no bottom grate and the clinkers formed rest on the firebox floor. These can be removed in one or at any rate a few pieces causing little dust. If a modulating thermostat is used, the maximum combustion temperature is less and no clinker is formed; a grate is then provided so that incombustibles are removed as ash. All will operate at the rated output of from 8 to 12 hours without attention, and some for longer periods. Efficiencies under test bench conditions lie



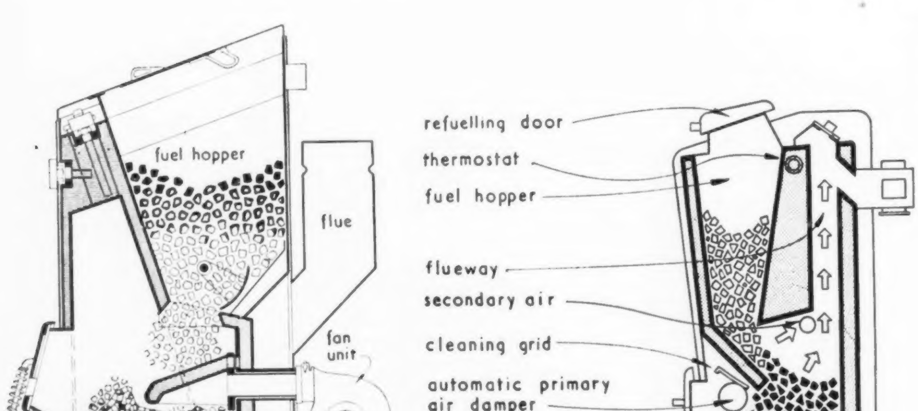


Fig. 5. Above: perspective sketch of small gravity feed boiler. Left: sections through two different models.

between 75 per cent. and 80 per cent. and field tests show that this can be maintained in actual practice.

Fuel consumption: A 50,000 B.Th.U's per hour rated boiler serving 50 gallons hot water storage and 175 sq. ft. radiation surface will require 6 tons per annum for a 50-week hot water and 30-week heating season. A 150,000 B.Th.U's per hour rated boiler serving a 75-gallon hot water storage and 750 sq. ft. radiation surface will require 14 tons per annum for a 50-week hot water and 30-week heating season.

Larger boilers

Boilers exceeding about 150,000 B.Th.U's per hour are normally placed in a boiler house. The price per unit of rated capacity tends to decrease, but it must be remembered that the boiler house costs must be added. Hand fired boilers can be operated at test bench efficiencies of from 70 per cent. to 75 per cent., but in practice 60 per cent. may be near the maximum and much lower figures can occur. There is no real difficulty in efficient firing but proper training of the stoker is essential and, unfortunately, the view that any fool can throw fuel on a boiler is still too common. All that is necessary is regular attention to details and care to anticipate changes in load, but constant supervision to ensure the maintenance of the standard is essential. Labour requirements are usually considered to be a part-time man for ratings up to 1,000,000 B.Th.U's per hour, but much depends upon the service required. If the boiler is required to give full service throughout the 24 hours a shift system will be needed, but for most office and flat blocks banking overnight is possible.

Normally it is better to split the larger loads among three boilers so that a reasonable service can be given from two should there be a breakdown. A single large boiler can cause a good deal of worry as it reaches the end of its useful life. If two boilers are the limit set by cost or space, it may be expected that each will have a margin of 25 per cent., so that in the event of breakdown not more than 0·625 of full load will be available.

1. *Cast-iron sectional boilers.* This is the commonest type used in this country for medium-sized installations (see Fig. 6). In many cases they are also used to provide hot water services through an indirect cylinder, although where the hot water demand is small compared to the space heating demand this will mean running the boiler at low rates and poor efficiencies during the summer season. It is doubtful if the saving in space and capital cost makes up for the lack of efficiency during partial use and in these cases separate boilers are preferable. It is also probable that peak hot water demand will at times coincide with peak heating demand. This is often the case in the early evening in the more expensive urban flat blocks and on Monday mornings in working-class flats.

Cast-iron sectional boilers may be used with pressures up to 90 ft. head of water; are relatively cheap to buy and, being sectional, can be built up or replaced in boiler houses where access for a one-piece boiler is too restricted. They have a recognized life of about 20 years provided they are not over-forced in use. Sizes range up to 3,000,000 B.Th.U's per hour and operational thermal efficiencies from 50 per cent. to 60 per cent. depending upon firing control. Consumptions, as is generally the case with hand firing, vary too much to give any useful guidance.

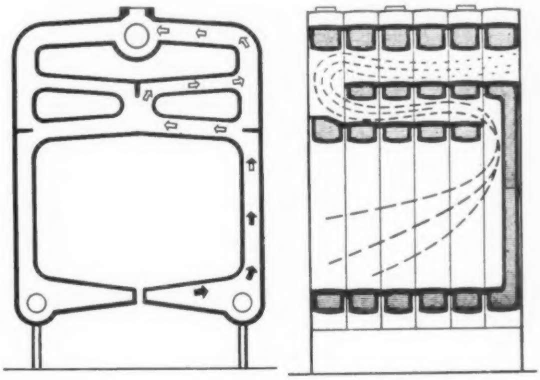
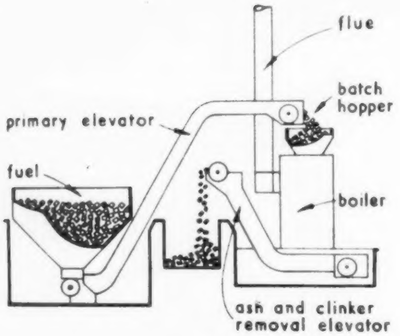


Fig. 6. Left, cross section and, right, part long section through a cast iron sectional boiler.

2. *Automatic boilers with continuous fuelling.* Since the war there have been developed a number of boilers designed to give completely automatic service for as long as the fuel store is kept supplied. They have automatic fuel feeds and ash removal and the rate of combustion is controlled thermostatically, generally by control of the forced draught although controls on the flue dampers may be used. Fuel feed arrangements can be varied, but generally there is an elevator from the main fuel intake and store to a hopper above the boiler. This hopper is arranged so that as it empties the change in weight starts and when full stops the primary feed elevator. This obviates continuous operation of the feed mechanism and ensures complete flexibility depending only upon the rate of combustion. A similar elevator is arranged for de-ashing. The design of the elevators has been greatly improved and there is no risk of jamming and relatively little abrasion. The general layout of the fuel feeds and section of a twin grate boiler for sizes exceeding 500,000 B.Th.U's per hour are shown in Fig. 7.

The clinker is pushed out of the fire zone, crushed and automatically removed. The grates are de-clinkered alternately by time-controlled rams, which function in accordance with the rate of combustion. At full combustion rates the rams come into action every 15 minutes on one grate or the other. Crushed clinker is automatically removed by conveyor. This intermittent running of motors makes for efficiency, but inevitably conveyors and crushers cannot be absolutely silent

gas supplement



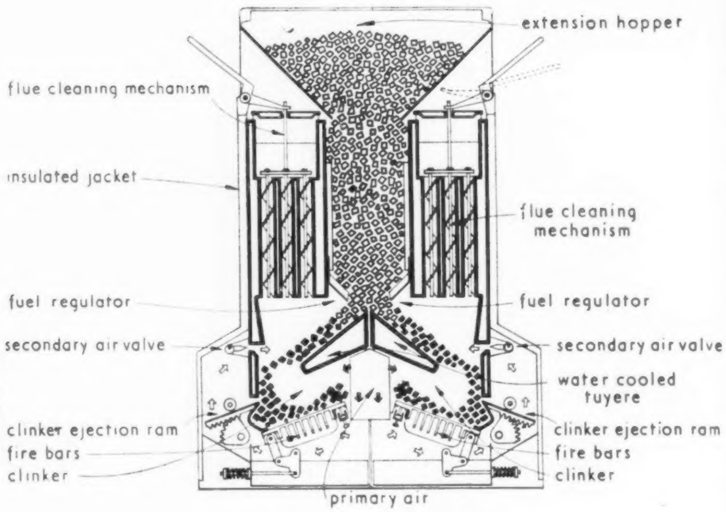


Fig. 7. Right: section through a large automatic boiler. Above: diagram showing the layout of the feed and ash disposal of a large automatic boiler.

and where the background noise level is low—as in flats at night—some precautions to reduce sound transmission are desirable, but for factories and installations with a high noise level this is not needed. The boilers can, of course, be used with manual hopper feed and ash removal. A thermostatically-controlled fan delivers primary air and a controlled amount of secondary air heated to 275/300° F. is injected above the fire bed to ensure complete combustion and uniform heat transfer in the tube banks. Very high efficiencies are obtained and the boilers can be run without labour apart from inspection once a week, flue cleaning once in three months, and a quarterly check on the control mechanism. The resulting heating costs are as low as is now possible with any fuel or system of combustion. The building owner need not supply any labour whatever for stoking, fuel supply or ash removal, all being eliminated or undertaken by outside contractors.

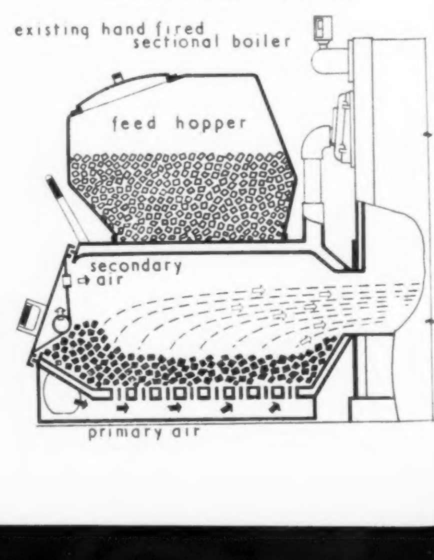
Mechanical firing equipment

Most existing types of boiler between 400,000 and 2,500,000 B.Th.U's per hour rating, and particularly the many hand fired cast-iron sectional types, can be converted to mechanical firing, generally with improvements in efficiency of up to 15 per cent. and greatly reduced labour requirements. The most common mechanical-firing conversion system is known as a "pre-burner unit" and consists of a water-cooled combustion chamber with gravity feed from a hopper above, which is placed in front of the existing boiler. Fuel feed is through a thermostatically-controlled fan. The hot gases pass through the existing boiler and together with the additional heating surface of the pre-burner unit, give an increased heat output from the combined unit. Arrangements can be made by means of time switching to cut in the fan at regular intervals so as to maintain combustion during banking periods or in warm weather. The thermostats may be linked to outdoor weather compensator mechanism to give very accurate temperature control and high utilization efficiencies. The clinker forms into a solid pad and can be removed with little trouble or dust. Labour is limited to hopper filling and clinker removal twice a day (see Fig. 8).

Such burners may be used for working pressures comparable to those of cast-iron sectional boilers and for steam raising up to about 30 lb. per sq. in. High efficiencies are usual, provided the boiler is suitable, and figures of 75 per cent. to 80 per cent. are quoted. The space requirements are not great and most makes are easily accommodated in the space necessary for hand firing. The height is generally less than that of most sectional boilers, but it is necessary to watch the space available for hopper filling, which can be a difficulty in a cramped boiler house.

An alternative type of pre-burner unit for use with most types of existing boiler is the "down-jet" burner. In this the fuel is also fed by gravity from a hopper to the water-jacketed combustion chamber. Combustion is promoted and the rate of burning controlled by a high pressure air jet directed downwards to the fuel

Fig. 8. Pre-burner unit attached to an existing hand fired boiler.



bed. The air penetrates the fuel for some four or five inches and combustion takes place at that level rather than on the surface which acts as a pre-heater. High combustion temperatures ensure clinkering of the ash which can be removed in solid lumps two or three times a day. Combustion is good and efficiencies of 75 per cent. to 80 per cent. are similar to other pre-burner units (see Fig. 9).

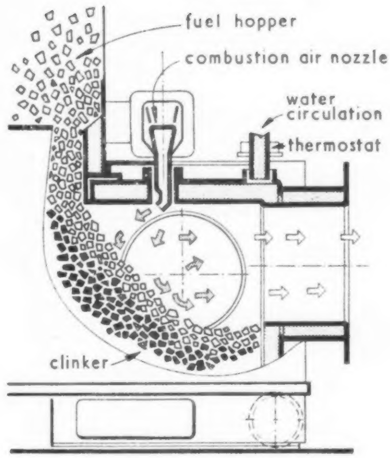


Fig. 9. Section through the combustion chamber of a down jet pre-burner unit.

Central Heating by Gas

Gas-fired boilers are available with output ratings up to 6,000,000 B.Th.U's per hour. While the direct cost of the gas consumed is greater than the cost of a similar amount of heat derived from coke or other solid fuel, there are certain great advantages which make discrepancies in price of less importance.

Space requirements: No space is needed for fuel storage or ash pending removal and no costs for ash handling.

Cleanliness: There is absolutely no dust in stoking or de-ashing and no smoke or flue dust. For this reason they are particularly convenient for installation in kitchens and the habitable areas of houses.

Silence: The plant has no moving parts and the smaller boilers are absolutely silent. Larger boilers generally have a slight flame noise but this does not transmit along heating pipes.

Smell: The smell of fuel oils can be very penetrating; gas properly installed is free of smell.

Safety: A properly installed gas-fired boiler of approved pattern is virtually foolproof.

Control: The entire operation can be automatically controlled so that inspection is unnecessary more often than once or twice in a heating season. All forms of thermostatic control can be fitted so that flexibility is greater and response more rapid than with any other central boiler system.

Position: The boiler can be placed on a roof top or in any other position since there is no storage or ashing to consider. This is of great value on urban sites where ground floor and basement space is exceptionally valuable.

Reliability: The consumer is assured of a continuous fuel service without risk of delivery failures.

One particular use for which gas central heating is pre-eminent is for lock-up shops, factories and offices where heating is not in use at nights or week-ends and where no porter labour has to be employed. The insurance companies appreciate the fact that no one has access to the premises except in the business hours, the manager alone holds all keys and there is no fire (or smoking) in the premises at week-ends. At the same time, the boilers can be started automatically in time to give satisfactory comfort conditions on Monday morning.

These indirect advantages are sufficient to permit a steady increase in the number of installations. In one Gas Board area alone about 900 new gas central-heating boilers are installed every year. Efficiencies are high, of the order of 75 per cent. to 80 per cent. and space requirements per unit of heat output slightly less than for solid or liquid fuel-fired boilers and there are no fuel storage space requirements.

TYPES OF GAS-FIRED BOILER AVAILABLE

1. *Cast-Iron Sectional.* The commonest type now in use is the sectional cast-iron which simplifies erection in confined spaces and allows a single section to be replaced should that be necessary at any time. Ratings from 30,000 to 1,500,000 B.Th.U's per hour are available (see Fig. 12).

2. *Welded Steel.* As with other types of steel boiler, the life is usually greater than cast-iron and a measure of repair by welding is sometimes possible. They are normally fabricated and delivered in one piece and this can cause difficulty with the larger sizes on a restricted site. The design generally allows of easy flue cleaning and there is exceptional freedom in positioning the necessary tappings and fittings. Ratings up to 600,000 B.Th.U's per hour are made.

3. *Tubular Boilers.* For the larger installation up to 6,000,000 B.Th.U's per hour multi-tube boilers are made for gas firing, in both vertical and horizontal

gas supplement

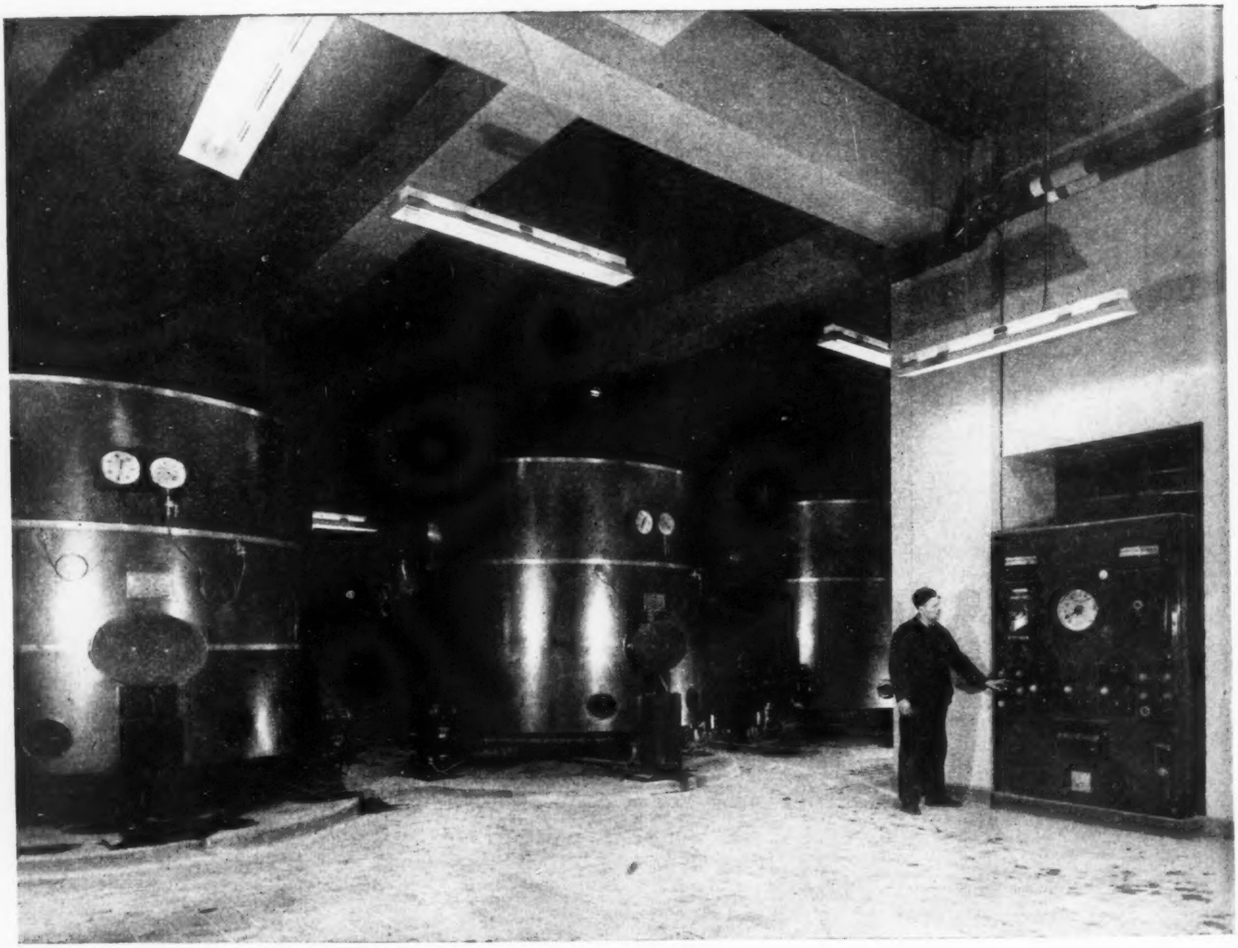
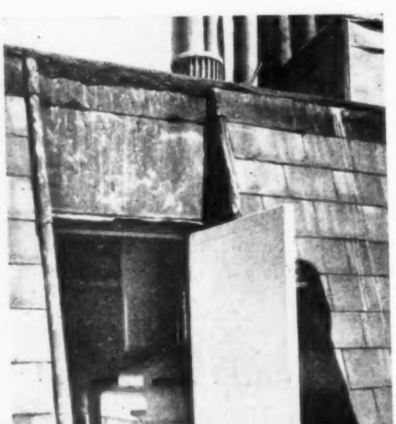
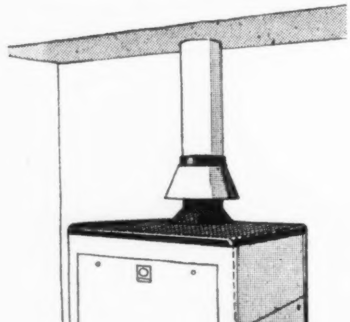
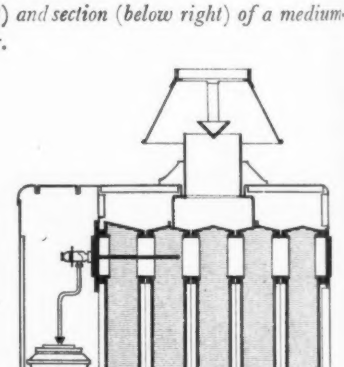


Fig. 10 (above) View of the large gas-fired boilers in the Royal Festival Hall.
Fig. 11 (left). Gas-fired boilers installed in the roof of Albion House, New Oxford Street, in space otherwise of low rental value.
Fig. 12. Perspective sketch (below left) and section (below right) of a medium-sized cast iron sectional gas-fired boiler.







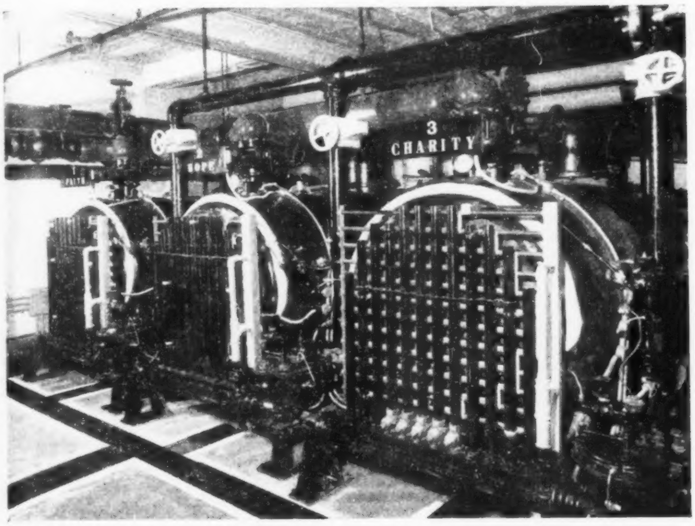
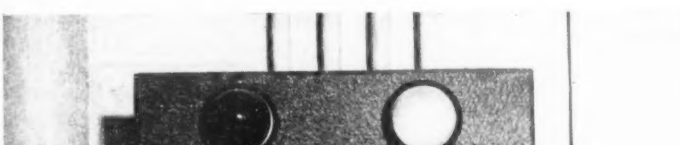


Fig. 13. Large gas-fired heating boiler fitted in triplicate in Simpsons (Piccadilly) Ltd. to provide continuity of heating servic during any necessary shut down periods.

Fig. 14. Full automatic control and time switching gear for a large gas-fired plant.



designs, which enable them to be fitted into sites that are restricted for space and height.

Control equipment for gas-fired boilers

Control equipment is of three types:

1. Clock controls, with one or a series of start and stop points so that the boiler may be started up for a pre-heating period before the staff arrive for early duty and be automatically shut down before the premises close, and over the week-end. Over-riding thermostats can cut the boiler in to prevent too low radiator temperatures and frost trouble in cold or prolonged shut down periods, a difficulty likely to occur over the Christmas holiday period.
2. The usual thermostats controlling flow temperatures, room temperatures and, if required, co-ordinated to an indoor/outdoor controller give very accurate and rapid temperature control.
3. The necessary safety devices, notably a flame safety device to cut off gas supplies should the pilot jet be extinguished, low-water controls and overheating controls. Latterly electrical ignition arrangements have become available.

Further details of control gear are given in Code of Practice 332:303, *Installation of Gas-Fired Boilers for Central Heating by Hot Water.*

Accessibility and appearance

Most small domestic gas boilers are designed to permit cleaning and maintenance with little dismantling and interruption of service. Models are made having sheet-metal casings to simplify external cleaning and to fit in with present-day kitchen equipment. Coloured finishes are usually available.

Flues

The thermal efficiency of gas boilers is high so that the residual heat in the flue gas is small and there is, therefore, a risk of condensation in the flue if it is exposed or of considerable length. It is, therefore, essential to consider this before the boiler is installed. Further details will be given in a further Supplement on flues for gas appliances. See also the Code of Practice CP. 331:104, *Flues for Gas Appliances.*

THERMOSTATIC CONTROLS

Full thermostatic control is now considered essential on any central heating system whether fired by coke, gas or any other fuel; and its addition to existing plants can lead to considerable economies and great improvements in the heating service obtained. At the same time, it is worth mention that where an existing installation has been badly run in the past, and particularly when it has been badly hand fired, the results of adding thermostatic control may in fact lead to greater fuel consumption simply because a full and continuous heating service at the originally calculated temperatures may be made available for the first time. Fuel savings of 15 per cent. are generally expected where the installation has previously been run by hand control and has given room temperatures up to the design requirements. Other advantages occurring may be:

1. Reduced clinkering troubles.
2. Saving in labour costs of continuous attention to boilers.
3. Avoidance of damage to boilers, due to over-heating.
4. Improved comfort conditions.
5. Longer life of boiler.

The positioning of the thermostats is of great importance. It is usual to place the master thermostat in a key room representative, so far as possible, of all the rooms on the heating system. This thermostat controls boiler water temperature of hand fired boilers, generally by a motorized damper on the primary air feed and on the flue outlet. For automatic units the control is generally by on/off switch to the fan motor and, where required, to the stoker motor.

Individual room or group thermostats may be placed throughout the building to control by motorized valve the flow of warmed water to the radiators in that room. The thermostat is usually placed at head height on an outside wall or wherever temperature variations may be expected as, for instance, near large windows or by shop or loading bay doors. The more thermostats in use the more accurate the temperature control will be, but there is a risk of waste of heat if the occupants of individual rooms leave too many windows open. For this reason it is always necessary to take into account the effect of an individual "fresh air fiend" who throws open windows and doors and prefers to sit in an icy draught. The more carefully designed the installation the worse the effect of such misuse on fuel consumptions.

In many schemes it is considered wise to link the key room thermostat with an inside/outside thermostat suitably placed outside the building. This reflects changes in the external temperature before it can cause a rise or fall indoors and leads to some saving in fuel and less fluctuation in indoor temperatures. The outside thermostat is less likely to be tampered with than an indoor fitting.

Room thermostats usually have some locking device to prevent unauthorized alteration. Despite this it is remarkable how often they are found to have been tampered with. In larger buildings it seems necessary to organize routine checks on all thermostats if there is to be a good standard of fuel consumption control.

It is impossible to give figures of fuel or cash savings arising from the introduction of full automatic controls because of the wide variations in conditions and in the state of the installation before controls are added. Neither is there a method of evaluating the efficiency of the manual control over which the improvement is to be calculated. During the war the Ministry of Fuel considered that the addition of a full set of automatic controls would be expected to save about 15 per cent. of the previous fuel consumption, give a better service and pay for itself in three years.

Appendix 1. Note on warm air systems

In this country virtually all space heating for domestic and office premises has been by means of individual appliances in each room or by piped hot water with radiators in the rooms. In America it has been much more common to distribute heat from a central source by means of warm air circulated by gravity or fans. The earliest types were little more than a furnace in the cellar with a hot air outlet in the hall floor above it. Since the war great improvements have been made in the heating unit and distribution arrangements, and when full house heating is required the system can give very efficient results. Compared to a conventional hot water radiator system it is probably lower in both capital and running cost. But unless the layout is considered very carefully when the building is in the design stage the system can become very costly and difficult to arrange. In effect the building has to become part of the heating system, which is no longer something added to a completed structure.

Layout

Several types of layout have been in use in America and have been considered experimentally here. There are, of course, climatic differences; generally the minimum temperatures here are not so low as in America, humidity is higher and there is greater and more frequent variation in temperature. There is less demand here for very high indoor temperatures and fuel costs are relatively much higher. Perhaps because of the extreme cold in America few families are prepared to forego continuous heating. Bearing these points in mind, it is considered that for this country the best layout will be to have duct outlets grouped in the centre of the house with low level discharge with downward directed louvres (see Figs. 15, 16).

Where the plan can be arranged suitably, warm air is discharged at low level directly from the appliance to the dining space and by floor ducts to the living space and hall/stairway. Air for the bedrooms is taken from the top of the appliance by insulated ducts in the floor thickness. Duct runs are short, and the discharge being directed towards the windows and outer walls, there is no cold down draught to cause discomfort. If the inner skin of the outer wall is built in insulating blocks, the wall surface temperature should be within 1° to 3° F. of the air temperature, which reduces the discomfort of heat loss from the occupants to cold walls. Return air is taken back at high level from ceiling registers near the outer walls. This system is normally used for higher income group housing. It can be modified, largely by saving in the amount of ducting, to suit some classes of local authority housing for units between 750 and 1,000 sq. ft. Schemes carried out for the LCC

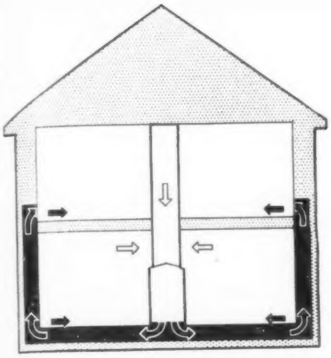
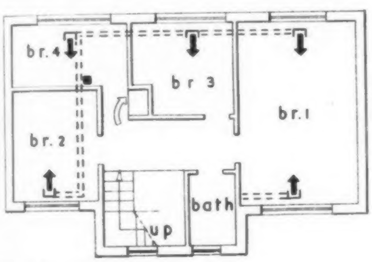
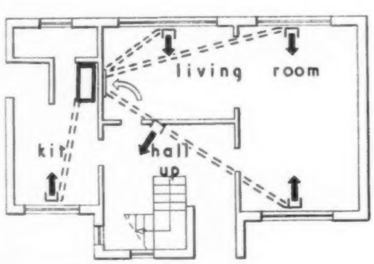


Fig. 15. Sectional diagram (above) and plans (below) illustrating the American system of warm air heating, with warm air discharging from the outer walls.



First floor plan



Ground floor plan

illustrate the application to some of their flatted dwellings (see Fig. 17).

The scheme provides full heating to the living room and background heat to bed- and bathrooms. These can be conveniently topped up with a small gas fire.

Advantages claimed

Considerable advantages are claimed for the use of forced warm air heat distribution systems:

(*a*) Reasonably uniform temperature distribution. It is possible to eliminate the excessive vertical temperature gradients associated with convection heating. Temperature gradients—in excess of 6° F.—appear unlikely and even better results are claimed. It is generally held that complaints of 'hot heads and cold feet' do not arise until the temperature gradient exceeds about 10° F. Variations of temperature on any one horizontal plane seem not to exceed 1° to 2° F. in any room. It is not difficult to adjust

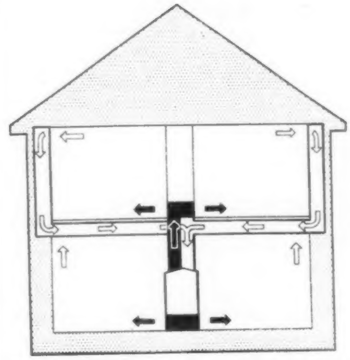
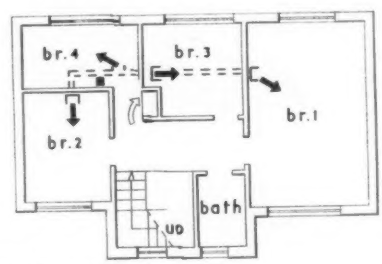
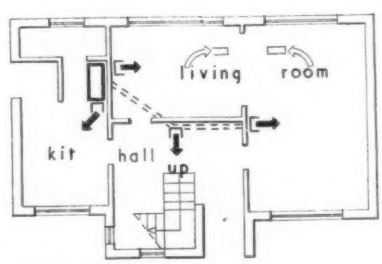


Fig. 16. Sectional diagram (above) and plans (below) illustrating the system of warm air heating usually advocated in England, with warm air discharging from the inner walls.



First floor plan



Ground floor plan

temperatures as between one room and another.

(*b*) Flexibility. There is great flexibility and control is easy. As an illustration, a house of 1,500 sq. ft. floor area, built to Egerton standards, can be raised in temperature at the rate of 8 to 10 degrees per hour. In normal use the living rooms are maintained at 65° to 67° F. and the thermostat set at the minimum for over-night running. By the morning the temperature of the living room will have fallen to 57° F. A temperature of 60° F. can be regained in, say, 20 minutes, which is probably sufficient for morning use.

(*c*) Stuffiness. This feeling can arise with convection heating where high vertical temperature gradients exist, where there is lack of air movement and where the ventilation rate is inadequate. This system greatly reduces the likelihood of stuffiness. The ducted warm air which enters at velocities of between 250-ft. and 350-ft. per minute is rapidly mixed and gives the required sense of freshness. In hot weather it is, of course, possible to circulate unheated air through the rooms or, by a special arrangement of ducts and dampers, to circulate cool external night air through the house and so reduce the temperature of the structure during any very hot periods.

(*d*) Cleanliness. There is little risk of discoloration of decorations since the warm air is discharged downwards at low level at sufficient velocity.

(*e*) Space economy. Space requirements are not large and there is great freedom of planning. When required, the whole of the house can be adequately warmed and so can be used in its entirety.

(*f*) Smokeless. Fuelled by gas or coke the appliance does not produce any smoke.

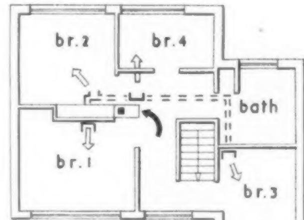
(*g*) If the air pressure in the room is maintained fractionally above that outside, there can be no draught through cracks round windows and doors and 'used' air is steadily eliminated so that a build up of smells due to re-circulation of air is impossible.

(*h*) Hot water. The provision of domestic hot water is generally combined in the one unit.

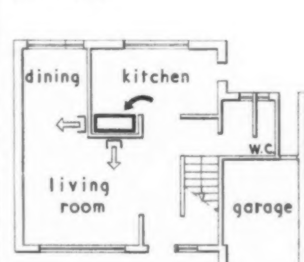
A criticism of the system is that there is no radiant heat factor and many people feel the need for this in English climatic conditions. Gas fires will provide this and also be useful for occasional and between season use. They should preferably be fitted to pre-cast block or tubular flues.

When fitted to 9 in. × 9 in. flues it is frequently necessary to consider restricting the flue area to ensure that the ventilation rate is not excessive.

Fig. 17. Plans showing an application of warm air heating to local authority housing.



First floor plan



Ground floor plan

gas supplement

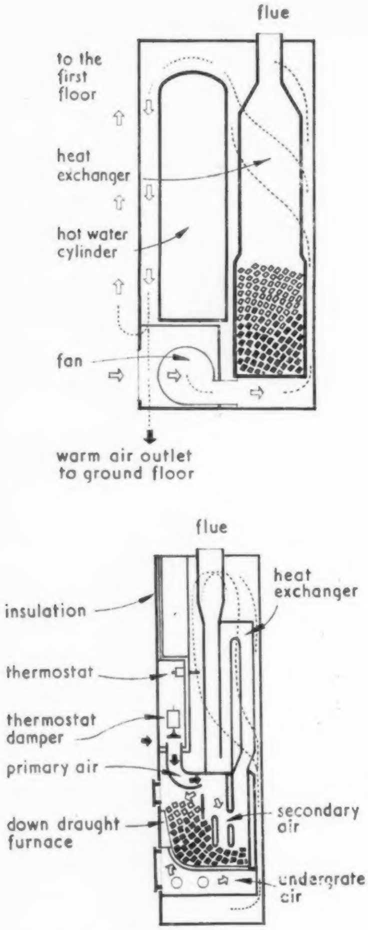


Fig. 18. Diagrammatic sections of a combined hot water and space heating unit for warm air heating, fired by solid fuel.

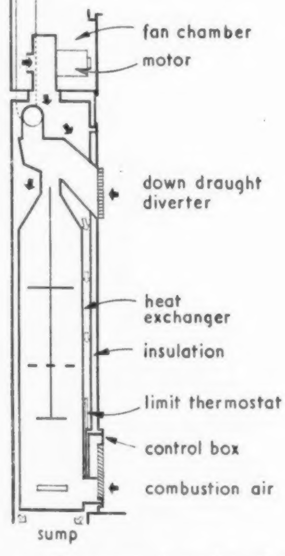


Fig. 19. Diagrammatic section of the gas-fired version.

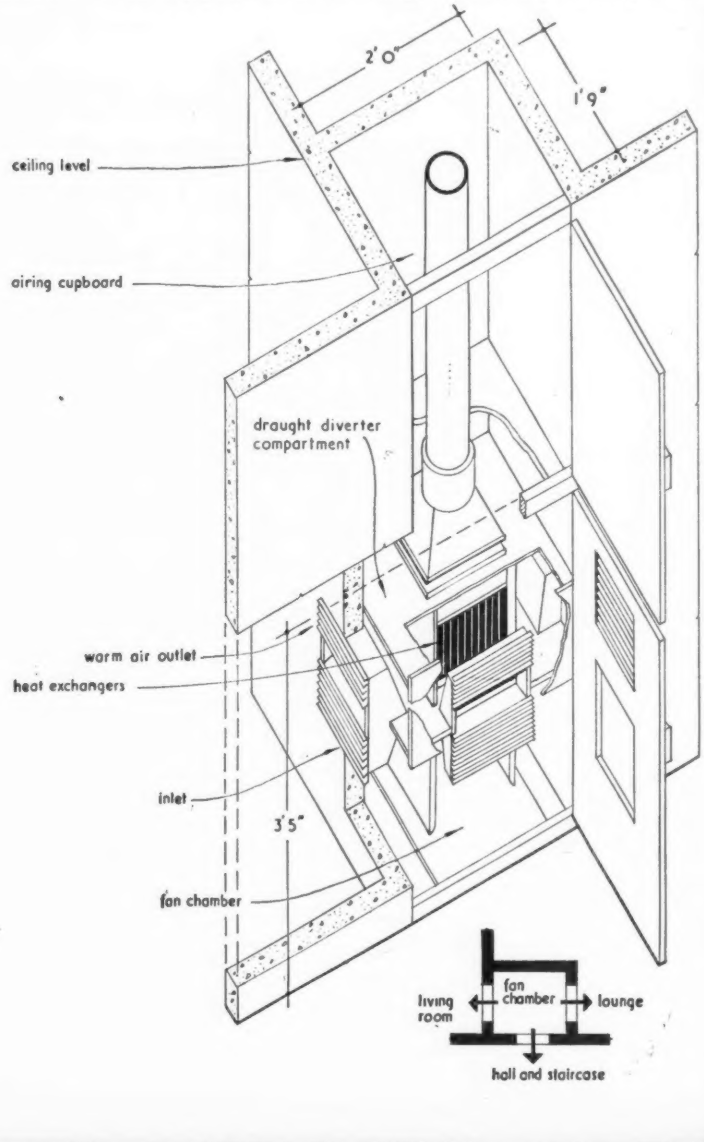
Appliances available for warm air systems
For fully ducted systems, appliances are made in ratings between 35,000 and 50,000 B.Th.U's per hour, suitable for the provision of full comfort conditions in houses built to Egerton standards and between 1,500 and 2,000 sq. ft. total floor area (see Figs. 18, 19).

This will provide either space or water heating, or both. The unit is built into an insulated recess and contains a solid fuel down-draught type furnace and heat exchanger or a gas unit, a motorized fan and a hot water storage cylinder with a gas circulator for summer use. Space and water heating components are fully thermostatically controlled and the heat output is controlled by a room thermostat coupled to the fan motor. Should less heat be required in any room, the temperature can be quickly controlled by closing the warm air outlet register.

The hot water storage cylinder is supported freely in the hot air (plenum) chamber and is heated by the air and by radiant heat from the furnace surface. Flue losses are very low and an overall efficiency of 80 per cent. is obtained.

For solid fuel the furnace has a simple riddling and dumping grate which must be de-ashed once and re-fuelled, when used with coke, from two to four times a day. If the chimney is arranged vertically above the unit, no sweeping is necessary as only fly ash is carried through the heat ex-

Fig. 20. Cutaway axonometric of gas fired air heater designed for heating adjoining rooms.



changer and this falls back into the firebox. For gas, the unit is fully automatic and similarly arranged. The gas heater is of the chimney furnace type consisting of a gas burner chamber, a single tubular heat exchanger and an integral down-draught diverter. Additionally, there is a thermostatic device which closes the gas valve should the pilot be extinguished. The gas unit, of course, requires no labour for fire-

per day of hot water at 140°F. The furnace is also of the down-draught type and will provide space and water heating and cooking with a thermal efficiency of 74 per cent. to 80 per cent. (see Fig. 20).

The following table gives the approximate annual fuel consumptions for whole house combined heating schemes in houses of 1,000 to 1,500 sq. ft. floor area constructed and ventilated to Egerton standards.

Fuel consumption for ducted warm air systems

	Solid-fuel unit		*Gas unit*	*Oil unit*	
Floor area of house, sq. ft.	*S.F., tons*	*Gas, therms**	*Therms (space- and water-heating)*	*Oil, gallons*	*Electricity, kWh**
1000	4	90*	850	600	2000
1500	5½	100*	1050	850	2250

* Summer water-heating

lighting and attention and gives very rapid initial heating up and great flexibility. The output rating is between 40,000 and 45,000 B.Th.U's per hour with an operating efficiency of 75 per cent.

Appliances for partially and non-ducted systems

Smaller but similar appliances are available for duties ranging from 15,000 to 25,000 B.Th.U's per hour with 50-gallons

These consumptions will maintain the whole house at 55° to 60°F. at all times. The living spaces at 67°F. for 8 hours a day and the bedrooms at 65°F. for 4 hours a day, and provide 50 gallons of hot water at 140°F. at the tap. These represent a very good standard of heating service, far better than is normally enjoyed by occupiers of houses of this size. If a lower standard is desired, the appliance is sufficiently flexible to provide it at a corresponding reduction in the fuel consumption.

Appendix 2. Design data

The following notes and data have been selected from a number of up-to-date sources. It is thought that they may be of help to architects and builders in the design of small schemes and in the checking of schemes prepared by contractors and others. Obviously they cannot pretend to be complete and to cover every fact likely to be needed.

Though this supplement is ostensibly concerned with domestic heating only, the opportunity has been taken to include data relevant to other classes of building. The reason for this is that since (with few exceptions) the same range of equipment is used for non-domestic as for domestic buildings, it has been thought unnecessary to publish a separate supplement on non-domestic heating; and it was judged that this was the most suitable place to provide the small amount of additional data which the architect will need. A complete bibliography will be given in a future issue. For further and more detailed information reference should be made to *A Guide to Current Practice* issued by the Institute of Heating and Ventilating Engineers, 49 Cadogan Gardens, London, S.W.1, or to *Heating and Air Conditioning of Buildings*, Faber & Kell, published by the Architectural Press, 9-13 Queen Anne's Gate, Westminster, S.W.1.

Comfort conditions

The provision in any room of an air temperature of 65°F. or a little over will *not* of itself ensure good comfort conditions although in the past this has been generally accepted as the design basis. Other factors than air temperature are concerned and must be considered.

Ventilation: for many years it has been held that to ensure adequate freedom from noticeable body odours in winter a minimum of 600 cu. ft. per hour per occupant is necessary and this was accepted by the Egerton Committee with the suggestion that it should be increased to 1,000 cu. ft. per hour per person for kitchens. Much higher figures are desirable for summer conditions. Such winter rates are easily attained where heating is by open fire or a gas fire with flue. The following Building Research Station figures give a measure of the flue effect:

9 × 9 flue, unrestricted, with coal fire—4·5 air changes per hour.
9 × 9 flue, unrestricted, no heat—1·7 air changes per hour
9 × 9 flue, restricted, with gas fire alight—3·1 air changes per hour.
Slow combustion stove, closed but with fire—0·7 air changes per hour.

At the Abbots Langley experiment it was found that for reasonably exposed houses the average external wind speed was 8.5 m.p.h. With such air speeds and with bedrooms having windows and doors shut, almost all had ventilation rates exceeding 600 cu. ft. per person per hour so long as the bedrooms had some provision for permanent ventilation such as a flue or a louvre to the landing space or from a convection duct from the heater below. With air speeds less than 8.5 m.p.h. or with no form of permanent ventilation duct, rooms will fall below the Egerton standard.

In other experiments in flat blocks, where no permanent ventilation ducts were provided, the necessary air changes were rarely reached with windows closed, and in many cases there was only half the necessary air change.

Warmth — equivalent temperature: for adequate comfort conditions it is necessary to take into account radiation from and to the body, air temperature, and air movement. These three factors can be measured by the eupatheoscope and the resultant figure is known as the Equivalent Temperature. The eupatheoscope is, in effect, an instrument designed to react to its thermal environment in the same way as does the human body and to record those reactions in a unit of temperature. A more correct definition is an instrument designed to measure and record a quantity representative of the physiological sensation induced by a thermal environment whether cool or warm. It is essentially a black-painted hollow copper cylinder internally heated so that its surface temperature is about 75°F. The rate of heat loss from the surface depends on the environment in which the instrument is placed and this loss depends upon air temperature, air movement and the temperature of the surrounding surfaces. The heat loss is automatically balanced by the internal heat input to the eupatheoscope and it is upon this heat input that the reading of the eupatheoscope depends. This reading is indicated or recorded on a specially calibrated scale which gives the Equivalent Temperature of the environment.

The Egerton Report accepts the use of the term Equivalent Temperature and the figures for space heating are given as degrees of Equivalent Temperature. While the report finalizes on an Equivalent Temperature of 65°F. for living rooms it does in fact discuss a range of from 62° to 68°F. Naturally, persons sitting motionless and resting will prefer temperatures nearer 68°F. Air temperatures required to produce a given Equivalent Temperature will vary according to the type of heating. With convection heating and cold walls a higher air temperature will be required than with high temperature radiant heating.

Heat distribution: for comfort there must be good distribution of heat throughout the room, both vertically and horizontally. The Egerton Committee suggest that the air temperature at head level must never be more than 5°F. above that at floor level. It has been found that where hot water radiators are to be used, long low units or better still, skirting board types, will give better heat distribution. With low level radiant heat distribution as from a gas or electric fire used as supplementary heating, the unsatisfactory effect of a high vertical temperature gradient is minimized.

Wall temperatures: if the surface temperature of the walls or other structural parts is materially below the air temperature, heat will be radiated from the occupants' bodies to those surfaces and there will be a feeling of chill. No surface should be more than 3°F. below the air temperature of the room. Walls built to Egerton standards of insulation, having transmittance or "U" values of not more than 0·15 B.Th.U's per sq. ft./h/°F. will, in cold weather, have an internal surface temperature of about 3°F. below the internal air temperature when that is at 68°F. With uninsulated walls having "U" values of, say, 0·4 the internal surface temperature may well be 9°F. below the internal air temperature. Again, a source of radiant heat tends to offset the effect of cold walls.

Convection heating: systems based on convection heating, particularly ducted and fan assisted systems, are always more comfortable if the heated air is supplied in large volume at low velocity and as near room temperature as possible, consistent with the need to avoid sensations of cool draughts. The incoming air should be directed downwards in order to overcome the natural tendency for the warmer air to rise and so create excess vertical temperature gradients.

Ceiling panel heaters: such heaters are necessarily radiant in character and, if the head is warmed by excessive radiant heat, there is a feeling of discomfort. The extent of the discomfort depends on the height of the room and the surface temperature of the radiant source. There is unlikely to be trouble where the height of the radiant source exceeds 12 ft. or where it is slightly lower and is not the sole source of heat in the room. Ceiling heating in low ceilinged rooms requires great judgment if it is to be successful.

Calculations can be made, based on height, surface temperature and length and breadth of the panel. For rough working it is, perhaps, sufficient to say that for installations of less than 12 ft. in height the surface temperature of the ceiling heating panel must not exceed 100°F. and this must be progressively decreased as the height decreases to a maximum of 82°F. at 8 ft. Fuller details of the requirements are given in the published results of research by A. F. Chrenko—*Ceiling Heating and Comfort*, Journal of IHVE 1955.

Floor heating: embedded panel heating in the floor has certain advantages, notably that there is no possibility of convection staining of decorations, and there is virtually no vertical temperature gradient in the room. There is still a good deal of controversy here but it is probable that the maximum surface temperature lies between 75°F. and 77°F. Higher temperatures may give rise to feelings of discomfort.

Horizontal heat distribution: so far as possible the heat should be equally distributed throughout the room. The fault of bad horizontal distribution is illustrated by the open fire. The extreme example of this is the case quoted by Fishenden thirty years ago when in a test room heated by an open fire in cold weather only 7 per cent. of the total floor area was in the comfort zone.

Radiant heat: it is now generally recognized that a source of high temperature radiant heat is associated with optimum comfort conditions although the proportion, placing or temperature is not so fully agreed. One advantage is the great flexibility of any system of radiant heat compared to any form of convection heating. Again, in any group of persons in a room there will be individual variations in metabolic rate and with a source of radiant heat personal adjustment of comfort level is easy. With convection heating, conditions are virtually uniform and personal adjustment is more difficult. Again, a person entering a room feeling cold will be able to warm up more quickly from a high temperature source than from air heated to about 65°F. Perhaps, above all, the advantages are related to the public association of radiant heat with comfort. There is no doubt that the great majority ask for some radiant source and there is no sound reason why it should not be provided. Where the heating is wholly convective a significantly higher air temperature is necessary than where there is a measure of radiant heating. This, of course, is taken into account where the temperatures are defined in degrees "equivalent."

Heating standards—temperatures and air changes

The Egerton Report suggested and the Codes of Practice confirm a series of temperatures suitable for all types of domestic rooms.

	Temperatures F.	Air changes
Living rooms	65°	1—1½
Bedrooms	50°—55°	2
Kitchen	60°	1—1½
Passages	40°—45°	—

Somewhat lower temperatures are now being suggested as a means of reducing capital and running costs. Sir Alfred Egerton has pointed out, however, in his paper to the Institute of Fuel, May, 1956, that such low figures, while they may be justified on grounds of economy will produce a poorer standard of comfort and may give rise to condensation troubles and the damp clothing inevitably caused thereby.

The desirable design temperatures for other classes of building have been less thoroughly worked over and never authoritatively checked and stated for a great many uses. The following figures represent current good practice: The "air changes" are those which must be taken into account for heating calculations. Higher figures occur in summer and may be necessary when calculating ventilating and duct capacities.

General building types:

	Temperatures F.	Air changes
Offices used for sedentary work	65°	2
Office storage rooms, occupied	60°	½
Office storage rooms, unoccupied	50°	½
Libraries:		
Reading rooms	65°	1½—2
Stocks and stores	50°	1
Art galleries and museums	60°	1
Hotels:		
Public rooms and sitting rooms	65°	2
Bedrooms	60°	1—1½
Lavatories and bathrooms	60°	1—2
Bars	60°	2
Dining rooms	65°	2
Shops	60°	1—2
Shop fitting rooms	70°	1
Shop stores	50°	½
Hospitals:		
General wards	65°	3
Recovery rooms	70°	2
Dormitories, bedridden	55°	2
Dormitories, ambulant	65°	2
Day and dining rooms	65°	2
Staff bedrooms	50°	1½—2
Operating theatres	80°	—
X-ray rooms	70°	—
Bathrooms	65°	2
Laboratories, general room	60°—65°	2—3
Swimming baths and plunge baths	70°	1½
Warehouses:		
Stores	50°	½—1
Packing spaces	55°	1—2

Schools: the temperatures which are required to be attained in the various rooms in schools are laid down in Statutory Instrument, 1954, No. 473, *The Standards for School Premises Regulations.* They are as follows:

	Temperatures F.	Air changes
Convalescent sitting rooms	65°	3
Medical-inspection rooms	65°	3
Changing rooms, bathrooms and shower rooms	65°	3
Teaching rooms	62°	2
Nursery playrooms	62°	
Common rooms	62°	2
Staff rooms	62°	2
Sanatoria and sickrooms	58°	3
Assembly halls	57°	1½
Dining rooms	57°	2
Cloakrooms	55°	2
Corridors	55°	2
Gymnasia	55°	1½
Dormitories	52°	2

Factories: the heating and ventilation of factories is controlled by the Factories Act, 1937, which, however, only lays down the broadest outlines, requiring adequate heating and ventilation. There are also wide variations where dirty, hazardous and hot processes are carried on. Consultations with the Factory Inspectorate and the Factory Department of the Ministry of Labour and National Service are essential. Broadly, it appears that rooms shall be heated as follows:

Light sedentary work	65° F.
Light work	60° F.
Heavy work	55° F.

Lower air temperatures will be allowed where there is suitable radiant heating.

Ventilation rates will vary widely, but for clean processes where there is no process heat, it is safe to consider for preliminary calculations between 1½-2 air changes per hour.

Heat losses

In calculating the sizes of boilers and of the amount of fuel needed to obtain the required comfort conditions it is necessary to calculate the heat required to make good losses through the structure of the building and to warm the air required for ventilation. It has been customary in this country to calculate all heat losses on the basis of an external air temperature of 30°F. This is adequate for normal purposes. Where the building to be heated is situated in an exceptionally cold—or warm—district, it is possible to obtain from the Meteorological Office some guidance as to the expected range of temperatures and the probability of very low temperatures occurring at the particular site. Based on this knowledge a more accurate calculation of heat loss is possible. Further and more accurate information on external design temperatures is also given in *Meteorological Data and Design Temperatures* by H. C. Jamieson in the Journal of the Institute of Heating and Ventilating Engineers, 1954—22—465.

The orientation and, therefore, the degree of exposure of any building must vary and with it the heat losses; allowances for this should be made. Sea coast exposures and the end blocks in built up areas will require more heat than the central blocks in a closely built up area. As guidance, for North and East exposures add 10 per cent. to window and wall co-efficients; for exceptionally exposed buildings add 15 per cent. to window and wall co-efficients. Alternatively, transmittance tables are available based on three exposures—sheltered, normal and severe—and for walls based on orientations (South), (West, South-west and South-east), (North-west), (North, North-east and East). Similarly, the height of the building will affect the exposure, particularly in partially built up areas. The following table suggests the allowances usually made on this score.

4th floor	add	10%	to total	B.Th.U's	required
5th	,,	15%	,,	,,	,,
6th	,,	20%	,,	,,	,,
7th	,,	25%	,,	,,	,,

It is usual to make allowances for room heights since the occupant is only interested in the lower 6-feet, while the warmth tends to rise. This effect, of course, depends largely on the method of heating and is not important in warm air heating systems since the air currents ensure the required adequate minimum temperatures.

For heights from 12—15 ft. add 10% to total B.Th.U's required.
For heights from 16—24 ft. add 15% to total B.Th.U's required.
For heights from 25—30 ft. add 20% to total B.Th.U's required.
For heights from 31—36 ft. add 25% to total B.Th.U's required.
For heights over 36 ft. add 33% to total B.Th.U's required.

Allowances for incidental heat sources

It may be necessary to make an allowance for heat derived from casual heat sources. These allowances can only be considered when calculating fuel requirements; the heating plant must be capable of maintaining the design temperature when the building is unoccupied.

Human occupants: it is quite possible for the occupants to produce all, or most, of the heat required to warm a fully occupied building. An insulated office block with one worker to every 20 sq. ft. will obtain from the occupants three-quarters of the total heat required to maintain an internal temperature of 65°F. when it is 30°F. outside.

The heat radiated by human beings can be calculated on the following basis:—

At rest	300 B.Th.U's	per hour	per adult	
Walking	500	,,	,,	,,
Light manual work	600	,,	,,	,,
Heavy manual work	800	,,	,,	,,

Machinery: the whole heat equivalent of the electrical energy consumed by motors in a building will ultimately affect the warmth of the air. Normally this is of no importance except in factories, but with the recent great increase in mechanization of offices and some shop premises it is of increasingly wide importance. The heat output may be calculated at 2,544 B.Th.U's per horse power actually in use. (Not the rated horse power or the connected load.) In machine rooms in some offices this is sufficient to make cooling or extra ventilation essential in summer.

Light: heat derived from light sources (electric or gas) is considerable and may be embarrassing in show rooms, exhibitions and window displays. The heat produced may in the case of electricity be calculated as for motors on the actual load in use—one kilo watt hour producing 3,415 B.Th.U's. Gas lighting produces greater heat and for certain purposes advantage can be taken of this heat. For example for induced ventilation or as part of the heating arrangement when every possible cost economy is essential. Pensioners will often appreciate this source of warmth in small houses provided for the elderly. A building lighted by incandescent gas burners at as low an intensity as 2·5 foot candles per sq. ft. will obtain virtually all its winter heat requirements from the lighting.

	B.Th.U's per lumen	*B.Th.U's per ft. candle*
Electric lamps, gas filled		
Smaller sizes	0·4	2·4
Larger sizes	0·3	1·8
Gas, incandescent		
Single mantle	2·9	17·4
Mantle cluster	2·2	13·2
High pressure mantle	1·4	8·4

Sun heat: temperature gains due to winter sun are, in England, so fickle that they are not normally calculated. They must, however, be taken into account when calculating air conditioning and cooling plants for summer use. Where a building has large windows facing south and is not unduly exposed to winds it may well be worth separating the flow and return services to these rooms and separately controlling them by an inside/outside thermostat. Fuel savings can, in a bright, cold period, be worth while.

Heat losses through structural elements "U" values

"U" = co-efficient of transmission in B.Th.U's per sq. ft. per degree difference of temperature between the two faces per hour. Heat loss by transmission is calculated by multiplying the area of the surface (wall, window and so on) in sq. ft. by the factor "U" and by the number of degrees fahrenheit difference between the inside and outside temperatures.

Therma' Transmittance Tables: "U" Values

	Thickness			
	4½ in.	9 in.	13½ in.	18 in.
Solid brick, unplastered	0·53	0·35	0·28	0·23
Solid brick, plastered inside	0·44	0·33	0·25	0·22
Solid brick, butting agains t soil	—	0·11	0·07	0·06
Solid brick, lined 1½ in. cork and plastered	0·14	0·13	0·12	0·11
Solid brick, lined 2 in. cork and plastered	0·12	0·11	0·10	0·09
Solid brick, and 4 in. stone facing, plastered	0·42	0·28	0·24	0·20
Solid brick and 8 in. stone facing, plastered	0·33	0·22	0·21	0·18

Cavity, unventilated 4½-in. brick; 2-in. cavity; 4½-in. brick (plastered) 0·29
Cavity, ventilated, 4½-in. brick; 2-in. cavity; 4½-in. brick (plastered) 0·33
Cavity, unventilated, 4½-in. brick; 2-in. cavity; 9-in. brick (plastered) 0·25
Cavity, ventilated, 4½-in. brick; 2-in. cavity; 9-in. brick (plastered) 0·28
Cavity, unventilated, 4½-in. brick; 2-in. cavity; 4-in. breeze (plastered) 0·24

	Thickness								
	2 in.	3 in.	4 in.	6 in.	8 in.	10 in.	12 in.	16 in.	18 in.
Solid concrete	0·86	0·77	0·66	0·58	0·51	0·46	0·41	0·34	0·21
Solid concrete with ½-in. plaster	0·77	0·69	0·60	0·52	0·47	0·43	0·39	0·32	0·30
Concrete cavity block	—	—	—	0·45	0·38	0·33	0·29	—	—
Concrete cavity block with ½-in. plaster	—	—	—	0·41	0·35	0·31	0·27	—	—

gas supplement

Breeze concrete 4½ in. thick: 0·55

(Thickness)	4 in.	6 in.	8 in.	12 in.
Hollow clay tile, rendered outside, plastered inside	0·40	0·30	0·27	0·19

4-in. stud partition, lathed and plastered both sides: 0·34
¾-in. weatherboarding, 4-in. studding, lathed and plastered: 0·44
Wood (average values):

½ in.	¾ in.	1 in.	1½ in.	2 in.	2½ in.	3 in.
0·52	0·44	0·41	0·32	0·25	0·23	0·20

Sundry walls:
Corrugated iron on studding, unlined: 1·50
Corrugated asbestos cement sheets on studding: 1·40

Doors:
Single wood doors: 0·50
Single wood doors, upper half glazed: 0·75

Floors:
Ground:
Ventilated, joisted floors, 1-in. boards, air bricks on one side only: 0·30
Ventilated, joisted floors, 1-in. boards, air bricks on two or more sides: 0·25
Ventilated, joisted floors, 1-in. boards, and parquet lino or rubber, air bricks on one side only: 0·40
Ventilated, joisted floors, 1-in. boards and parquet, lino or rubber, air bricks on two or more sides: 0·35

(Thickness)	4 in.	5 in.	6 in.	8 in.
*Solid concrete floors on earth	0·18	0·17	0·16	0·15
*Solid concrete floors on earth with 1-in. terrazzo or granolithic	0·17	0·16	0·15	0·14
*Solid concrete floors on earth with screed and wood block	—	—	0·10	—

* *Note.*—Recent work by Billington has shown that these figures are very approximate and that attention must be given to the area and degree of edge insulation.

Intermediate:

	Heat flow down	*Heat flow up*
Wood joist, boarded and plastered	0·22	0·29
6-in. concrete; 2-in. screed	0·40	0·50
6-in. concrete; 2-in. screed; and 1-in. wood flooring	0·29	0·33
Hollow tile, 6 in. plastered under	0·33	0·40
Hollow tile, 8 in. plastered under	0·30	0·35
Hollow tile, 10 in. plastered under	0·27	0·32
Hollow tile, 6-in. wood flooring	0·25	0·29
Hollow tile, 8-in. wood flooring	0·23	0·26
Hollow tile, 10-in. wood flooring	0·21	0·24

Roofs:
Flat:

Asphalt on 6-in. concrete, plastered	0·55
Asphalt on 6-in. concrete, 1-in. cork plastered	0·21
Asphalt on 6-in. concrete, 2-in. cork plastered	0·12
Asphalt on 6-in. hollow tile, plastered	0·44
Asphalt on 6-in. hollow tile, 1-in. cork, plastered	0·19
Asphalt on 6-in. hollow tile, 2-in. cork, plastered	0·12
Asphalt, with 1-in. cork and 1½-in. boards on joists, plastered	0·16
Lead, zinc or copper on 1-in. boards, joists and plaster ceiling	0·26

Pitched:

Corrugated asbestos	1·40
Corrugated asbestos on ½-in. boards	0·50
Corrugated iron	1·50
Corrugated iron on felt and 1-in. boards	0·35
Tiles on boards and felt	0·35
Tiles on battens	1·50
Tiles on battens and felted	0·70
Plaster ceiling, with roof space over, under tiles and battens	0·56
Plaster ceiling with roof space over, slated, boarded and felted	0·30
Roof lights—single glass	1·20
Roof lights with lay light below	0·60

Windows:

Single windows in wood frames, Georgian panes	0·9
Single windows in metal frames, Georgian panes	1·2
Double glazing in wood, Georgian pane sizes	0·65
Double glazing in metal, Georgian pane sizes	0·9

In practice it has long been customary to take all single glazing at 1·0 and double glazing at 0·5.
Air leakage is of considerable importance.

Heat losses from air change

For the purposes of calculation the specific heat of air is taken as 0·02 B.Th.U's/cu. ft./°F.

Air changes: the number of air changes required for various buildings is given on page 618. At the same time, the actual and unintended air changes due to leakage may exceed the requirements and it is desirable to check the possible losses in case extra heat is required to overcome this wastage.

Infiltrations of air through 9-in. brickwork

Wind speed, m.p.h.	*passes, cu. ft.*
5	1·75
10	4·2
15	7·8
20	12·2
25	18·6
30	22·9

If the wall is plastered infiltration may be improved to about a 1/100th part of these figures. Plastering can, therefore, have a greater effect on heat losses in this way than would be expected from the additional "U" value obtained. Excess infiltrations should be prevented.

The effect of cracks in joinery and in roof structure is also important. As a measure of this the following figures give the number of cu. ft. per lineal foot per hour for a crack of only 1/16th in. width. The advantage of weather stripping is obvious with gaps of ½ in. under doors.

Wind speed, m.p.h.	*Passes, cu. ft.*
5	20
10	45
15	70
20	96
25	125
30	154

Calculation of heat losses

To calculate heat losses for any building or room of a building:

1. Calculate transmission losses multiply the area of the surface (wall, window, roof, etc.) in sq. ft. by the "U" value for that form of structure and multiply the figure obtained by the difference in temperature between the two sides of the structural unit under consideration. The sum of the losses through each part of the structure will be the total heat transmission losses.
2. Calculate heat requirements for the necessary air changes: multiply the total cube of the room or building by the number of air changes per hour and again by 0·02, the specific heat of air.
3. Make the necessary adjustments for exposure, height, unintentional air change and so on.

The result will be the total number of B.Th.U's required for that room or building and the sum of all the separate parts will give the boiler requirements.

To calculate the heating surface required in each room divide the total heat loss for that room by the heat emission per sq. ft. for the selected heating medium.

For general calculations an emission figure of 150 B.Th.U's per sq. ft. is often taken.

Approximate calculations

For very rough calculations and as a means of checking other calculations:

For a room or building heated to 60° F. inside when outside is at 30° F., allow 1 sq. ft. of radiating surface for each of the following:

14½ sq. ft. of 9-in. brickwork, exposed and unplastered
15 sq. ft. of 9-in. brickwork, plastered inside
22 sq. ft. of 11-in. sealed cavity wall, plastered inside
5 sq. ft. single glass
10 sq. ft. double glass
20 sq. ft. ground floor concrete and wood block
33 sq. ft. lath and plaster ceiling, boarded roof tiled
250 cu. ft. for one air change per hour
125 cu. ft. for two air changes per hour
Add 10% for exposed situation. Reckon 150 B.Th.U's per sq. ft.

Appendix 3. Notes on the layout of central heating schemes for small houses.

It is not possible to give any useful notes on the layout of central heating schemes generally but for smaller houses there is now a greater measure of standardization and the following diagrams of typical layouts may be of help in the drawing office when fitting pipework into the building or during discussions between architects, builders and fitters.

1. Open fire grate with back boiler used (Fig. 21) in the more usual arrangement for

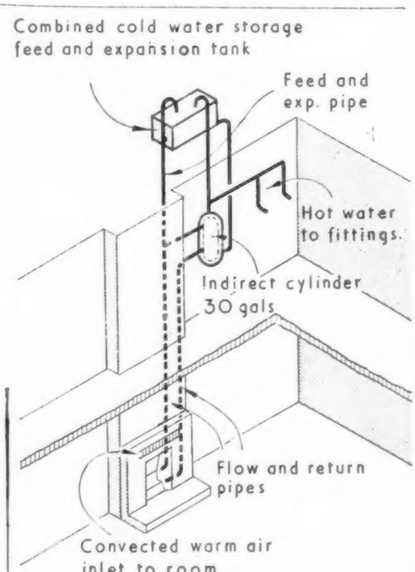


Fig. 21. Pipe layout of hot water supply from an open fire with back boiler.

gas supplement

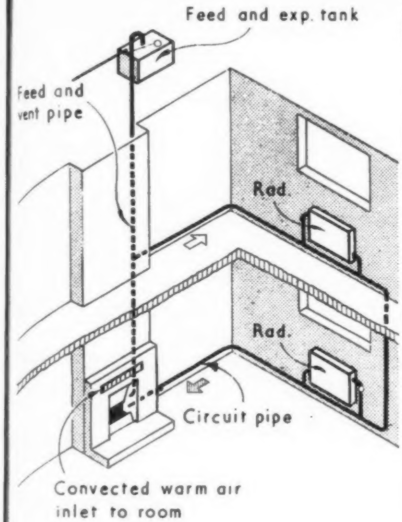
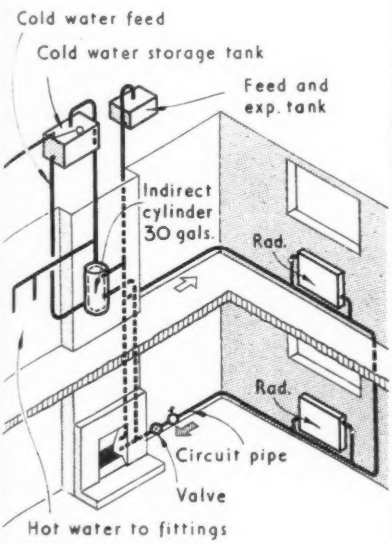


Fig. 22 (above). Pipe layout showing the provision of additional space heating from an open fire with back boiler. Fig. 23 (below). Pipe layout of a combined hot water supply/space heating system using an open fire with a large surface area back boiler.



hot water supply only; (Fig. 22) arranged to provide further space heating by means of radiators in the same or an adjoining room or hall and staircase and, (Fig. 23), arranged to provide both space heating and hot water. Only the largest sizes of back boiler are capable of this combined duty.

2. The simplest domestic boiler layout—(Fig. 24), arranged to give domestic hot water supplies and bathroom towel rail only. Note the towel rail should always be on the hot water circuit as it is required all the year through. In Fig. 25 the small boiler is

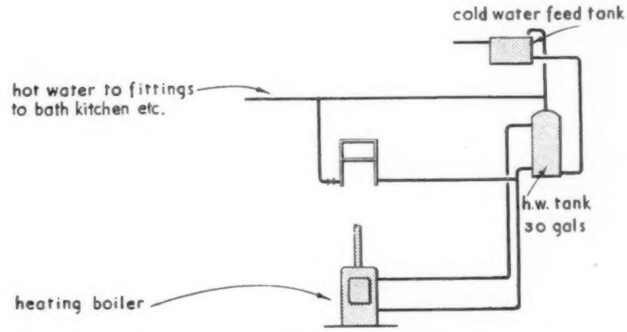


Fig. 24. Pipe layout for a hot water supply and bathroom towel rail only.

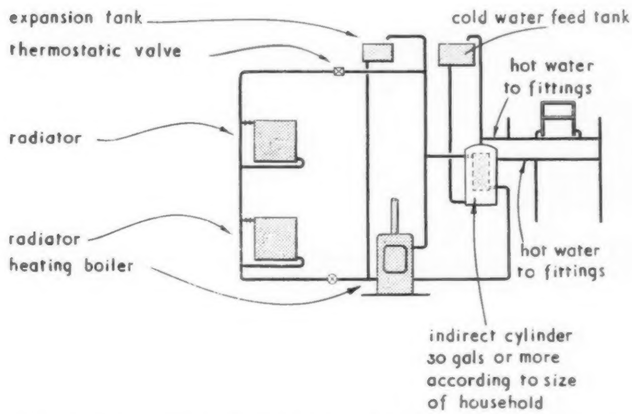
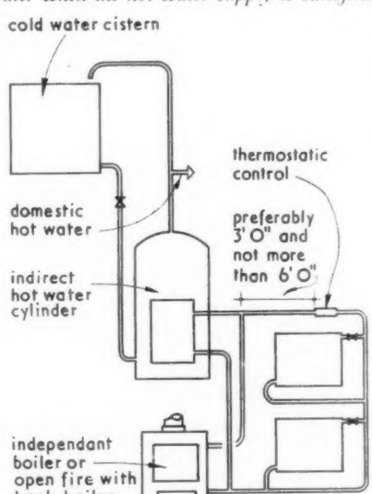


Fig. 25. Pipe layout of an indirect system ***providing*** *both hot water and space heating.*

used with an indirect cylinder to provide both hot water and space heating.

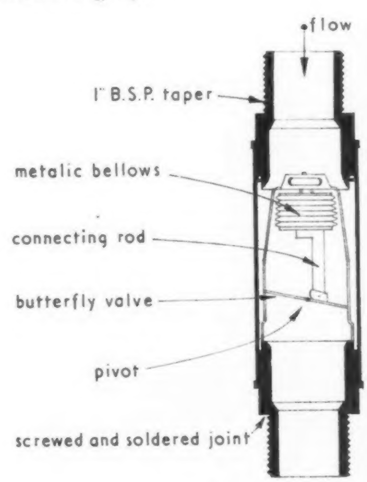
3. In the smaller combined space and water heating units the radiators can sometimes draw too much of the available heat at the

Fig. 26. Pipe layout of a small combined hot water supply/space heating system showing the use of a thermostatically controlled check valve to ensure that the radiators only take hot water when the hot water supply is satisfied.



expense of the hot water. This can easily be overcome by fitting a thermostatically controlled check valve in the circuit, the valve being set for a predetermined temperature ratio between hot water and radiators. Fig. 26 shows diagrammatically the normal position of the thermostatic control and Fig. 27 gives a detail of the valve construction.

Fig. 27. Check valve used in the layout shown in Fig. 26.



Appendix 4. Unit Heaters for overhead use

For a number of types of building, particularly factories and exhibition halls, central heating is difficult to arrange and suspended unit heaters are convenient and efficient. They are available either as convection heaters with a fan built in or as radiant heaters.

Convection types. For the heating of large volume buildings unit heaters are normal practice, in many cases consisting of a steam or, less often, a water-heated finned or car-type radiator fixed well above head height and equipped with an electrically-operated fan and louvres to direct the air flow downward where required. However, they are slow to heat up the surfaces of walls, floors and fittings and so long as such surfaces are more than some 3° to 5° F. below the air temperature there can be a feeling of chill due to the radiation of bodily heat to the colder surfaces. Gas-heated unit heaters which operate without hot water or steam supply are available in two types:

1. Indirect, having a flue to carry off products of combustion. Heat input ratings from 66,000 to 375,000 B.Th.Us per hour are available with overall efficiencies of 70 to 75 per cent. (see Fig. 28).

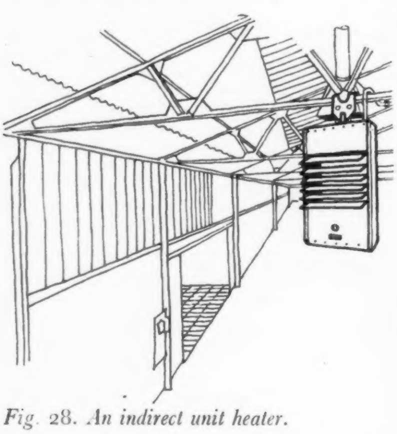
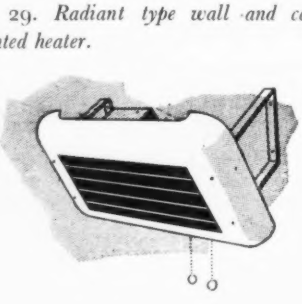


Fig. 28. An indirect unit heater.

2. Direct or flueless heaters in which the products of combustion are circulated together with the heated air. Ratings are approximately 100,000 B.Th.Us per hour at 90 per cent efficiency.

Radiant types. For intermittently used buildings where the structure is of high thermal capacity it is necessarily expensive and often uneconomic to heat the whole of the air and the structure by full central heating installations, or even with convector units alone. The most commonly occurring examples are churches and assembly halls and some school buildings.

Fig. 29. Radiant type wall and ceiling mounted heater.



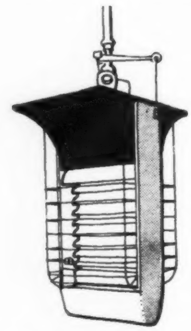


Fig. 30. Ceiling type radiant heater giving "black" radiant heat. This is particularly useful for halls where the room has to be blacked out for film or slide projection.

A good measure of comfort can be obtained at far lower initial and running costs by radiant heating so long as the heaters can be placed so as to give direct heat to the occupiers without risk of shadowing by columns and structural details. Though radiant heaters tend to offset the effect of cold walls, greater comfort can be obtained if the walls are covered with curtains or low thermal capacity panelling to reduce body radiation to the structure. Optimum conditions can be fairly quickly obtained so that there is no need for the same period of pre-heating which is required with traditional central heating systems based on convection. Radiant heaters have, perhaps, their best application when used in conjunction with a central or mainly convective system. The quickly available radiant heat together with the direct air heating produces a high standard of comfort with reasonable economy.

In the case of churches the massive construction of the building and its very intermittent use present particular problems in regard to the use of flueless heating, when ventilation rates are low. When flueless heating is considered it is essential that the ventilation should be adequate (say, 1½ changes per hour). It should be remembered that the rate of ventilation in churches is frequently less than 1 air change per hour, and in some churches may be as low as ½ an air change per hour. If condensation occurs, damage to organ and church fitments can take place. The complete heating of a church by unflued overhead heaters should not generally be considered. Their use should preferably be confined to zonal heating or as a supplement to a flued system providing the basic background warmth. A full technical review of the heating of churches has been published (*The Heating of Churches*, published for the Central Council for the Care of Churches. *The Builder*, February, 1955). One of the advantages of radiant heating in churches is the fairly quick establishment of comfort and reasonably low capital cost and economy in running cost.

An example is given of radiant heaters fitted into the ceiling of a church and venting into the roof space. The ceiling itself is formed of insulating board on a light frame, which also carries the heaters. Ventilation of the heaters is by louvres at both ends of the roof. Automatic ignition is arranged by electric circuit since pilot jets would consume an appreciable amount over the week and could, perhaps, be extinguished. The installation cost was some £312 compared to an estimate of £1,000 for gas fired central heating, while running costs for the whole of Sunday and one mid-week service was at the rate of £1 3s. 2d. a week compared to an estimate of £4 6s. 7d. a week for gas central heating run for only 12 hours on Sunday, which might not have given very good comfort conditions in the early part of the day.

Suspended or wall-mounted units, are available with heat inputs from 7,500 to 75,000 B.Th.Us per hour. The calculation of requirements is not on the usual basis used for convection heating and is governed chiefly by considerations of coverage.

Heat distribution diagrams are available from which the radiant heat intensities and pattern can be found at floor level according to the mounting height of the heater. In multi-heater installations the heat distribution patterns of the individual heaters will overlap and the siting of appliances is arranged so as to give an intensity of the order of 15-20 B.Th.Us per sq. ft. at floor level in the zones being heated.

Overhead radiant heaters

Types	Input rates, B.Th.U./hr.
Wall Fixing Type	
High temperature (incandescent panel)	12,500–50,000
Low temperature (black panel)	11,000
Suspended Type	
High temperature (incandescent panel in vertical or inclined plane)	7,500–30,000
High temperature (incandescent panel in horizontal plane)	12,000–75,000
Low temperature (black bowl type)	15,000–16,000

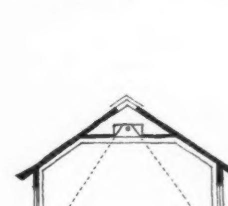


Fig. 31. Sectional diagram showing the application of gas-fired Unit heaters to a church. It will be noticed that the heaters themselves are in the roof space with separate ventilation.

THE ELEMENTAL BILL

Earlier this month the RICS committee on elemental bills issued a report which concluded against *the elemental bill of quantities but displayed a serious lack of evidence from those with practical experience of it, and—more significantly—announced that the committee was to remain in being. On Wednesday last week the committee held a public discussion of the elemental bill of quantities (to be reported in a later issue of the* JOURNAL*). To prepare readers to form their own view, we commissioned two teams of architects, quantity surveyors and builders—" for " and " against " the elemental bill of quantities—to express their opinions. To allow freedom of comment, they all remain anonymous.*

for elemental bills

AN ARCHITECT

The Bill of Quantities in its present form is time honoured and is designed primarily as a means of obtaining competitive tenders. For this particular purpose the bill as we know it is satisfactory, but my reason for writing in favour of the elemental bill is not merely because I am against one type of bill and for another; like most subjects they are hard to express in terms only of black and white.

Conditions of practice have changed so drastically since the conception of the bill in its present form that it is not unnatural that some quantity surveyors and architects have been tempted to explore different forms of bills and, in fact, have challenged the conventional relationship of the two professions.

The wider range of clients the architect serves today, the shortage of time and money, and in fact a growing social conscience among the profession make value for money not just a slogan to be bandied about. To achieve progressively greater value for money the architect must have a more detailed, accurate and analytical knowledge of how the money is spent on jobs and what given sums of money will buy. Too often adjustments of expenditure are made by superficial adjustments to design while the absence of techniques for fundamental analysis of costs leaves unquestioned other aspects of design which may be inefficient in terms of value for money. As the practice of cost analysis of past jobs and cost planning of future jobs gains ground—and it would be of inestimable value if a standard basis for this work could be agreed by the professions concerned—an architect would be able to make comparative assessments of jobs in terms of money that will be of real service to him in future projects. It is generally agreed that to equip the architect in this way the cost information must be given to him in terms of the elements in which he designs. In my opinion this quantity surveyor service should be a normal part of the design process and thus the elemental bill naturally follows.

From my experience of the use of elemental bills of quantities in practice, I am convinced that during the design stage they offer a superior source for reference and analysis than the conventional bill and that during the contract their aid to programming of the works and their convenience for reference for day-to-day queries—particularly if they are indexed and annotated—is readily acknowledged and appreciated

against elemental bills

AN ARCHITECT

The architect's problem is to translate the client's requirements as rapidly as is possible into a finished building. The architect looks to his quantity surveyor to assist with that problem in each stage.

The principal objections to the bill of quantities in its present form have been that it is complicated by an emphasis on details and " labours " in trades which are measured, and that current developments in technique and materials have increased the proportion of the contract which must be included as P.C. Sums. The simplified bill agreed after the war for use in housing contracts was a step in the right direction which we had hoped to see continued. The use of the bill of quantities to analyse the cost of a building and to provide a basis of assessing the cost of new buildings, has been practised since the bill was first introduced, and it has proved perfectly simple to break down the total cost of a building by *trades*, and use the cost per trade as the means of estimating for a new project.

It is essential that the architect appreciates all his designs in terms of the trades of which they are composed so that he can appreciate the builder's problem on site. Where analysis of elements is desired it can easily be carried out to suit a particular project and it is unlikely that analysis by any standard element will be better than by trade.

The elemental bill dividing, as it does, the individual trades among the various building elements, is no advance for most type of building because by complicating the method of billing, it—

Increases the time required to prepare a bill of quantities.

Increases the size of the bill of quantities and thereby adds to the cost.

Increases time for tendering and checking tender, as all the sections of each trade have to be drawn together for the purposes of obtaining a price, and all sections must be checked to ensure that analogous rates apply to all sections of the building.

In practice many trades of P.C. Sums are not readily divisible between elements, and variations in construction make direct comparison of the same element in different buildings impossible.

In preparing an estimate for a new building, the most important factor is the intelligent interpretation of past knowledge in the light of the detailed requirements of the new building. This is particularly not only by the architect but by the builder, foreman and clerk of works. The billing of work by elements, in the terms in which an architect designs, prepares his drawings, and in terms in which the builder builds, helps to put the whole operation of designing and building in the same gear and is helpful for the purposes of planning and programming a contract on the lines outlined by the Building Research Station in Building Digest, No. 91. Such means, in the opinion of the writer, offer most hope for the improvement in the speed and efficiency of building.

The successful use of the Elemental Bill depends just as much as the conventional bill on complete and timely information being provided by the architect—any form of organization will be destroyed by designing during construction. I do not intend to suggest that the Elemental Bill will overcome all our difficulties and that it will not create others, but I do suggest that all the work the quantity surveyor puts into the bill could be of greater service to the architect if alternative forms were explored provided, of course, and this is important, the prime purpose of the bill is not impaired. It is encouraging that there are some quantity surveyors and architects with open minds, who are prepared to experiment. As with all experiments success cannot be guaranteed, but procedures may evolve which may have their effect on contract procedure that will make it easier for builders, architects and quantity surveyors each to play a constructive part during design and embark on jobs fully informed and prepared for them.

A QUANTITY SURVEYOR

No great departure

The elemental bill of quantities is a departure from conventional practice but not so great a departure as may first appear. For some time many trade bills have contained sections which cannot be classified as trades (*e.g.*, Substructure, Work in connection with Services, External Works) and the elemental bill may therefore be considered as a logical further extension of a well-established trend.

Appeals to the advance guard

The departure has been the result of the many changes which are taking place in the building industry. Changes induced by the entry of industrial methods into a predominantly craft industry; by the insistent demands for more efficient, economical and speedier construction and by the call for closer integration of design, cost and construction. Individuals and organizations not subject to such influences will have no cause to alter their conventional procedures. Those who have already made contact and thus may be considered as the reconnaissance troops of the industry are sympathetic to the elemental bill. They see in it an attempt to tackle the problems which appear to be ahead and the promise of a contribution to greater efficiency.

important in central areas where complications of adjoining buildings, rights of light, party walls, and old foundations, causes considerable variation in cost between similar buildings built in the same areas at the same time.

Where different forms of construction are intended to be compared with each other, particularly on complicated buildings, it is frequently possible to get a check price on individual trades so that the unit rates used in building up the estimate are accurate at current prices for that particular class of work on that site. This means that check prices by association of trades is easier, than by association of some element which, in many cases, is not easily divided in the same way in different classes of construction. As far as progressing work on site is concerned, there is a great advantage in knowing the quantity of each trade to be carried out in money, broken down into labour and materials, as it is frequently the quantity of some key trade in which either the labour is short or delivery of materials is long, that decides the main programme. Where the buildings to be compared are very similar buildings, mostly on clear sites, with similar functions, it is possible that an elemental bill of quantities can give a rapid appreciation of the comparative costs of buildings on different sites, especially where the analysis is being made by those unfamiliar with the peculiarities of individual sites or local conditions. But for the architect and quantity surveyor dealing with individual buildings for individual clients, such a yardstick is not helpful, and anything which tends—

To delay the preparation of the bill.

To delay the preparation of tenders.

To increase the cost of the quantity surveying services, is unfortunate, especially at a time when many commercial clients have accepted the approximate bill, or even at times a schedule contract, as the most satisfactory way of getting their buildings rapidly.

In this connection it must be borne in mind that in most commercial and industrial work, it is essential to erect a building as rapidly as possible, both from the point of view of avoiding excessive loss of interest on sites, and getting production out of the buildings at the earliest possible date. The longer a project is delayed in starting, the more inevitable changes become, because industrial techniques or organization are changing constantly, and 12 months' or more delay in starting a project may well mean a variation in the requirement, which will only serve to complicate what might at first sight appear to be a final plan.

A QUANTITY SURVEYOR

Supporters of elemental bills claim that it is possible by their use to estimate more accurately the probable cost of a building in the planning stage because each material and labour is shown for each particular element of the building and not aggregated into a single item for the whole job as is normally done. This, of course, is perfectly true in theory but it is doubtful whether or not the theory is justified by the

for elemental bills

Development by a team

The initial idea could not have reached its present stage of development without the close co-operation of architect, quantity surveyor and builder. Such teamwork acts as a reminder that the elemental bill does not serve any one special interest. It is designed to satisfy the wider range of uses of the present day bill.

Reasons for its introduction

It was the method of cost analysis suggested in the MOE's Building Bulletin on Cost Study which suggested the introduction of the elemental bill, as it provided a cost analysis more readily than the trade bill. But cost analysis was not the sole reason.

For some time there has been a growing awareness that conventional billing was not entirely satisfactory. From time to time there has been criticism of the bill in the technical press (see article by the Guest Editors: AJ 20.10.55). Indeed, since the beginning of 1955 a committee of builders and quantity surveyors has been examining the possibility of altering its format. The modern architect, faced with the problem of designing to a strict budget finds the bill a complicated and esoteric document which does not provide him with the " feed-back " of cost information essential for present day practice.

Several types

The elemental bill is simple and straightforward in principle. The items are grouped by elements of building, not by trades. There is room for a choice of elements and for varying definitions of each one. It is not surprising, therefore, that there is a variety of elemental bills and the advantages and disadvantages claimed for them in general may not apply equally to each type.

Practical tests

Although still in its novitiate, it has already been put to several practical tests: in negotiated and competitive tenders; for a variety of building types (*e.g.*, schools, houses, hostels) and for different constructional methods (*e.g.*, light steel frames, loadbearing brickwork, reinforced concrete frame). On such evidence it may be admitted that the elemental bill qualifies for further consideration.

Bigger bills

The main criticism is that recurring items tend to increase the size of the bill. This criticism can be allowed but with important reservations. First, the trade bill is not devoid of recurring items, secondly, the number of additional items occasioned solely by elemental presentation will depend upon the number and definition of the elements. Some bills which have been examined have shown that the increase is generally about 2 per cent. The highest percentage increase, so far revealed, is said to be 6 per cent. If the advantages claimed for elemental billing can be achieved, a 2 per cent. increase in size is not formidable.

No change in " taking-off "

As far as the quantity surveyor is concerned, elemental

against elemental bills

actuality. For that to happen the contractor's estimator pricing the bill must enter into the spirit of the thing and plan the running of the contract before he puts his tenders in, even though he may not get the job. He must know where his materials dump is going to be situated and decide the progressing of the job before he begins to price so that he knows, or can estimate, the time taken to move his materials for each part of the job and reflect that time in his cost. Now the usual time for tendering is three to four weeks and the marking up of the bills of quantities (normal style), getting them typed and out to the sub-contractors for tender is the first job to be done which, allowing for the normal routine work of any office is a matter of two days at least. Where an elemental bill is concerned, however, this process is going to take longer and use far more paper, as the various sub-contractors bills will be prepared from little items from a number of elements instead of being a straightforward extract. Some sub-contractors will co-operate and meticulously price each item, others however will just return a lump sum even as they do now and to satisfy the demands of the elemental bill and because there is seldom time to ask for a breakdown before submitting his tender the estimator will have to break down the lump sum price as he thinks fit, which is the first possible flaw.

Supposing, however, that everything is done perfectly, will the contract be carried out without any variation? If it is, no one would be more gratified than the quantity surveyor, but if extra materials and labours are introduced into any element, pity the poor quantity surveyor. Contractors' surveyors take, and rightly, every advantage given them by the ordering of variations to increase the amount received for the job, and they have merely to show, for example, that there are different rates in the contract bill for similar sections of timber in partition studding and in studding for outbuildings to be able to back up most plausibly a story that a similar section of timber ordered as a variation in some other element of the bill is worth an even greater figure than either of the other prices, although the quantity surveyor knows that the labour in all three items is identical and obviously the cost of the material is constant.

If the contract is carried out as planned, however, the architect and quantity surveyor are left with a bill split into the elements of the job and priced in great detail, a bill which will theoretically be of assistance to them for their next similar job. The operative word is, of course, similar. Are any two jobs identical? Even if the plans are identical, are the sites even comparable, that is, are all the main services within equal access?; are both sites equally accessible from the main roads and a railway station; is the sub soil identical and the availability of labour the same in both cases? The point is that the elemental bill is of no use whatever for the cost control of the building for which it is prepared but only for similar buildings which may be erected later, a fact which limits its usefulness, economically, to possibly only school buildings and blocks of flats.

My objection to the introduction of this type of bill is that it is unnecessary. If the quantity surveyor for the for elemental bills

billing need have little effect upon his customary procedures, although this again will depend upon the choice of elements. In the London or "Group" method, dimensions can be "taken-off" in the normal way but in "abstracting" the items are arranged under element headings instead of trade headings. The writing of the bill, which follows, can be accomplished without any change in the basic procedure.

Billing direct

In general, the elements are similar to the sections of a building in which a quantity surveyor "takes-off" his dimensions. Where the element and the section are substantially the same the elemental approach allows the abstracts to be closed and the writing of the bills to start at an earlier stage than normal. It has also been claimed that this approach will allow the dimensions to be "taken-off" and billed direct thus avoiding the clerical process of "abstracting." If the shortage of "workers-up," who perform this work, should become more acute, this aspect of elemental billing may appeal very strongly to quantity surveyors.

Interim valuations

A further advantage, is the greater ease with which the quantity surveyor may be able to prepare interim valuations. With many buildings the sequence of erection does not allow trade to follow trade. Instead, there is a complicated interaction of trades and specialists. As a result, much time can be spent extracting the value of the appropriate items from different sections of a bill. It is claimed, that with elemental billing the elements could be related to the erection sequence and much time saved when preparing a valuation. It has also been suggested that it would help to avoid the risk of under valuing.

Worth encouraging

The elemental bill has been described as a tool for pre-planning. It is a tool which is still being forged, but sufficient work has already been done to show that it has substantial promise and that further examination and testing of its possibilities should be encouraged.

A BUILDER

In order to analyse the advantages of elemental bills of quantities from the contractors' viewpoint, it is necessary to consider the uses to which he puts the bill, be it elemental or otherwise. Principally he uses it as a means of calculating and arriving at his tender, the preparation of interim valuations and for the site foreman in order to supplement the specification, if provided, and the drawings.

Let us therefore examine these uses in relation to elemental bills. Before doing so it may be interesting to make brief comment on existing practice regarding the compilation of bills. Quantity surveyors and others are in the throes of furious debate concerning the res-

against elemental bills

job is capable he should be able to provide the architect with all the detailed advice in cost that is required without having to prepare elemental bills for all jobs so that he can refer to them when a similar job turns up. They are more costly to prepare, to print and to price. The number of dimensions and draft bill sheets, on average, is increased by fifty per cent. when an elemental bill is required and it necessarily follows from that that more time is spent in measuring and working up the dimensions and in typing, reading over and pricing. They nullify the greater skill of the experienced taker off and cause the estimators a great amount of duplication of effort. The printing will cost more as the charge is based on the amount done and if elemental bills are demanded by the architectural profession I feel that a rise in quantity surveyors' fees must follow. Is it just that the client should be asked to pay more than he need for his bill of quantities simply because the elemental form may provide the architect with some information which may be useful to him at some later date? Information incidentally which would always be given by the quantity surveyor on request for no extra charge, *e.g.* which form of wall construction of two or three suggested methods would be cheaper?

If deductions are drawn from a priced elemental bill by anyone other than an estimator or a quantity surveyor the chances are that the deductions will be faulty and it is more than likely that the various factors which influence the cost of a job, some of which are listed in the third paragraph above, will be overlooked; furthermore will the date of the pricing of the bill referred to be remembered?—a vital point when costs change as they have done over the last few years.

In conclusion, I would stress that the elemental bill was born in a Civil Service office, and its supporters, in the main, are either Civil Service or Local Government officers, people who do not have to show a profit on the time spent on the job. It certainly provides nothing that the trained quantity surveyor cannot supply and it takes very much longer and far more money to do the same job. Lastly, is not the quantity surveyor the best judge of how to do his own job?

A BUILDER

When considering a bill of quantities from a contractor's point of view we should perhaps divide the question into three sections:

Estimating

In its present form a bill of quantities is relatively concise and separated into trades. Thus when tendering it is quite a simple and quick operation to "mark-up" a price for typing, or copying in some way, for the purpose of obtaining quotations for sub-contractors. Obviously by virtue of trade sections this work is reduced to a minimum and, an important consideration, can mostly be done by clerical staff. However, if an elemental bill is used it must be converted into trade bills before enquiries are sent out—furthermore these bills would be much longer due to repetition. Pricing would take much longer as items

for elemental bills

for elemental bills

pective merits of billing by trades or elements, but is the gap between the two schools of thought as wide as it might appear? It has been the practice for many years to introduce elements into the normal trade bill. Such items as substructures, outside works, drainage and builder's work in connection with services spring readily to mind, and certain trades are elements in themselves, *i.e.* plumber, heating and hot water engineer, and electrician. It is usually only in the superstructure of a building that the trade method is used.

Estimating is the most vital operation in which the contractor uses his bill. In order to arrive at a really accurate tender the contractor must be left in no doubt about the exact meaning of each item and the part it plays in the building as a whole. In dividing the structure into elements the estimator is better able to visualize the exact circumstances and conditions under which the items are to be executed. Estimating inevitably contains a varying element of risk. In these days of fierce competition within the industry when the contractor's estimator has to be able to calculate his tender to a very fine degree, the reduction of this risk is a major factor. The division into elements involves the disintegration of certain items into a number of components, but an item often requires a different rate depending upon the element to which it belongs, and the extra work for the contractor in the preparation of his tender may well be justified.

A well planned elemental bill follows the operational sequence of work. This helps both the contractor and quantity surveyor in the preparation of interim valuations. So often does one have to thumb through practically all the pages of a trade bill picking out items piecemeal in order to arrive at the value of the work executed. When these items are billed elementally and in operational sequence the surveyor can value the whole, or part, cost of the elements as an entity, and he will find when it comes to the final account that his task of arriving at the value of omissions is simplified. The cost conscious contractor also finds a more convenient basis for unit costing.

One must not forget the use of the bill of quantities in relation to the site agent or foreman. In many cases the bill has to act as a specification on the site and often foremen ask where certain items are measured in the bill and conversely to what operation billed items refer. Their collection into elements forms an index which the foreman can easily locate. The perfect document from the foreman's angle is the annotated elemental bill, for this combines the duties of both specification and bill, thus avoiding the necessity of continual cross reference between the two documents. Programming, an essential function of contracts management, is simplified as the labour and time content of stages is readily ascertained.

To sum up, an intelligently planned elemental bill can be of much value to the contractor. One must not denigrate the existing form of trade bill for this is an admirable document, which has served the industry well, but a break away from its rigidity is a subject which should commend itself to all members of the building team.

against elemental bills

would be repeated floor by floor. Consider the troubles if an estimator varied his prices—assessment of labour content trade by trade would be very difficult. We must also realise that contracts would rarely if ever be completely repetitive elementally. One would have to attempt to break down each job to basic elements—thus records would tend to be more voluminous than ever.

Surveying

When placing bulk or "warning" orders for materials the present bill is an excellent guide. Likewise for the purpose of valuations, trade bills are most useful—because building generally proceeds progressively by trades. On the question of variations, one can foresee that final accounts would be hampered by changes of one element or by the introduction of a completely new one. How would an additional element be dealt with in the final account?

Constructional staff

Spare a thought for the agent—already adapting himself to ever changing and improving techniques. With a new type of bill, both longer and more difficult to follow—with separate bills prepared by the contractor for sub-contractors. It might take a long while to check whether a particular item is to be executed by the pavior, the plasterer or himself, because a sub-let trade might occur in several different elements. Here again we find we are unable to obtain an overall clear picture without resorting to trades.

To sum up then, it would appear from the contractor's side elemental bills would give his estimator more work and require longer periods for tendering (heaven knows they are short enough now!) and thereby increase the cost. Generally, it seems certain that the surveyor and agent would both have more work and thus need more time to solve their various problems, or alternatively, they will need more assistance.

BOOKS

Architecture of the New Establishment

English Country Houses—Mid-Georgian. By Christopher Hussey. *Country Life,* 6 gns.

The publication of the middle instalment of Mr. Hussey's Georgian three-decker marks a symptomatic juncture in the consolidation of an "establishment" in English Architectural taste—and the following attempt to unravel this ponderous judgment will have to serve as a review of a book that cannot otherwise be reviewed without vanishing into the ionosphere of art-historical niceties. Timothy Shy justly observed that the French had settled the problem of their historic homes by burning them to the ground in the interests of *egalité* and *fraternité,* but we English, with our taste for gradualness and mental cruelty have preferred to expropriate our ancient fiefs by inches. Although this process didn't really start until well after Lloyd George had initiated the Gradual Revolution, the existence of *Country Life* as the House Magazine of a cornered feudality dates back into the previous century, and signals the existence even then of the idea that the Country House Way of Life was worth conserving. In those days, of course, it was all gun-dogs, gardening and good works, but an occasional article did notice architecture.

After 1918 all this began to alter; the social pressure on the Country House set began to increase, but at the same time the arrival on the architectural scene of anti-Ruskinian pleasure-principle critics—notably Geoffrey Scott and the Williams-Ellis family—suddenly rendered the country-houses of the eighteenth century OK in the eyes of literate Englishmen. The main intellectual monuments of the changed state of affairs are (apart from Sir Albert Richardson): Rex Whistler's Murals in the Tate tea-room, and Noel Coward's grisly ditty about the "Stately Homes of England," which between them document both the palsification of taste and the cynicism with which it has been exploited ever since. But greater far than these is H. Avray Tipping's *English Homes,* a splendid many-volumed thing published, need one add, by *Country Life.* It summarizes its *milieu* with horrible accuracy — woolly-minded, long-winded, dynastic, snobbish, garden-mad—but in pursuit of long-standing dynasties and antique grants of arms it overspills the narrow taste of its time, and rummages through Jacobean, Tudorbethan and back into the mists of antiquity and illegitimacy. That was its classic virtue; Tipping, is catholic and all embracing, and his volumes come on and off the library shelves as busily today as they ever did.

But, of course, they are no longer quite the thing. The Pevsner-Wittkower revolution in historical method has made Tipping's amateur-fusspot research techniques unsupportable to the boys who want the facts. And the buildings themselves have undergone a change in value. To Tipping they were interesting because of the fabulous, rich, titled people who lived in them, which is why he called them *English Homes,* but to us nowadays with our Fabian anti-snobbery they have become jewels in the Nation's treasury of the arts, inhabited not by people, but by Old Masters and Chippendale furniture.

For what the Playboy-Pansy period has done to us is to narrow the English vision of architectural good to the Eighteenth Century, and at the same time to render that century's architecture absolutely and unquestionably good. The same citizen who sneers at Post Office Georgian will raise cain at any proposal to demolish the most gim-crack, rot-ridden heap that looks symmetrical in a good light and has sash windows and a cornice, to take down any Adamitic ceiling, however, dreary, to sell to America any Augustan portrait however dim. You may have noticed, too, the belief (widespread among landlords who are trying to unload uneconomic Georgian houses) that the sole function of the National Trust is to conserve uneconomic Georgian houses And you will notice, too, that *Country Life's* overhaul and condensation of Tipping, which Mr. Hussey has admirably in hand, started with Early Georgian, and the first three volumes will cover the rather long century that runs from Colen Campbell to Decimus Burton, near enough. No bets are being laid, but it will probably be a very, very long time before any other volumes appear, once the Georgian trilogy is complete, and the six-guinea touches that crept slowly from cheque-books for Early, Middle and Late Georgian won't even stir for Early Stuart.

Georgian, let's face it, is the *beau ideal* of the New Establishment, the administrative ascendancy, the managerial Etonians, the Luckiest Jims. That Zephyr with the salami and vin rosé in the boot will nod to a halt in front of a portico attributed to Henry Holland, but that charabanc with the crate of Double Diamond, that Cadillac with the Coke, that Popular with an art-historian's thermos of coffee, will shortly meet on the crunchy gravel of Montacute, Hardwick, Haddon, Cliveden or Longleat. For——as now seems to be usual—popular and specialist tastes co-incide (Longleat has as much to offer the historical sleuth as it has for the celebrity fancier) leaving the cultured establishment in a waste-land of preformed preferences — Georgian houses, *Economist* opinions, *Design Centre* furniture, *New Statesman* wines, *Observer* Jazz—and more Georgian Houses.

Mr. Hussey's book is too good for these people. It is a well-presented, well illustrated work by a thorough-paced historian, orderly and sound—apart from a tendency to play slightly fast and loose with the word *Rococco,* though this playful streak is one of the things that make it too good for the embalmed taste of the Establishment. It is a book to which all serious students can be confidently directed—especially as its introduction has a useful section on factory-made materials and components, that neatly undermines all that stuff about "universal good craftsmanship"—but what a pity it is that the author's considerable and painstaking talents had to be deployed on canonising a dying taste, and not in illuminating some of the murkier periods of the history of the English Home.

REYNER BANHAM

Ancient, Classical and Byzantine

Simpson's History of Architectural Development. Vol I. Ancient and Classical Architecture. Edited by Hugh Plommer. (Longmans Green & Co. Ltd. 35s.)

Byzantine Architecture and Decoration. J. Arnott Hamilton. (B. T. Batsford Ltd. 42s.)

As a student one knows two kinds of book about the history of architecture in general: the Banister Fletcher or catalogue kind, and the Simpson's or narrative kind. Of the two architypes, Simpson's first appeared in three volumes in 1905, and cannot any more be regarded as a wholly reliable and all-inclusive guide. Now the original publishers have decided to issue a wholly new edition, in five volumes. The book will still be limited to Europe and the eastern Mediterranean cutting out India, the Far East and the Americas—which is a lot—in the interest, presumably, of making the development a continuous narrative. The first section, dealing with ancient architecture until the end of the western Roman empire has been considerably re-written and expanded by Hugh Plommer, an archaeologist and a classical scholar.

"The buildings of savages" Mr. Plommer ominously begins "considered on their own merits have no place in this book." O Vico, Frazer, Freud and Jung, when is a savage a savage? The answer to such a question would seem self-evident to Mr. Plommer, since he does not bother to ask it. The whole history of architecture, according to him—or so it seemed to one reader could be reduced to a progression towards and a regression from the perfection of Roman classical work. Such an attitude enforces limitations, of course, especially as Mr. Plommer considers all building in aesthetic terms almost exclusively. For this, if one is to judge by the appearance of his book: the nasty drawings (even when they are copied from the old edition, they have been made gross, and to lose their old-world charm) the fuzzy photographs and rather wretched layout, he is conspicuously ill-qualified. The mean references to modern architecture, the acrimonious and patronizing tone in which authorities are referred to—Wittkower, Pevsner and Le Corbusier are trounced incidentally—and the inelegance and pedantry of the prose make the text very distasteful reading. But then, however pedantic, no-one not even Mr. Plommer is infallible: where, for instance, could he have got the notion of an octagonal town in Vitruvius from? He certainly did not get it from Vitruvius' own text. Or what is one to do with the marble fragments of the Frieze from the Mausoleum of Halicarnassus, if the Frieze—as Mr. Plommer implies—is an invention of Professor Dinsmoor's. And so on.

For a substantial, five-volume history of architecture this is a most inauspicious opening. Scissors-and-paste history is all very well in a way, even without too much paste; but this book is not learned, good-looking, readable or orderly enough to qualify for a low place in that category even.

After Mr. Plommer's book it is a relief to turn to Dr. Hamilton's wholly convincing book about Byzantine architecture. Not that—as Henry James said of another one—this book is *written* at all. But it is never unacceptable, even at its most pedestrian. One is always sure, too, that Dr. Hamilton knows what he is talking about although he may sometimes seem a little fanciful, as in his discussion of the relation between Byzantine theology and the physical shape of the church. Where one is not able to follow him fully for want of information, one feels sure that this information would have been forthcoming, if only there had been the space. I am not at all sure that the book would not have been better for more discussion of this kind at the expense of the purely descriptive passages. But in any case one is extremely grateful for Dr. Hamilton's ability to set the whole thing out in an orderly manner, to quote authorities courteously, even if critically at times; and most of all for his sympathetic treatment of the intricacies of Christological discussion, and for his genuine enthusiasm for the intoxicating splendour of the liturgy.

Unfortunately, the production is poor again. This is a considerable piece of re-editing of an earlier work, and the additional photographs are noticeably superior to the old ones. But the generally lifeless and crabbed layout and the very poor wrapper and binding are not worthy of the subject and are bound to put off many prospective buyers.

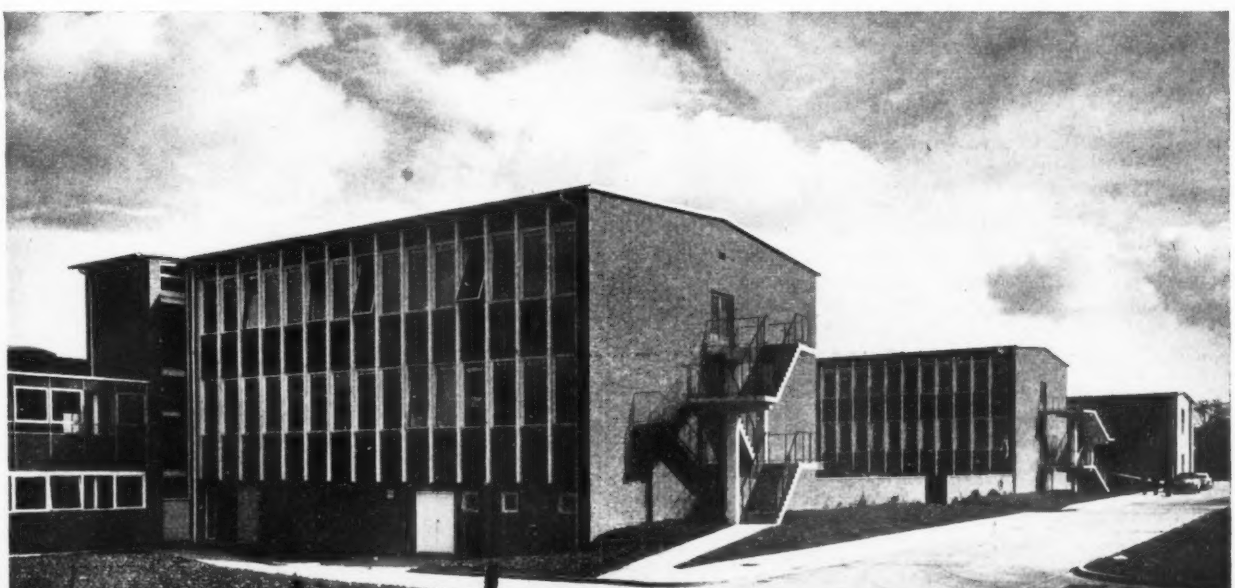
JOSEPH RYKWERT

LABORATORIES

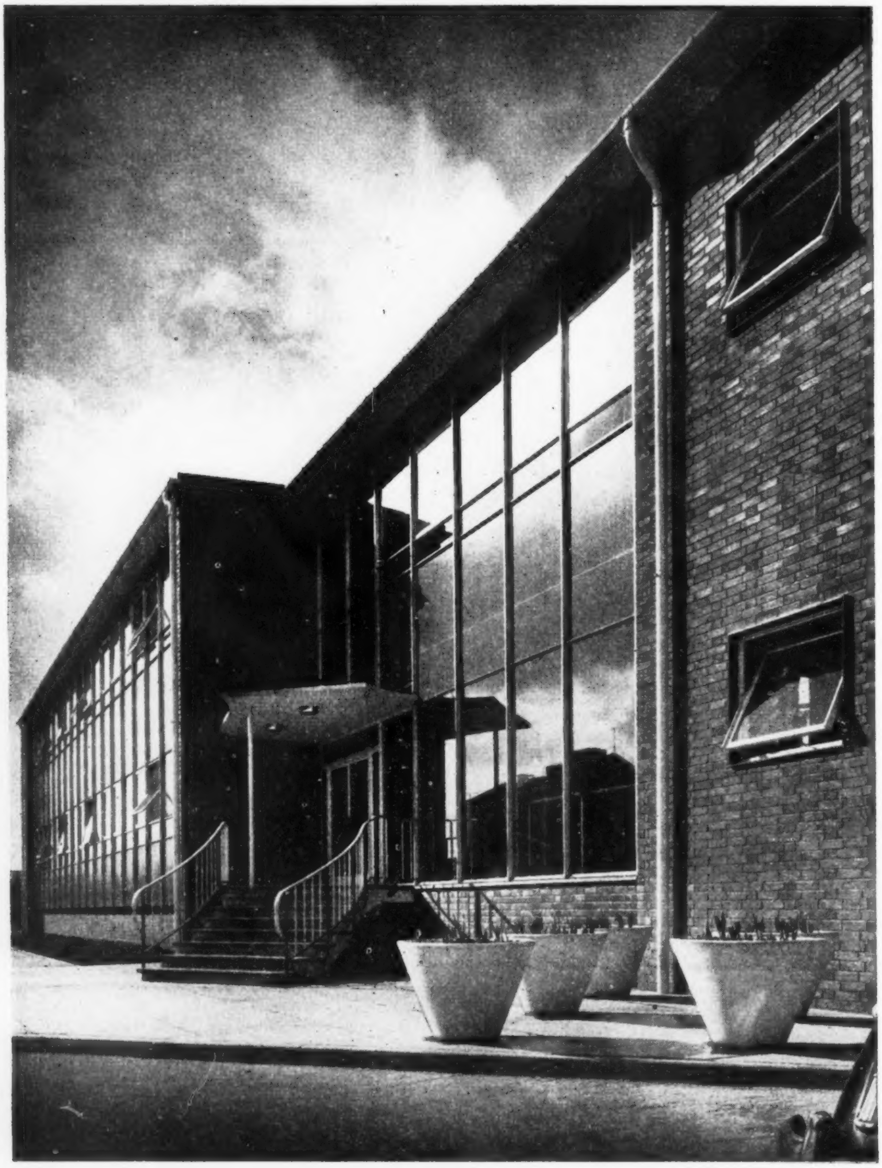
at WELWYN GARDEN CITY, HERTS. designed by E. D. JEFFERISS MATHEWS of J. DOUGLASS MATHEWS and PARTNERS; associate partner-in-charge R. S. POOLE consultants (structural) A. C. ASTON; (heating and electrical) ENGINEERING DEPT, PLASTICS DIVISION I.C.I. LTD; quantity surveyor R. E. N. LOWE

This Technical Services and Development Building for I.C.I. Ltd. at Welwyn Garden City forms part of a group of research and development buildings, the first stage of the research laboratories having been built. When subsequent stages of the research buildings are built the whole will form a unified group of buildings with related architectural composition. This building provides various technical services for customers who purchase plastic bases for the manufacture of plastic articles. It also carries out production development work in the use of various plastics, and forms part of a large sales organization. The research laboratories, to the south of this building, were illustrated in the JOURNAL for January 7, 1954.

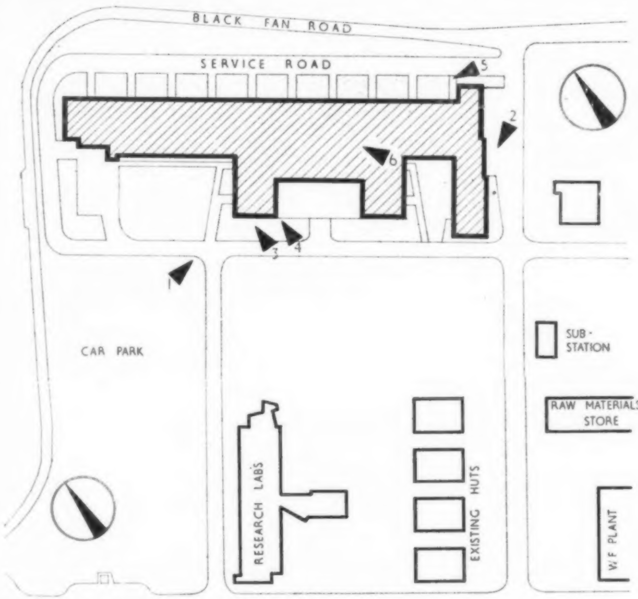
Viewpoint 1, from the south-west, showing the two service laboratory wings.



building illustrated

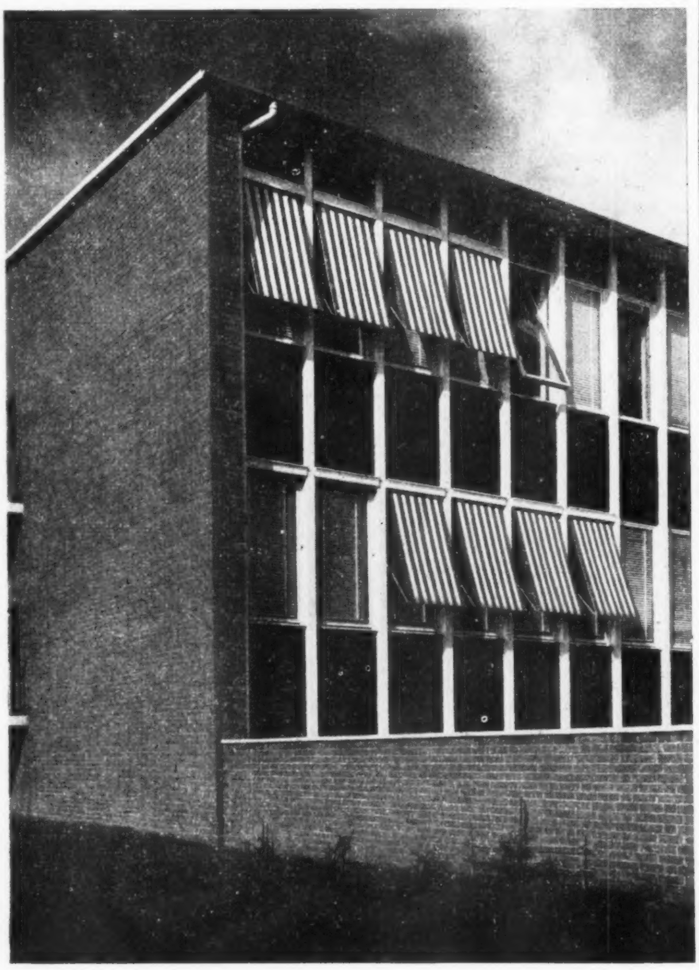


Viewpoint 2 (above): the visitors entrance on the east side of the administrative wing. This two-storey wing is seen extreme right in the previous photograph. As in the case of the two three-storey wings containing service laboratories, this block is built at right angles to the main single-storey building, which accommodates the service and development plant. External walling consists of cavity plastic panels clipped to a steel sub-frame between continuous vertical aluminium mullions. The centre-pivot-hung hardwood windows are double glazed. Viewpoint 3 (right): the reinforced concrete escape staircase at the south end of the west block of service laboratories.



Site plan showing photographic viewpoints

Viewpoint 4: the west three-storey block. All double glazed windows have Venetian blinds between the two panes of glass and external sunblinds are provided in addition for the controlled-temperature laboratories which also have air-conditioning. Behind the low wall on the right is a service yard situated between the two service laboratory blocks.



analysis

CLIENT'S BRIEF: his stated requirements

To provide the following basic accommodation: 1, administrative offices, conference room, exhibition room. 2, a semi-technical laboratory to accommodate the service and development plant and equipment to be arranged departmentally but in relation to the common use of stores and administration. In general, design requirement in this area is more comparable to a production area than to a laboratory. 3, service laboratories

SITE: topography, surroundings, access, planting

Topography: open, slightly sloping to east. Surroundings: industrial within property boundary and to south and east; future residential to west; undeveloped agricultural, future industrial to north. Access from within client's property. Planting to be carried out on site boundary by client

PLAN: general appreciation and relation of units

The accommodation requirement dictated three basic units—administration, development plant, service laboratories—each with distinctly different purposes and therefore requiring different design and construction techniques, but each related one to another and so arranged as to provide visitors with a comprehensive grasp of the extent of the resources and services being offered. Area requirements were large and the movement of staff between the various departments became, therefore, an important factor in the design. Before finalising the basic lay-out a time and motion study was undertaken in order to resolve as economically as possible these factors. The resulting design—which had also to be related to the whole composition of the development of this area of the site, as stated above, can briefly be stated as follows: 1, a one-storeyed, structurally uninterrupted space of 60 ft. span and 460 ft. long, giving a 20 ft. clear height forming the semi-technical laboratory space and sited as a closing block at right angles to the axis of the other blocks of the research area. 2, one longitudinal side of this block is external for light and access for plant which changes frequently; the other longitudinal side is adjacent to ancillary accommodation, stores and staff entrances and services on the floor level of the block. 3, above this accommodation a gallery runs the full length of the main block off which are sited the offices directly related to the work of the departments of the semi-technical laboratory—this gallery is connected to the main entrance and administrative block and provides a general view for visitors and customers of the activities in the semi-technical laboratory. 4, at right angles to this block are three wings which, being on the major axis of the other blocks already built and to be built, form the architectural link to the whole, and provide accommodation for general administration, conference and exhibition room and two service laboratories

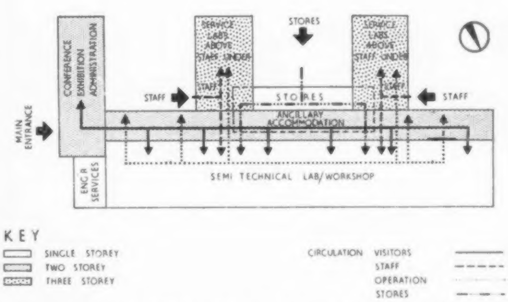
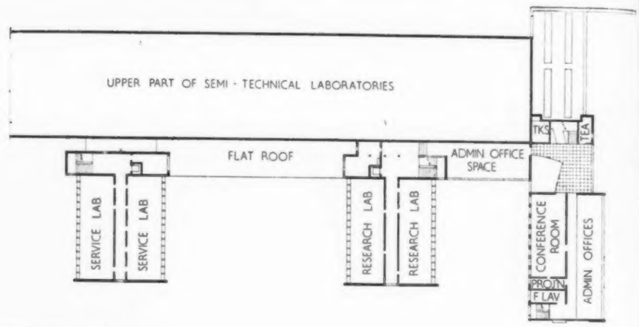
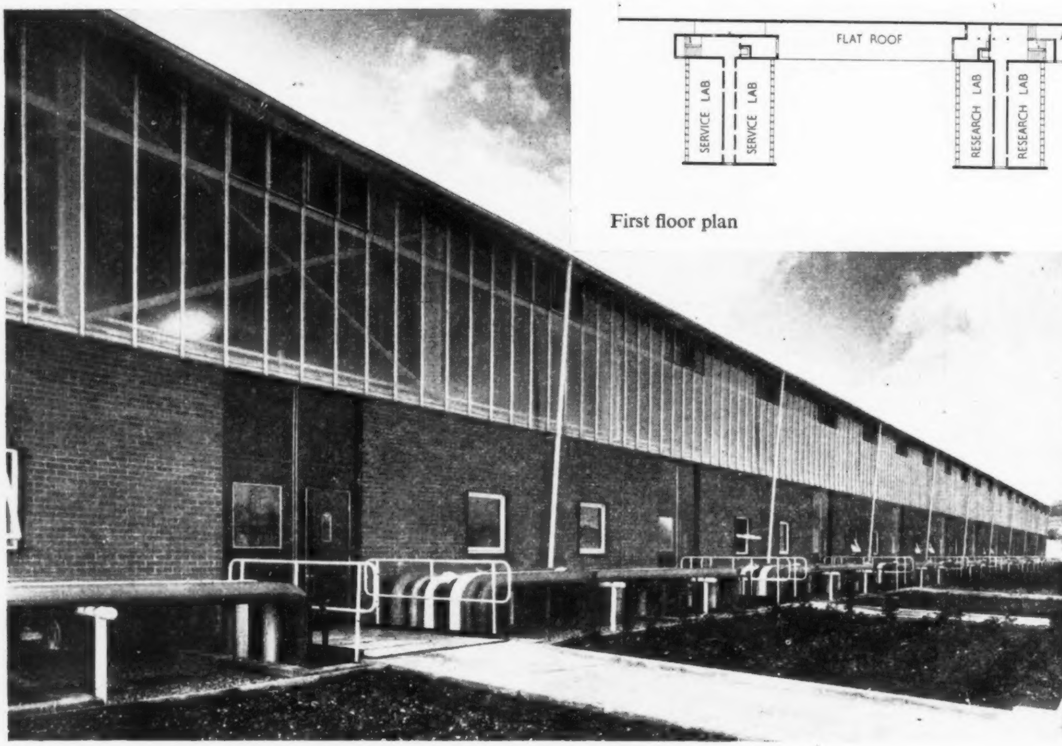


Diagram of plan relationship and ground floor circulation

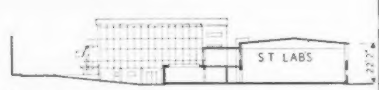
building illustrated



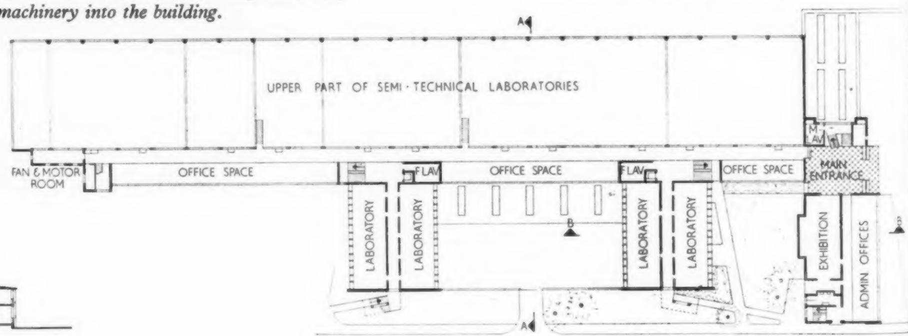
First floor plan



Viewpoint 5: the north elevation of the main semi-technical laboratory block. Cladding above the brick plinth wall is patent glazing with panels of glass louvre ventilators at high level. All main services, high pressure hot water, steam, etc. (but excluding electricity) are run externally in lagged pipes painted with appropriate code colours. Portable "bridges" over the service pipes, which connect with the laboratory entrances, are required for the entrance and exit of machinery into the building.

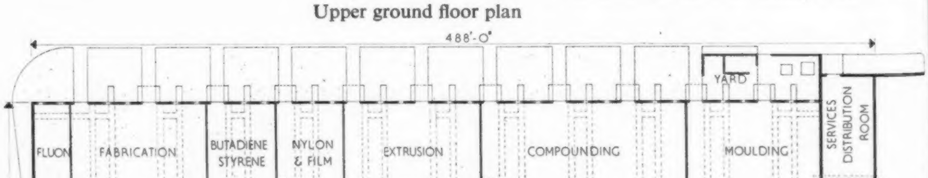


Section A-A [Scale: 1/64" = 1' 0"]

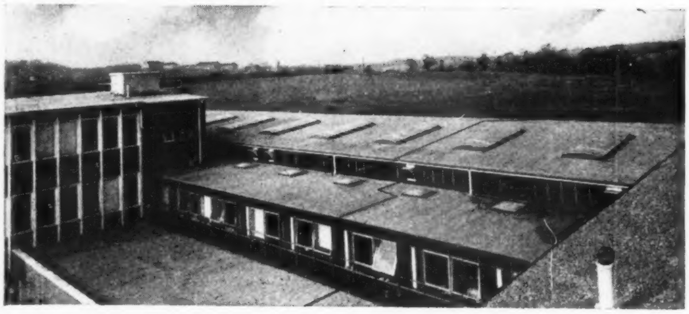


Section B-B

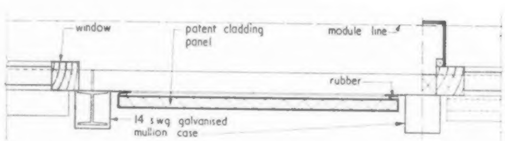
Upper ground floor plan



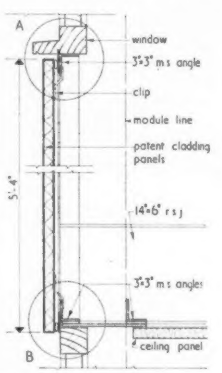
Lower ground floor plan Scale: 1/64" = 1' 0"



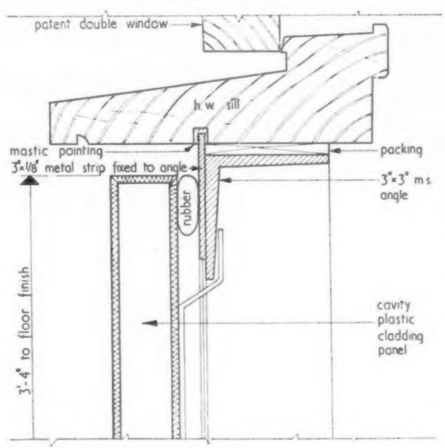
Viewpoint 6: this view of the roof shows the curved corrugated opal acrylic roof lights to the semi-technical block and the domed acrylic roof lights to the gallery corridor. The air intakes for the overhead down-discharge unit heaters can be seen in the clerestory.



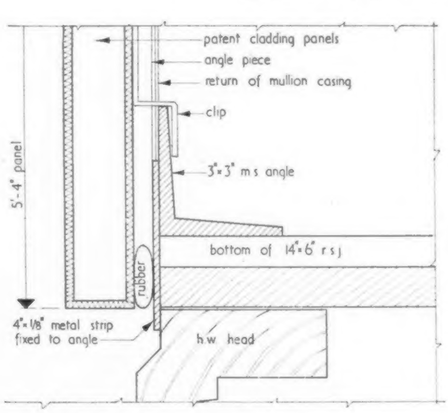
Key plan, cladding to services laboratories [Scale: ⅛" = 1' 0"]



Key section cladding to service laboratories [Scale: ⅛" = 1' 0"]



Detail at A [Scale: 3" = 1' 0"]



Detail at B [Scale: 3" = 1' 0"]

analysis

MAIN CONSTRUCTION : general appreciation

The varying requirements of the different blocks required different forms of construction and cladding but at the same time each had to be articulated with the others. A steel frame was used generally, but in combination with some load bearing brickwork to support other spans. A co-ordinating 4 ft. module was used, stanchions being placed at 20 ft. c/c in the semi-technical laboratory and at 12 ft. c/c elsewhere. Curtain walling is placed outside the structural grid to avoid interruption by columns

STRUCTURAL ELEMENTS

cost per sq. ft.	s	d
Work below ground floor level	4	6½

Mass concrete foundations throughout; reasons: a good sub-soil bearing at nominal 4 ft., and steel economy

External walls and facings 6 2

Semi-technical laboratory: brick cavity/panel walls with facing bricks externally and tiling internally, patent glazing above. Adopted because few openings were needed, for internal fixing of equipment, and economy

Service laboratories: plastic and glass cladding, self colour; reasons: continuous perforation for glazing.

Ancillaries for semi-technical laboratory: plastic panel curtain walling

Administration, east side: self-colour curtain walling and brown plastic panels; reason: to provide continuous perforation for glazing

Administration, west side: structural brick, facing bricks externally, plaster internally; reasons: few openings required

Frame or load-bearing element 9 3¼

Steel generally with brick spines for economy in service laboratories and administration. Lattice beams, or roof trusses, placed off module to simplify partitioning, in areas enclosed by curtain walling

	Beam spans (ft.)	*Column grid (ft.)*
Semi-technical laboratory	60	20
Semi-technical ancillary	12–8	12
Service laboratory	20	12
Administration	20	12

Upper floor construction 4 4¼

Precast reinforced concrete trough units, grouted and screeded; reasons: speed and simplicity in site operation, no shuttering, flexibility for determination of service holes, economy in steel during shortage

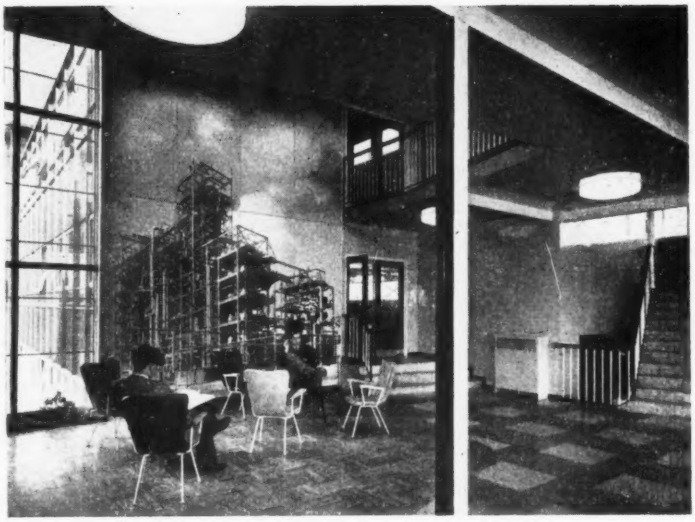
Staircases 11

In-situ reinforced concrete, screeded, for economy. Height, floor to floor, 12 ft. 4 in., width between landings 5 ft.

Roof construction 2 7

Low pitch insulated decking of compressed straw panels, finished in built-up bitumen sheet and gravel, on steel frame; reasons: light weight and good thermal insulation at economical cost

building illustrated



Above: the waiting space in the visitors' entrance hall, with its large photo mural. The area of wall now covered by this photo montage was originally intended as a background for sculpture. The clients allotted a sum of money and a limited competition was organized by the architect in collaboration with the Royal Society of British Sculptors. Unfortunately none of the entries, in the opinion of the architect and the client, fulfilled the requirements and many did not come up to the standard expected. The clients hope in due course to consider replacing the photo montage by a piece of sculpture or a mural when, on the recommendation of the architect, an artist presents himself whose work is considered suitable. Opposite page: a further view of the entrance hall showing some of the various forms of lighting designed for the building by the client. The 30-in. circular fittings of opal acrylic sheet flush with the lower ceiling each contain four 100 watt tungsten lamps. The ceiling over the gallery is of corrugated opal acrylic sheet illuminated from behind. Though providing a good standard of illumination, the overall surface is of relatively low brightness and very comfortable to the eyes. Above the open wall the ceiling is painted matt black with recessed circular concentric louvred fittings which provide a high intensity over the sitting area. The steel frame is exposed with the I-section columns painted white on outside surfaces and black on the concave surfaces. Connections between beams and columns are bolted. There is a change of floor finish between circulation and sitting areas. Below: the gallery corridor between the semi-technical laboratories, which can be seen at a lower level to the left, and office accommodation to the right. The glazed screen to the left has plastic panels in the lower half supported in vertical extruded aluminium sections. The office partitions are of compressed fibre faced with hardboard.

analysis

	s	d
Roof lights		7½
Acrylic domes in semi-technical laboratory and gallery corridor		
Curved corrugated acrylic sheet in semi-technical laboratory		
Windows		8½
Aluminium pivot windows in curtain walls, natural finish		
Hardwood double-glazed pivot windows, elsewhere, painted or polished; reason: to meet laboratory requirements for sunblinds and thermal insulation	2	7½
External doors		5¼
Hardwood, painted or polished		
Glazing		6
Patent glazing in natural aluminium finish; reason: economical for clerestory lighting		
Thermal insulated clear sheet adopted generally for thermal insulation		7

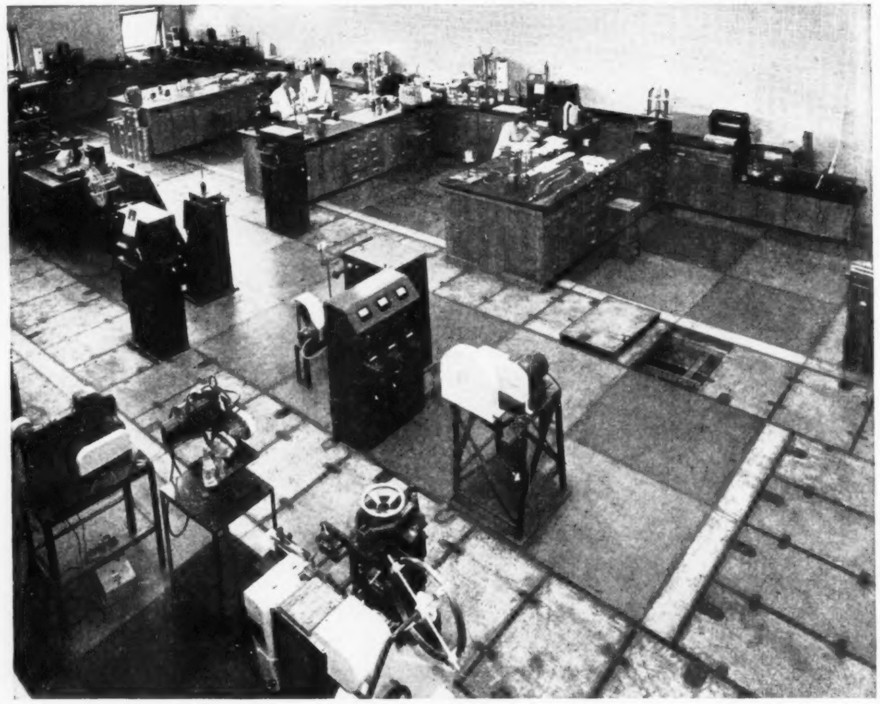
PARTITIONING

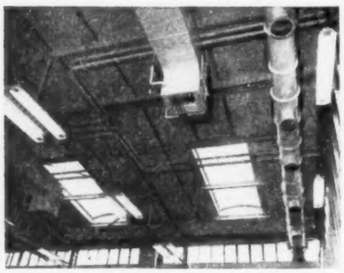
	s	d
Internal partitions		
Brick, tiled from floor to glazing level, in semi-technical laboratory; reason: to give stability for fixing equipment		3¼
Plastic panels, stove enamelled, in service laboratories; reason: flexibility and impervious surface	2	0½
Compressed fibre core spray-painted hardboard in offices; reason: flexibility	1	3
Screens		
Plastic panels, stove enamelled, and glass in semi-technical laboratory, gallery and corridor	1	1
Hardwood and steel, painted, in main entrance		2¼
W.c. doors and partitions		1
Metal faced ply, painted		
Internal doors		
Generally, of same material as partitions		6¼
Hardwood, polished, half glazed doors		1¾
Ironmongery to internal doors		4¾
Polished aluminium		

FINISHINGS

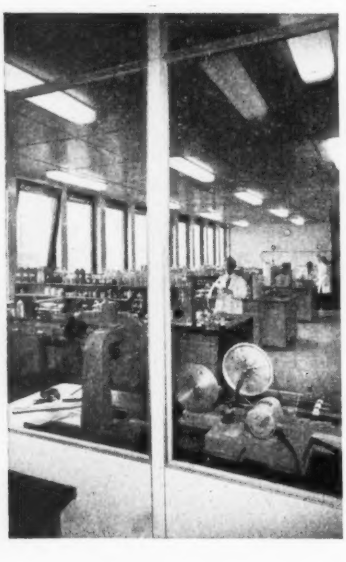
	Cost per sq. yd. s.	d.	s	d
Floor finishes				
Granolithic, plain and in coloured squares, in semi-technical laboratories, stores and ancillaries			1	7½
Coloured granolithic flooring, 2341 yd.	191	0		
Grey granolithic flooring, 1288 yd.	167	0		
Tesselated tiling in lavatories 158 yd.	30	2		1¼
Terrazzo tiling in main entrance 142 yd.	47	3		3
Cork tiling in exhibition room 119 yd.	37	6		0¾
Hardwood mosaic, polished, in service laboratories, gallery and offices 1245 yd.	30	6		11¼
P.V.C. in administration block 539 yd.	35	0		3¼
Wall finishes				
Blue-grey eggshell glazed tiles in semi-technical laboratory			1	5
White glazed tiles in lavatories				2½
Hardwood panelling and plaster, painted, in conference room				1¼
Plaster in administration block				3

building illustrated





Top left: a detail photogragh from the gallery corridor showing the reveals of the roof-light boxes. These are of precast concrete painted. The domes are of opal acrylic sheet. The pin spot opal acrylic diffuser with twin 40-watt fluorescent tubes achieves a comfortable surface brightness without specular reflections and gives an illumination of 13-ft. candles. The sound absorbent ceiling is of perforated fibre tiles. Above: a workshop in the semi-technical laboratory block, which is 460 ft. long by 60 ft. wide, showing the floor ducting system for electrical power services operated on a ring main system from the distribution room. The duct is continuously accessible from manhole covers in the granolithic floor. Connections to machines can be seen in the foreground. Interior walling is faced with blue-grey glazed tiles. Centre left: roof lighting in the semi-technical area is from curved corrugated acrylic vault lights. Artificial lighting is by twin 5-ft. open trough fluorescent fittings with opal acrylic sheet trough reflectors mounted on the roof trusses, giving some upward light to the ceiling and an illumination of the working plane of 22-ft. candles. This view also shows an overhead down-discharge unit heater and an extract ventilation duct. Left: along one side of the semi-technical area and beneath the gallery offices are a series of small service laboratories and testing bays separated off by glazed screens.



Left: one of the service laboratories in the projecting wings. The ceilings are of demountable perforated aluminium sheet with cork backing and provide sound absorption with low susceptibility to flame spread. Above, centre: a corridor in the administrative wing with reeded acrylic sheet ceiling lighting concealing fluorescent tubes. Above right: the conference room which can be sub-divided by the sliding and folding partition seen on the right. Projection screens are provided both on the end wall and above the partition. Blackout curtains are provided and ventilation louvres above each window. There is continuous convection heating beneath sill level.

analysis

	s	d
Ceiling finishes		
Perforated aluminium panels with cork backing, spray painted in factory, in service laboratories; reason: demountable and fire resistant	1	11½
Perforated fibre tiles, emulsion painted, used generally; reason: sound absorption	1	2½
Vermiculite plaster, natural finish, sprayed direct to solid ceiling in semi-technical laboratory ancillaries		3¾
Acoustic, heated ceiling, painted, in exhibition room; reason: to free floor and walls for display units		1¾
Plaster, elsewhere		5½
Decorations		
Full gloss paint or plastic emulsion British Standard specification (revised)	2	9½

SERVICES

	s	d
Plumbing external and rain water disposal		8¾
Copper and lead for flashings, etc., sheet steel, painted, for rainwater pipes and gutters which connect to client's existing system and local authority sewers		
Plumbing internal: cold water storage and sanitary fittings	1	8¾
Waste disposal by cast iron pipes, painted and generally run internally		
Ducts		
Internal floor ducts	5	0½
External ducts		7½
Wall and ceiling ducts	1	3
Cold water storage		
Local water supply completely insulated from cooling water services in technical laboratories by 1000-gallon storage tank in the distribution room and two pumps delivering at 50 psi		
Sanitary fittings		
White glazed stoneware in lavatories		
Heating installation		
Cost includes, hot water, steam, air conditioning and other services		
Hot water service		
Site high pressure hot water service at 200 psi is piped into the distribution room to a horizontal tubular heat exchanger of 5·8 million B.Th.U.'s per hour rated capacity, producing low pressure hot water at 180 deg. F. for a forced circulation system supplying convector radiators, radiant panels and overhead down discharge unit heaters in the semi-technical laboratories, all thermostatically controlled with modulation and low-load night setting switches. Chemical laboratories, stores and offices heated by convector radiators only, and exhibition room by an acoustic metal panelled ceiling. Local electric storage and gas water heaters for domestic services	2	5
Steam service		
Site steam service at 200 psi piped to distribution room, metered and distributed to semi-technical laboratories along external mains, supplying ring mains in floor channels to floor mounted control units alongside each machine		
Air conditioning		
Air conditioning equipment for three service laboratories installed in adjacent plant rooms		
Other services		
Special psi compressed air service and a 1 ton per sq. in. hydraulic service provided from pumps in distribution room, and piped in a manner similar to steam services. Gas, cooling water and compressed air at 100 psi piped similarly to steam, with extensions in rising ducts to service laboratories		
Drainage		
Soil and surface water systems connected to client's existing system	2	7½
Artificial ventilation		
Some partial artificial ventilation in semi-technical laboratory, ancillaries and service laboratories	1	0
Gas installations		
For technical services, to service laboratories in similar manner to steam		2½
Electrical installation		
Source		
Three-phase 450 volt supply to distribution room		
Power supply (cost not available)		
Ring main for semi-technical laboratory to switchgear under gallery, then by floor channels to floor mounted distribution boxes and machine controllers. Separate feeders in vertical ducts to service laboratories. Switched fuse sockets on benches		
Lighting	6	6½
Illumination level 22 ft. candles in laboratories and offices, 13 ft. candles in corridors. Transparent plastic diffusers used wherever practicable. Pin-spot opal diffusers in service laboratories and offices, reeded diffusers in corridors		
Lifts		10½
Two fully automatic push-button control lifts in service laboratory blocks, for 8 persons or 12 cwt., 100 ft. per minute, motor room on roof		
Paved areas	3	11½
Concrete, for economy, on north side of semi-technical laboratory and stores yard		
total net cost per sq. ft. of floor (based on final cost)	**78**	**7**

Thermal insulation
Standard generally, a U-value of 0·20; materials: glass fibre filled plastic panels and cavity brickwork, double glazing, compressed straw roofing and gravel

Sound absorption material
Perforated aluminium ceiling panels with cork backing in service laboratories
Perforated fibre tiles in ceilings generally

TIME SCHEDULE

Drawings November, 1953	*Tender date*	*Contract signed*
Work commenced June, 1954	*Work completed* August, 1956	*Type of contract* RIBA

RATIOS

$$\frac{\text{Area of enclosing walls}}{\text{Total floor area}} = \frac{0\cdot5646}{1}$$

$$\frac{\text{Area of windows (including ext. doors)}}{\text{Total floor area}} = \frac{0\cdot2313}{1}$$

$$\frac{\text{Area of solid wall}}{\text{Total floor area}} = \frac{0\cdot3333}{1} \qquad \frac{\text{Total roof area}}{\text{Total floor area}} = \frac{0\cdot7612}{1}$$

Total ground floor area of superstructure: 52,649 ft. super.

analysis

COST COMMENTS

The cost analysis shown above is broken down into more detailed sections than is normal, but, with the exception of floor finishes, which also includes actual areas for each type of flooring, the costs are expressed only as cost per ft. super of floor area.

Completion of the analysis with actual areas alongside the various constructions and finishes would provide useful data of some of the more unusual featues of the building. For example plastic panels appear both in internal partitions and internal screens respectively, at 2s. 0½d. and 1s. 1d. per ft. super of floor area. Naturally this tends to be somewhat misleading unless the actual area covered by these panels is known and comparisons, if any, can be made.

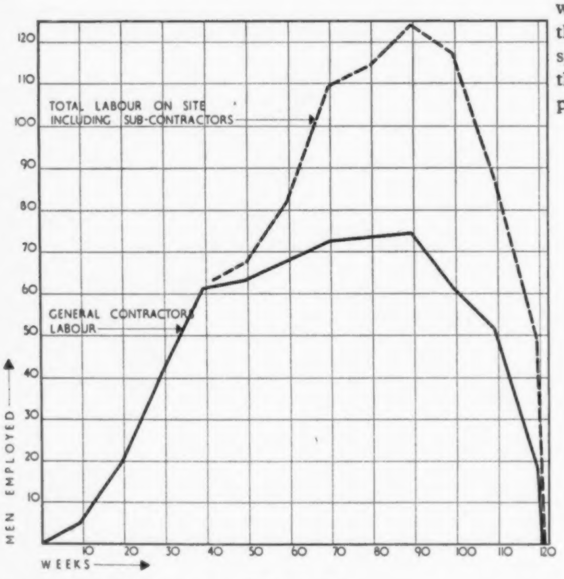
Examination of the analysis must also allow for the semi-technical laboratory 20-ft. floor to ceiling with 27,600 sq. ft. uninterrupted floor space. This item affects considerably the cost of the elements expressed as overall floor area costs and which are not part of this section of the building e.g. internal partitions, w.c. partitions, internal plumbing, etc.

Special items for consideration are:

1, the extensive use made of ducts which have proved an expensive item in this scheme and worthy of close examination as to the form of construction and the use which has been made of them.

2, decorations amount to 2s. 9½d. per ft. super of floor area, although considerable use has been made of self finished materials to wall and ceiling surfaces.

3, costs are exclusive of any built-in furniture and fittings.



Graph showing labour strength by weeks

SITE ORGANIZATION by Welwyn Builders Ltd.

Site labour and equipment: The peak of activity was particularly slow in developing on this contract, possibly due to the very special and complex requirements of the building, much of which only became resolved as the work progressed. Site preparation included the removal of some 7,000 cubic yards of heavy clay, which was carried away to a distant tip. This was successfully accomplished by a heavy crawler loader/excavator and tipping lorries. The erection of precast trough section concrete floor units called for special handling arrangements. The units were provided with lifting hooks cast in and were delivered to the storage area which was accessible for very heavy lorry loads. The units were then picked up singly by a loading shovel converted into a 1-ton mobile crane with a special crane attachment, and conveyed to the point of hoisting. This machine proved to be very easily manoeuvrable on the difficult site. The units were then hoisted singly by a 15-cwt. mobile crane with a telescopic mast equipment, to the level required. Hoisting generally was by mobile platform hoists moved as required to positions of work in progress. Wheeled scaffold towers were used very extensively throughout, internally, together with lightweight staging spanning the roof trusses. This equipment was provided by the general contractor, but except for painting, it was used mainly by the specialist sub-contractors.

Sub-letting: Principal trades sub-let by the general contractor were plasterer, wall and floor tiler, asphalter and glazier. All other work, excepting that of specialist firms nominated by the architect, was done by general contractors' own labour. Joinery, plumbing and painting, which are trades frequently sub-let, were carried out by the contractors' specialist departments.

Job management: This is the system of control that usually applies with the larger contracts undertaken by our firm, with the exception that a site manager is not always employed. That position would normally be occupied by a surveyor, who would visit the job periodically and would have other work in hand, running concurrently. The employment of a site manager in this instance arose because it was foreseen that the high proportion of specialists work created a special problem of co-ordination. In the course of the work, the value of this arrangement was amply proved. Although a pattern of co-ordination was worked out at the start, many modifications arose

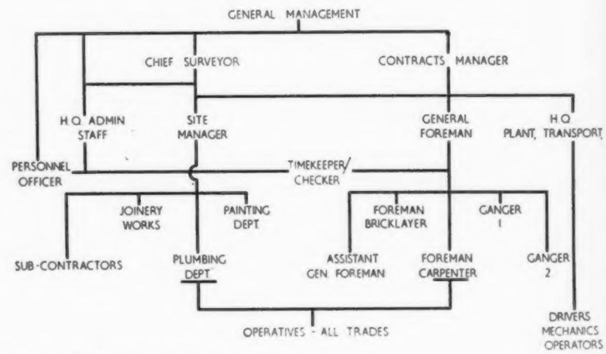


Diagram showing system of control

as the job developed. The whole time of the site manager was spent in keeping the pattern workable, and in taking action to maintain the shape of the programme whilst giving effect to new instructions reaching the job continuously throughout the progress of the work. Because of the very high proportion of specialists' work and specially manufactured components, much of the site manager's work was in transmitting detailed instructions to the firms concerned, and demanded an intimate knowledge of the job and of every variation that arose. The general foreman devoted his whole time to physical control of the work, and, being relieved of the paper work, he was able to ensure the extreme accuracy of setting out demanded by the type of construction, whilst maintaining quality and output. The contracts manager's duty was, by daily visits to the job, to observe and circumvent any failures in organization and obstacles to progress.

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working detail

BALCONIES: FLATS AT HELLERUP, DENMARK

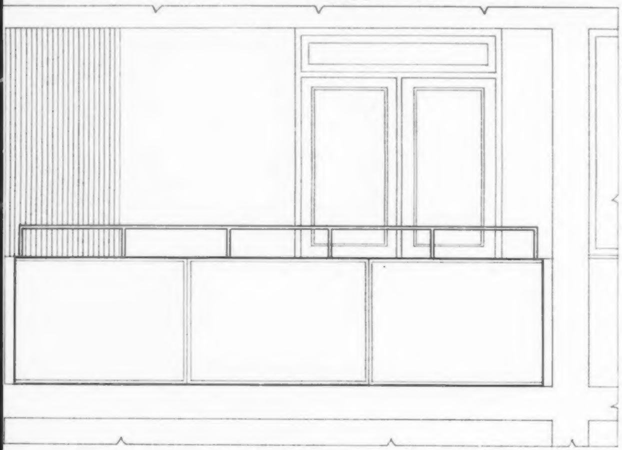
Eske Kristensen, architect (material supplied by Michael Sadler)

Points to notice about these very generous balconies are the use of double glazing for all but the ventilator lights and the incorporation of both an outside cupboard and a precast concrete flower box within the balcony enceinte.

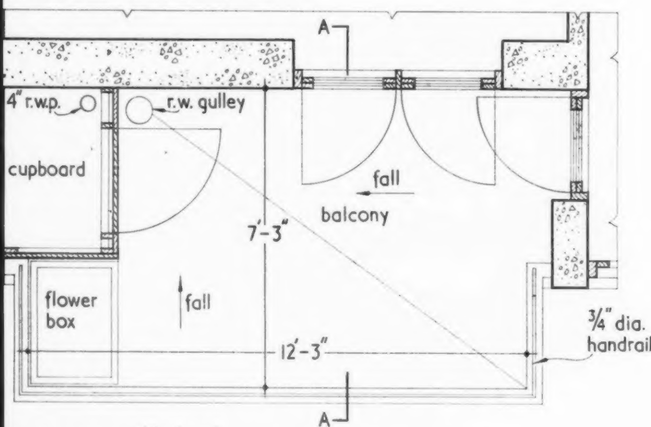
working detail

BALCONIES: FLATS AT HELLERUP, DENMARK

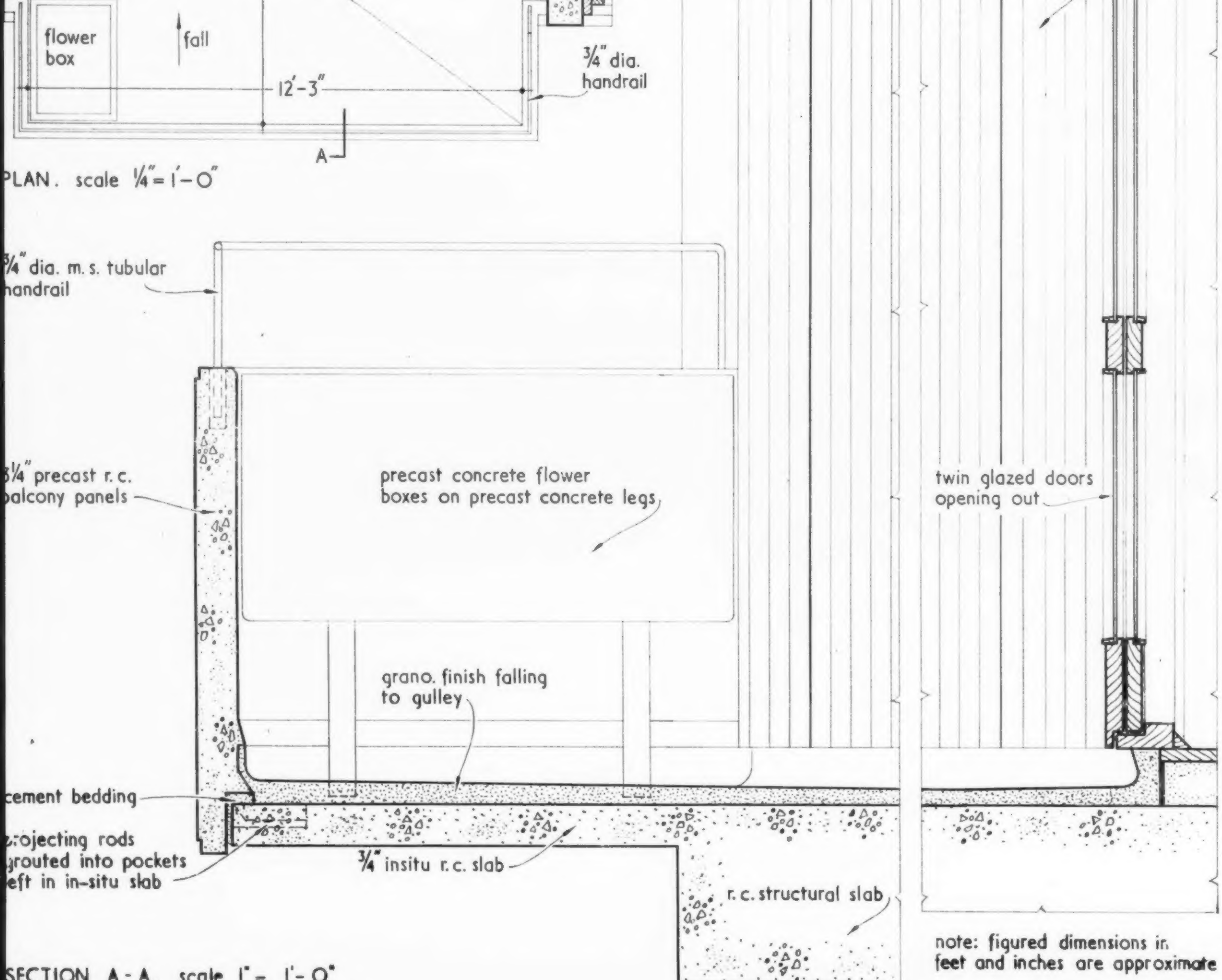
Eske Kristensen, architect (material supplied by Michael Sadler)



ELEVATION. scale ¼" = 1'–0"



PLAN. scale ¼" = 1'–0"



note: figured dimensions in feet and inches are approximate

SECTION A-A. scale 1" = 1'- 0"

working detail

ROOFLIGHT: OFFICES AT CARDIFF

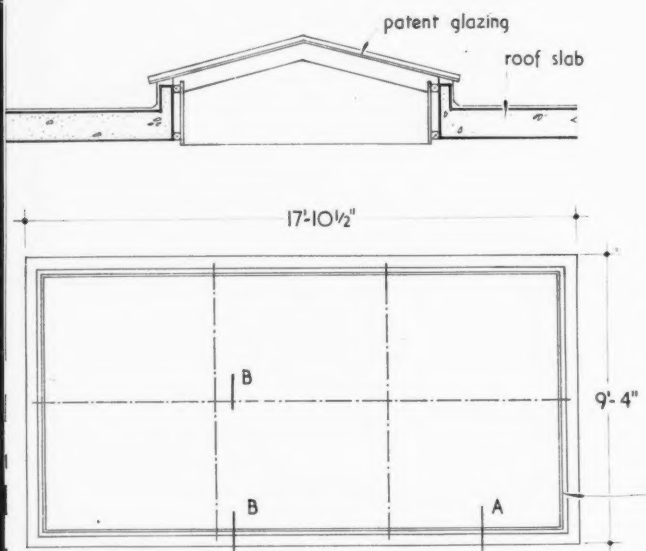
Grenfell Baines and Hargreaves, architects

The interest of this detail lies in the use of the plywood facing board to frame the light and to cut off from sight the eaves of the patent glazing and the green stains which commonly form there. It is also to be noted that the veneers on the separate pieces of board which comprise the facing on the long side have been carefully matched by the joiners: a precaution which is essential to obtain a good effect.

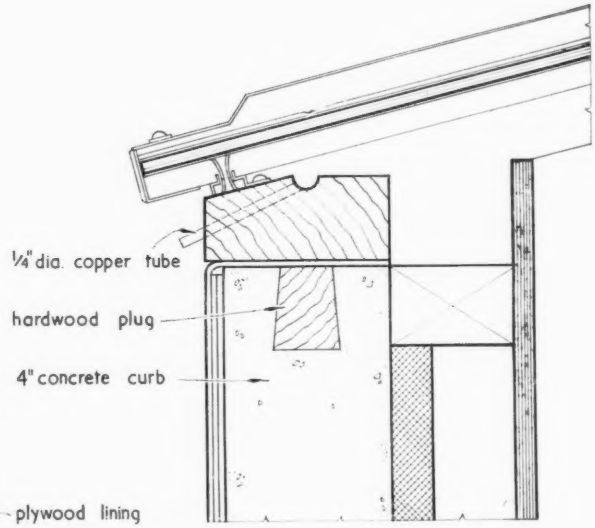
working detail

ROOFLIGHT: OFFICES AT CARDIFF

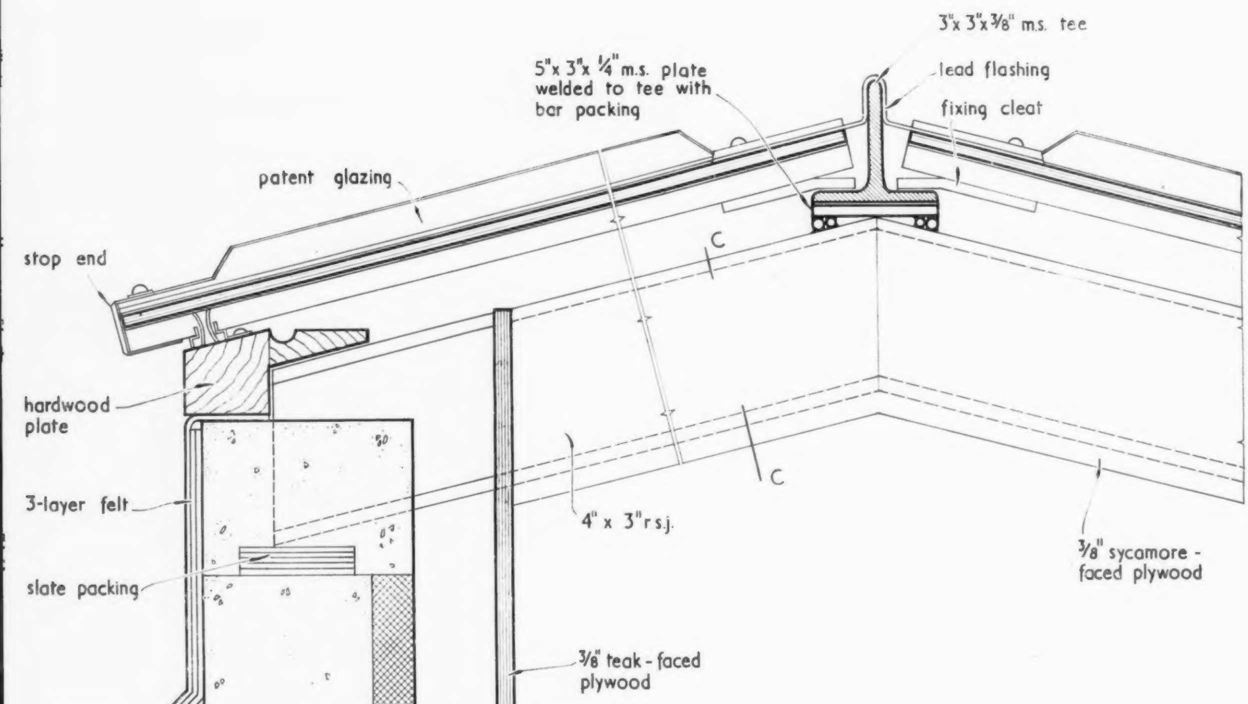
Grenfell Baines and Hargreaves, architects



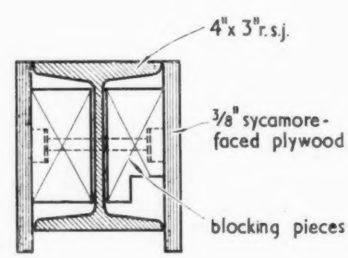
PLAN AND SECTION. scale 3/16" = 1'-0"



SECTION AT A. scale ¼ full size



SECTION AT B-B. scale ¼ full size



SECTION AT C-C. scale ¼ full size

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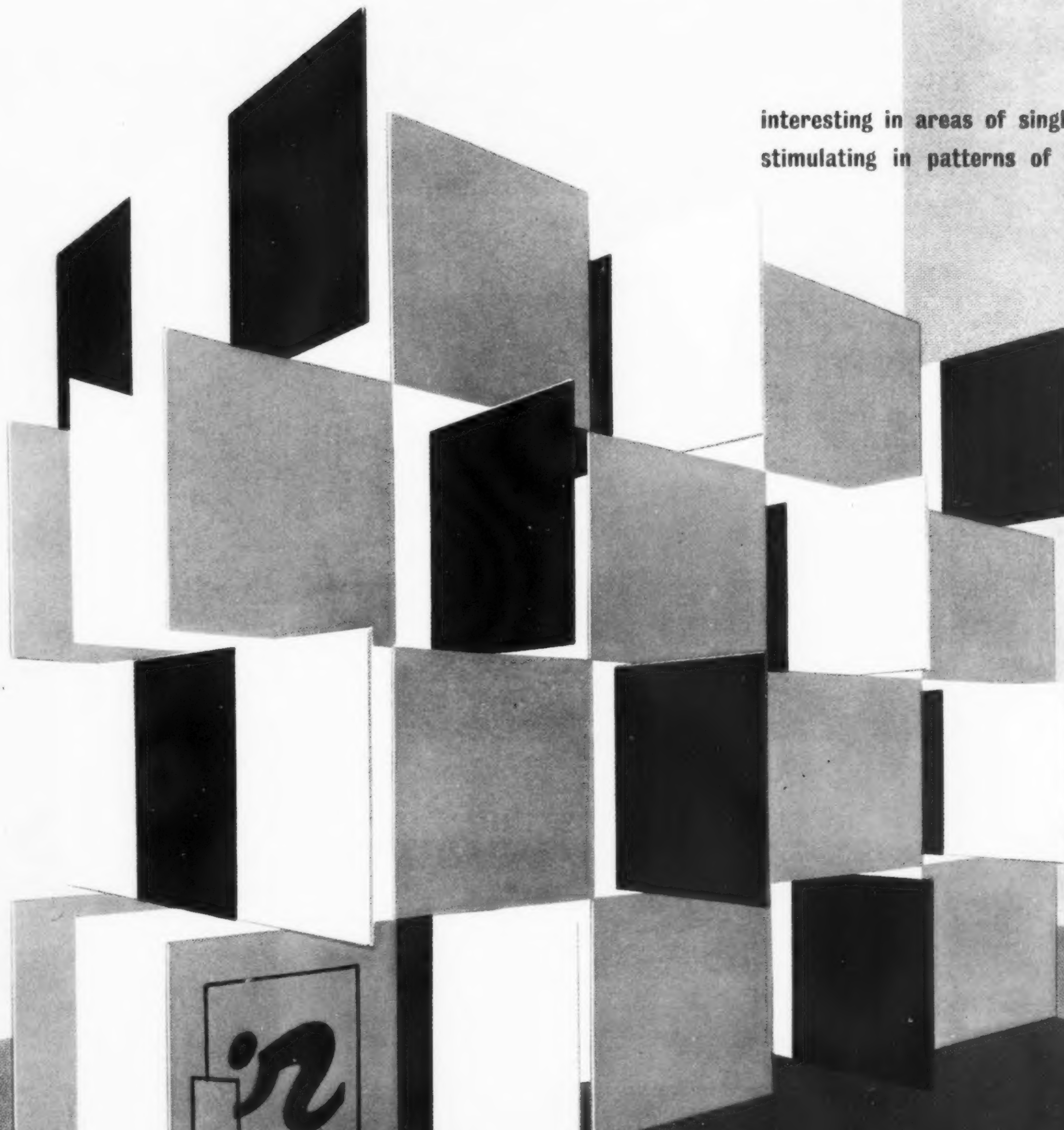
interesting in areas of single colour
stimulating in patterns of contrast



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non-absorbent

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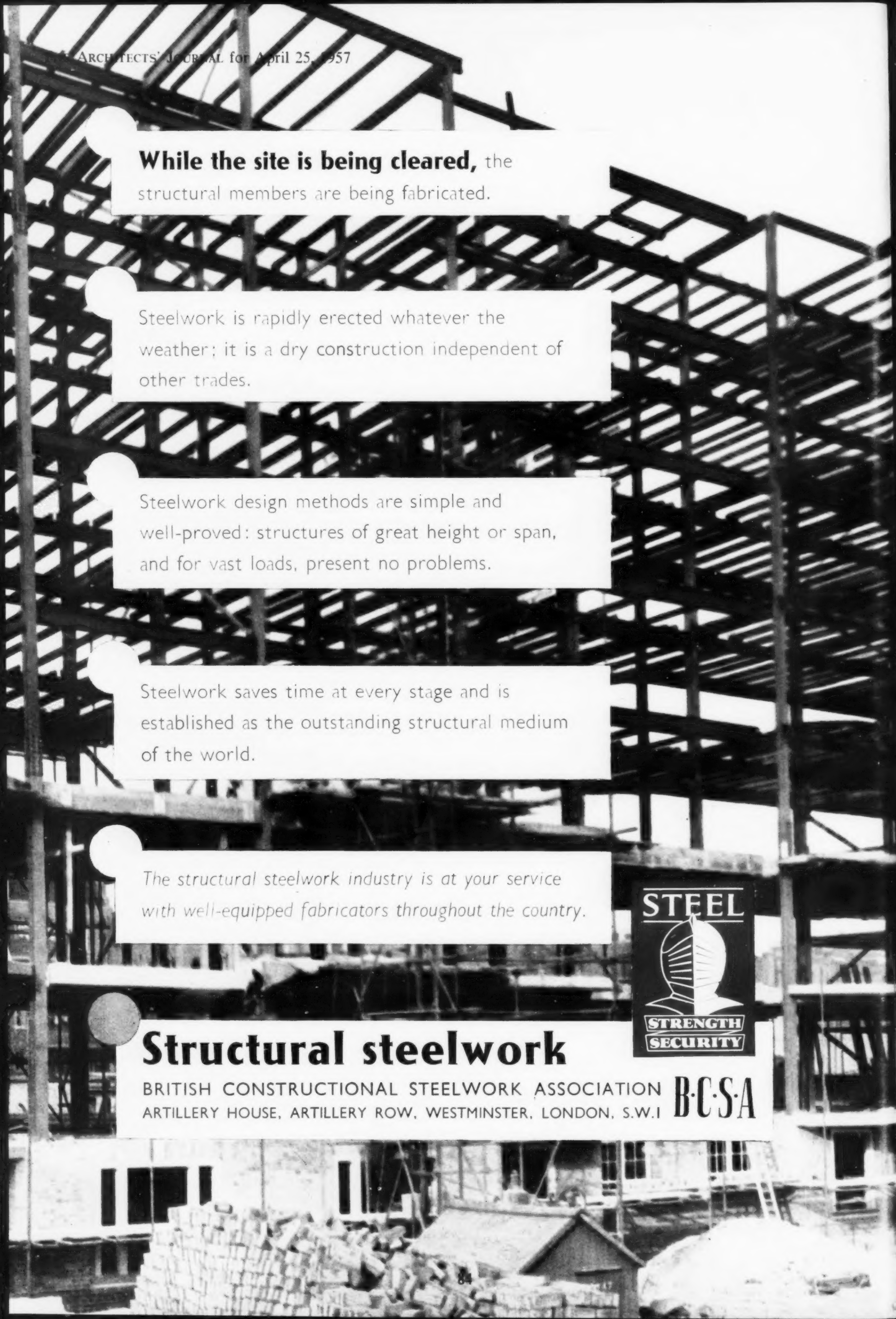
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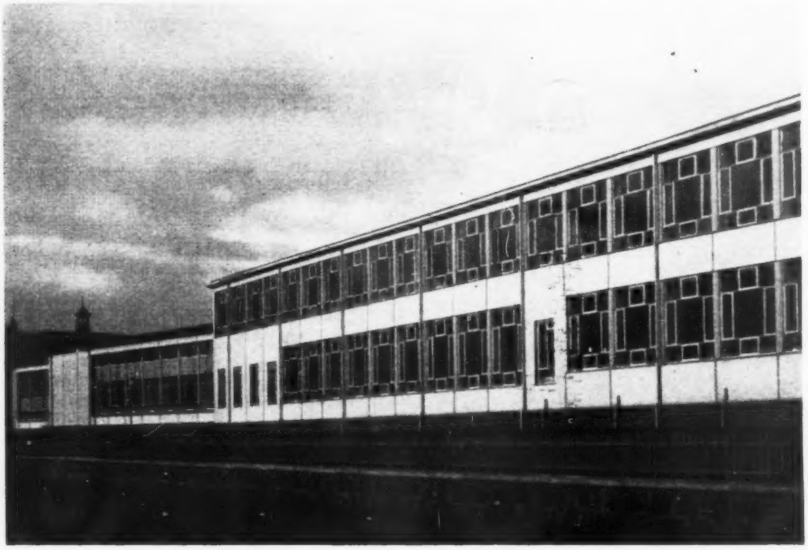
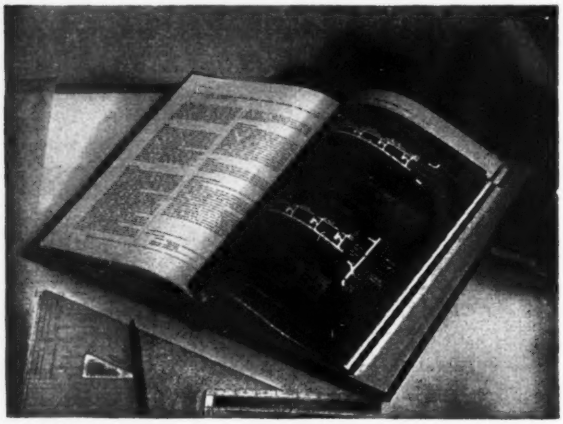


The new secondary school for 750 children at the Nicolson Institute, Stornoway, in the Isle of Lewis, is the largest building of its kind in the Highlands. It was designed by Peter S. Leask, the Ross and Cromarty County Architect, R. W. Fraser, architect-in-charge, and M. F. Kirkwood, assistant architect. General contractors, A. Hall & Son (Builders) Aberdeen Ltd.

Contractors

Technical Services & Development Building, Welwyn Garden City, Hertfordshire, for Plastics Division, I.C.I. Ltd. (pages 639-648). *Architects:* E. D. Jefferiss Mathews, O.B.E., F.R.I.B.A., of J. Douglass Mathews & Partners. *Associate partner-in-charge:* R. S. Poole, A.R.I.B.A. *Consultants, structural:* A. C. Aston, B.SC., A.C.G.DIPL. *Consultants, heating and electrical:* Engineering Department, Plastics Division, I.C.I. Ltd. *Quantity surveyor:* R. E. N. Lowe, F.R.I.C.S. *Clerk of works:* Engineering Department, Plastics Division, I.C.I. Ltd. *General contractors:* Welwyn Builders Ltd. *Sub-contractors.—Reinforced concrete:* Twisteel Reinforcement Ltd. *Bricks:* R. Y. Ames Ltd. *Special roofings:* Stramit Boards Ltd. *Roofing felt:* Standard Flat Roofing Ltd. *Partitions:* Holoplast Ltd., Firmin & Collins Ltd., Flexo-Plywood Industries. *Patent glazing:* Haywards Ltd. *Wood block flooring, sanitary fittings:* Broad & Co. Ltd. *Artificial stone, patent flooring:* Atlas Stone Co. Ltd. *Structural steel:* Sommerfields Ltd. *Central heating, gas fitting, ventilation, plumbing:* Matthew Hall & Co. Ltd. *Door furniture:* Parker, Winder & Achurch Ltd. *Telephones:* General Post Office. *Casements, window furniture:* Holcon Ltd., W. James & Co., Holoplast Ltd. *Folding partitions:* Esavian Ltd. *Roller shutters:* Dennison Kett & Co. Ltd. *Acoustic ceilings:* Wm. Maccinson & Sons Ltd., Campbell Denis Ltd. *Metal*



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Announcements

PROFESSIONAL

Leonard Manasseh, A.R.I.B.A., A.A.DIPL., has moved from Southwood Lane to 7, Hampstead Lane, Highgate, N.6 (telephone: Mountview 5528).

F. B. Wills, A.R.I.B.A., has resigned his appointment as senior architect in the Borough Architect's Department at Southampton and has moved to 6, Victoria Terrace, Inverness (telephone: Inverness 973).

C. L. Cadell, B.A.(CANTAB), A.R.I.B.A., A.R.I.A.S., has moved his office to 30, Fitzroy Square, W.1 (telephone: Euston 2039).

TRADE

Kingston (Architectural Craftsmen) Ltd., of Hull, manufacturers of laminated timber structures, joinery, box and packing cases, announce that G. Harriott has been appointed Managing Director, in succession to D. W. T. Bruce, F.C.A. A. Holwell has been appointed Commercial Manager.

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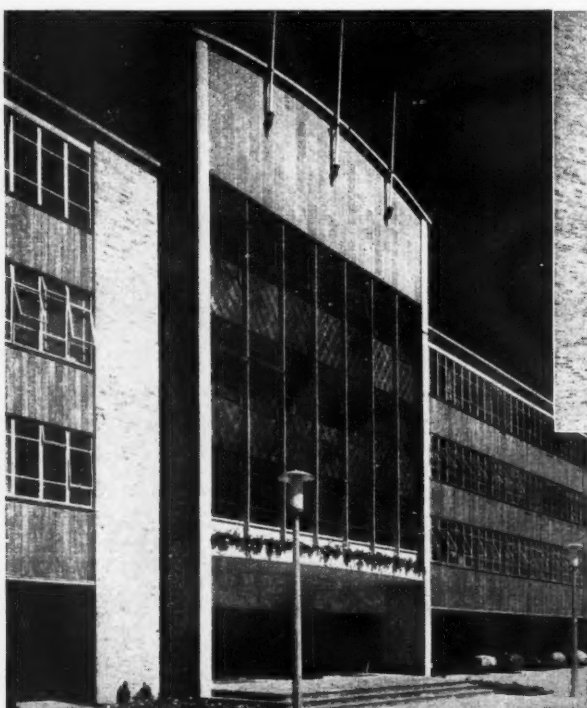

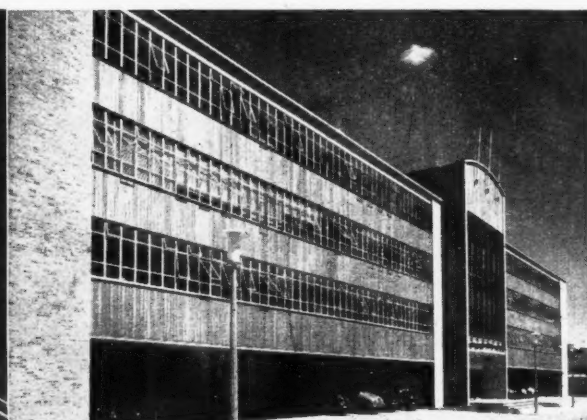

Consulting Engineers: Messrs. Frederick S. Snow & Partners.
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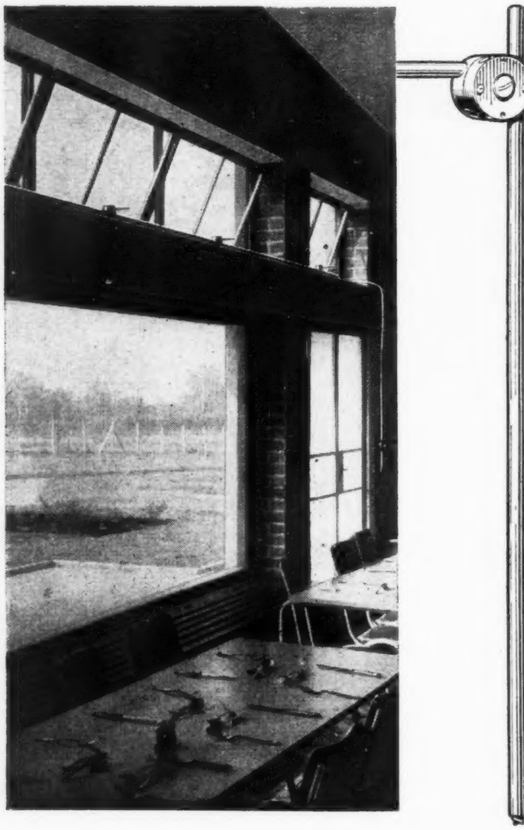

Illustration shows part of the canteen at the Administration and Design Office of W. J. Fraser & Co. Ltd., at Harold Hill, where Teleflex Remote Controls were used for window operation.

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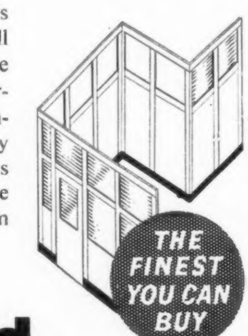

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Siscomatte is extremely easy to apply, far easier than ordinary eggshell finishes. It is partially thixotropic in consistency, which means that it is much less liable to drip or splash. It may be brushed or sprayed and requires no working out. Siscomatte dries quickly and evenly—touch-dry in about four hours, hard overnight.

Siscomatte has been formulated to produce a velvet-smooth surface which is simple to keep clean, tough enough to be scrubbed and to give maximum resistance to detergents.

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Siscomatte is made in a basic range of 30 carefully chosen colours, 14 of which are from the new B.S.2660 selection.

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"Plain and Pearl" not only gives a toning, attractive finish to any room—it also saves time on "cutting in" and eliminates the time usually spent matching up matt and gloss paints.

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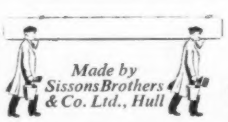

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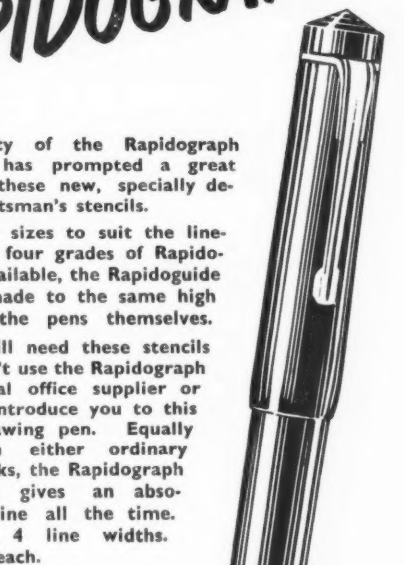

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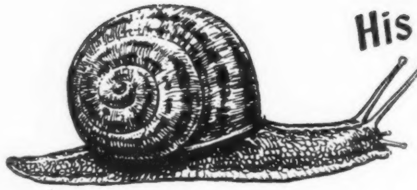

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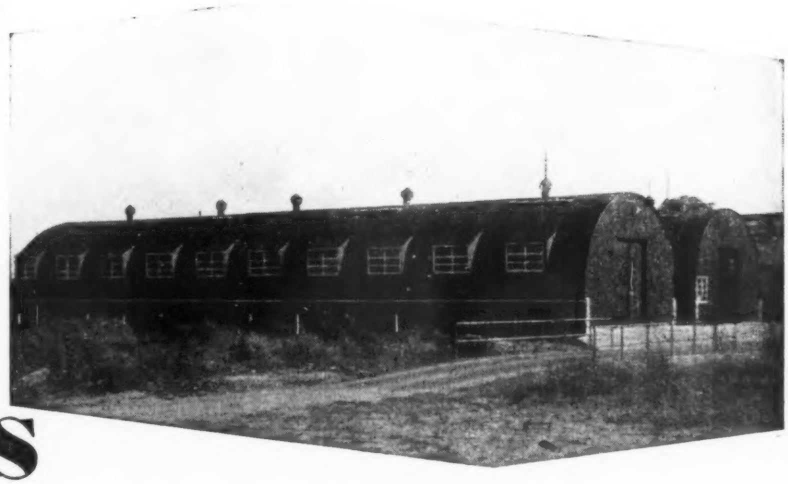

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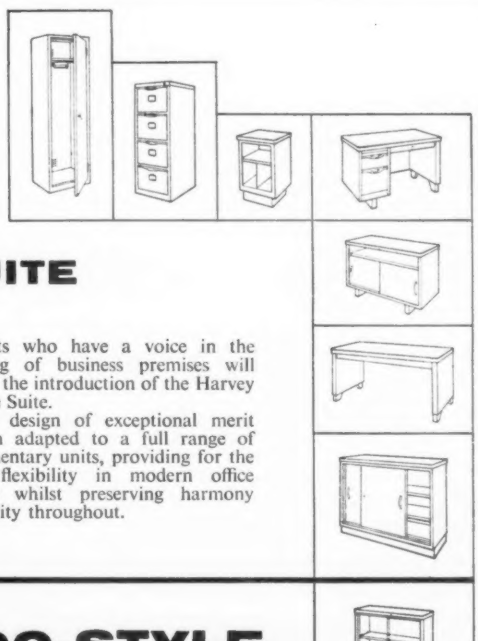

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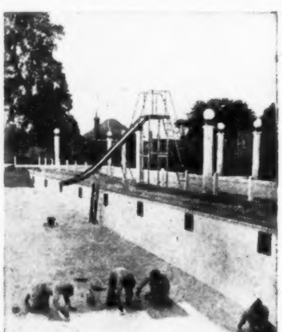

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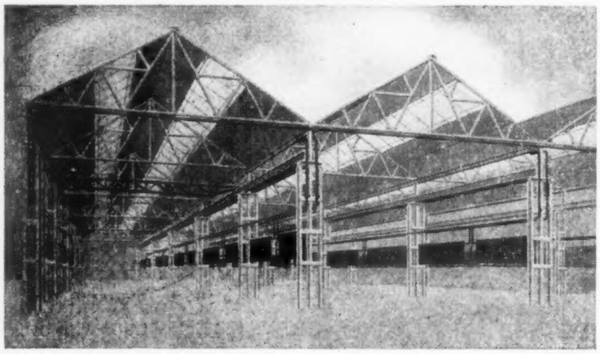

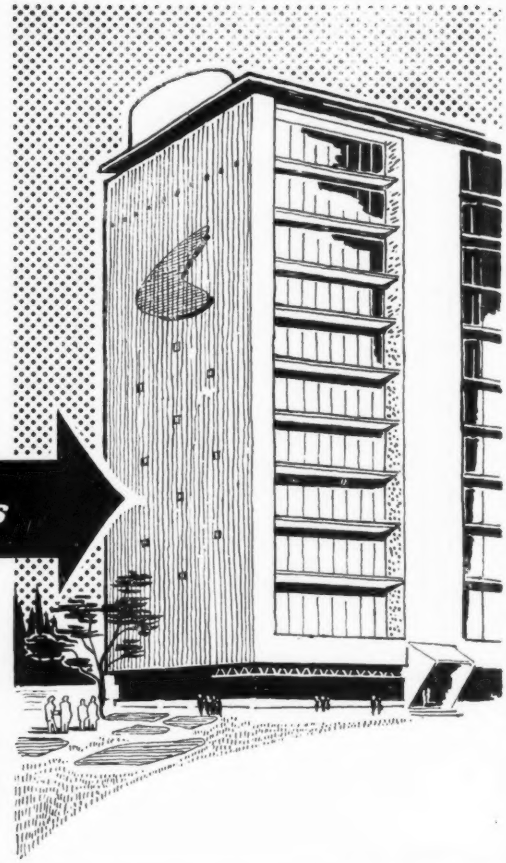

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In the chemical section of the new T.V. Research Laboratory, Enfield, Cygnet Laboratory Furniture has been chosen and installed for its high standard of design, craftsmanship and finish. This installation was carried out under the direction of G. A. Jellicoe & Partners, F/A.R.I.B.A.

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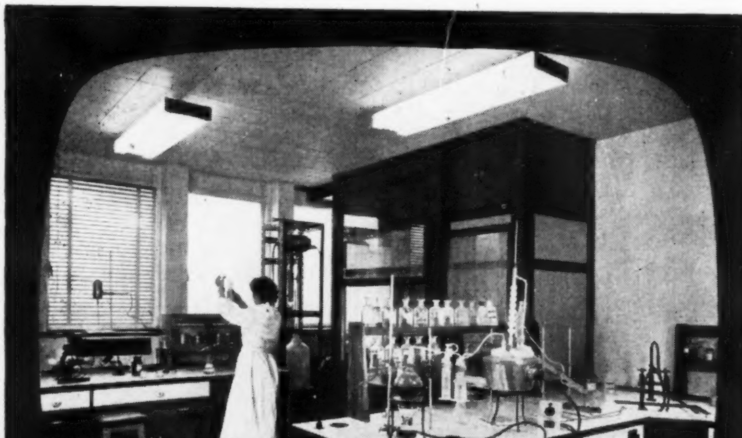

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The Gas Council's 246-page official handbook 'Coke Burning Appliances', price 12/6, should be in the hands of all concerned with smokeless heat in the modern home.

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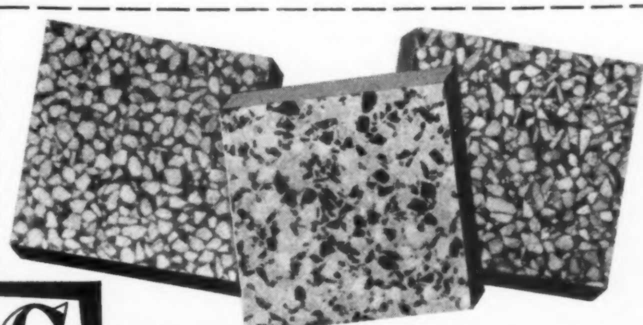

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CLASSIFIED ADVERTISEMENTS

Advertisements should be addressed to the Advt. Manager, "The Architects' Journal," 9, 11 and 13, Queen Anne's Gate, Westminster, S.W.1. Replies to Box Numbers should be addressed care of "The Architects' Journal," at the address given above.

Public and Official Announcements

30s. per inch; each additional line, 2s. 6d.

HUYTON-WITH-ROBY URBAN DISTRICT COUNCIL
ASSISTANT ARCHITECT—GRADE IV
(Salary £727—£907)

Applicants should have had a sound architectural training and several years' office experience. The person appointed will be required to assist with the design of new type houses, flats, shops and Community Centres.

Housing accommodation will be considered.

Applications stating age, qualifications, experience, present position and salary together with the names of two referees must be sent in envelopes endorsed "Assistant Architect" to: The Architect, Architectural and Housing Department, "Grasscroft," Archway Road, Huyton, Lancs, by the 30th April, 1957.

H. E. H. LAWTON,
Clerk of the Council.

Council Offices,
Derby Road,
Huyton. 5911

BOROUGH OF WARWICK
APPOINTMENT OF CHIEF ARCHITECTURAL ASSISTANT

Applications are invited for the above appointment from persons possessing as a minimum qualification the Associateship of the Royal Institute of British Architects. Salary will be on Grades A.P.T. III to A.P.T. IV (£656—£907 2s 6d.) according to qualifications and experience. The appointment is permanent, and subject to the Local Government Superannuation Acts, Scheme of Conditions of Service of the National Joint Council, one month's notice on either side and the passing of a Medical Examination. The Corporation will give assistance with regard to housing accommodation.

Warwick is a Town of great historic interest and Architectural beauty, and the position offers excellent opportunities to any person interested in the type of work which has to be carried out in such a Town.

Applications stating age, qualifications, training and experience must be delivered to the undersigned with the names of three Referees before First Post on Monday, 6th May, 1957.

Canvassing will disqualify and applicants should disclose relationship with any member or Senior Official of the Council.

HECTOR SETON BROWN,
A.M.I.C.E., A.M.I.W.E.,
Borough Engineer & Surveyor.

23, Jury Street,
Warwick.
HSB/LS.
9th April, 1957. 5943

AYCLIFFE DEVELOPMENT CORPORATION
ARCHITECTURAL ASSISTANTS
(New Towns Grade A.P.T. IV—£728 to £907 p.a.)

Applications are invited for two posts as Architectural Assistants from persons who have had at least three years' varied experience. Preference will be given to applicants who are approaching the Final standard of the R.I.B.A.

Appointment subject to N.J.C. Conditions, superannuation, medical examination and one month's notice in writing on either side.

Housing accommodation if necessary.

Applications stating age, qualifications and experience together with names of two referees to arrive not later than Saturday, 4th May, 1957.

A. V. WILLIAMS,
General Manager.

Newton Aycliffe,
Nr. Darlington,
Co. Durham. 5956

AIR MINISTRY require WORKERS-UP in Quantities Division, London. Must be fully experienced and competent to work-up entire bills of quantities. Preference holders C. & G. (Quantities), O.N.C., or equivalent technical qualification. Salary range £660 at age 26 to £980, starting pay dependent on age, qualifications and experience. Pensionable and promotion prospects. 5-day week. Over 3 weeks' leave a year. Applicants normally should be natural born British subjects. Write, stating age, qualifications and previous appointments, including type of work done, to A.A.242, London Appointments Officer, Ministry of Labour and National Service, 1-6, Tavistock Square, London, W.C.1. No original testimonials should be sent. Only candidates selected for interview will be advised. 5853

BUCKS COUNTY COUNCIL

Applications are invited for the appointment of a qualified STRUCTURAL ENGINEER in the County Architect's Department, salary £907 p.a.

This post offers good prospects to applicants with experience in design and detailing of reinforced concrete and steel structures.

A weekly allowance of 25s. 0d. and return fare home once every two months may be paid for six months to newly appointed married officers of the Council unable to find accommodation.

Applications, on forms to be obtained from F. B. Pooley, County Architect, County Offices, Aylesbury, must be returned by 6th May, 1957. 5959

WESTERN AUSTRALIA
STATE PUBLIC SERVICE
TOWN PLANNING DEPARTMENT
SENIOR PLANNING OFFICER (Permanent)

Salary Range: £A2,015—£A2,165 (gross) per annum on current basic wage

Qualifications: Recognised Degree or qualification in Town Planning supplemented by additional recognised Degree or qualification in Architecture. At least five years' experience in a town planning office or an office carrying out town planning work of both a regional and local nature.

Duties: Second-in-charge of the Town Planning Department under the Town Planning Commissioner where the duties involve work in connection with the implementation of a regional plan for the Metropolitan Region of Perth and Fremantle; regional planning problems in the remainder of the State; detailed planning schemes and planning projects in the Metropolitan Region and country areas; development control in the Metropolitan Region and subdivisional control throughout the State.

Transport: A reasonable amount will be allowed for transport of appointee and dependent family to Western Australia provided bond is entered into to serve State for a period of at least three years.

Conditions of Service: Superannuation benefits, long service leave (three months after each period of seven years of continuous service), liberal sick leave concessions and other general conditions of service applicable to permanent officers under Public Service Act.

Further particulars available from Official Secretary, London Agency.

Applications in duplicate stating age, qualifications, marital status and experience should be addressed by 31st May, 1957, to Official Secretary, Western Australian Government Agency, Savoy House, 115-116, Strand, London. 5960

BOROUGH OF SWINDON
APPOINTMENT OF CHIEF ASSISTANT PLANNING OFFICER, A.P.T. GRADE VII

Applications are invited for the above appointment in the Department of the Borough Surveyor and Planning Officer. The successful applicant will take charge of the Planning Section of the Department consisting of a staff of 10. The section is responsible for the preparation of development plans, housing and industrial layouts, Central Area redevelopment and development control.

The rapid growth of the town under the Town Development Act (present Borough population 76,000—projected T.M. Area population 104,000) gives scope for varied and interesting work.

Applicants must be Corporate Members of the Town Planning Institute with preferably a second allied qualification, and should have considerable experience in the problems of urban development and redevelopment.

Housing accommodation is available.

Applications on forms obtainable from the Town Clerk, Civic Offices, Swindon, must be returned by 6th May, 1957. 5958

WORCESTERSHIRE COUNTY COUNCIL
COUNTY ARCHITECT'S DEPARTMENT

Applications are invited for:—

1. Appointment of ASSISTANT ARCHITECTS, Grade A.P.T. IV (£727 15s. to £907 2s. 6d.) on the permanent staff to deal with Education and general contracts.

2. BUILDING INSPECTOR, Grade A.P.T. II (£609 17s. 6d. to £691 17s. 6d.) to deal with all repair, maintenance and minor alterations in a section of the County under the supervision of a senior architect. Applicants must be familiar with pricing and specification writing for painting, decoration and small alteration work.

The Council provide a limited amount of staff accommodation and the successful candidates can apply for this.

Forms of application should be obtained from L. C. Lomas, F.R.I.B.A., County Architect, 14, Castle Street, Worcester, not later than 30th April. (T102). 5921

ARCHITECTURAL ASSISTANTS
REQUIRED BY MINISTRY OF WORKS

For employment in London and Provinces on design and detailing work on construction and maintenance of all types of public buildings.

Salary range £500 (age 21) to £790 p.a. London (slightly less elsewhere). 5-day week. 3½ weeks' annual leave initially. Starting pay according to age, qualifications and experience. Good prospects of promotion with salaries of £925 p.a. and above. Opportunities for permanent posts leading to pensions (non-contributory). Interviews at Regional Offices where possible. Applicants should be of Intermediate R.I.B.A. standard.

State age, training and experience to Chief Architect, Ministry of Works (H), Abell House, John Islip Street, S.W.1. 5387

PADDINGTON BOROUGH COUNCIL

require BUILDING SURVEYING ASSISTANT (A.P.T. II, £639 17s. 6d. to £721 17s. 6d. per annum). Candidates should have practical knowledge of building construction, experience in surveying and levelling, the repair, adaptation and conversion of civil and residential properties, and be capable of preparing plans, specifications and estimates of costs in respect of those works and their supervision. Candidates preferred at advanced stage of preparation for R.I.C.S. Intermediate or equivalent examination. Written applications, stating age, qualifications, experience and names and addresses of three referees, should reach the under-signed (quoting A.336) by 6th May, 1957.

W. H. BENTLEY,
Town Clerk.

Town Hall, Paddington Green, W.2. 6009

NORTHAMPTON
ARCHITECTURAL ASSISTANT (HOUSING SECTION), A.P.T. III

Full details and application form, returnable by 6th May, from Borough Architect, Guildhall, Northampton.

C. E. VIVIAN ROWE, *Town Clerk.* 6011

NORTH WEST METROPOLITAN REGIONAL HOSPITAL BOARD
ARCHITECT'S DEPARTMENT

Applications are invited for the following posts:—

(a) ASSISTANT QUANTITY SURVEYOR.

Applicants must be Corporate Members of the R.I.C.S. and be thoroughly experienced in taking-off, abstracting and billing of quantities, measurement of work in progress, and settlement of final accounts. (Reference No. 532.)

(b) ASSISTANT BUILDING SURVEYOR.

Applicants must be Corporate Members of the R.I.C.S. and capable of preparing working drawings and specifications for alteration works, site surveying and levelling. (Reference No. 533.)

Salary scale for both posts £680 × £25 (3) × £30 (2) £35 (1) × £30 (1) × £35 (3)—£985, plus £20—£40 London weighting. Commencing salary above minimum may be paid according to relevant practical experience appropriate to the post.

Apply, stating age, qualifications (with date), experience and position held, together with the names of two referees, to Secretary, North West Metropolitan Regional Hospital Board, 11a, Portland Place, W.1, by 6th May, quoting appropriate reference number. 6026

WEST SUSSEX COUNTY COUNCIL
(Amended Advertisement)

Applications are invited for the undermentioned appointments:—

AREA PLANNING OFFICER.

For the Worthing Area of the County. Salary: A.P.T., Grade VII (£999 8s.—£1,230 p.a.).

Applicants must be Corporate Members of the Town Planning Institute, and should have had experience of planning practice. A car is provided.

TECHNICAL PLANNING ASSISTANT—FOR HEADQUARTERS.

Salary: A.P.T. Grade II (£609 18s.—£691 18s.).

Applicants should have a knowledge of research techniques. University Graduates who have obtained their degree in Economics or Geography would be considered. Planning experience, although desirable, is not essential.

Further details, application forms and conditions of service may be obtained from Mr. John G. Jefferson, County Planning Officer, County Hall, Chichester, to whom applications should be returned by Monday, 13th May, 1957. 6018

CITY OF PORTSMOUTH
CITY ARCHITECT'S DEPARTMENT

There are vacancies for ARCHITECTURAL ASSISTANTS of Intermediate standard, preferably with some office experience, on Grade II (£609 17s. 6d.—£691 17s. 6d.), commencing salary according to ability.

These Assistants will be added to teams of Architects engaged on a new College of Art, and Civic Centre, comprising Civic Offices, Magistrates' Courts, and Divisional Police Headquarters.

Applications, setting out in tabular form, name, age, qualifications, present post and salary, previous posts with dates, details of experience, with names of two referees, must be delivered to the undersigned not later than 12 noon, Friday, 17th May, 1957.

Canvassing will disqualify.

V. BLANCHARD,
Town Clerk.

City Council Chambers,
1, Clarence Parade, Portsmouth. 6019

BOROUGH OF SHREWSBURY
BOROUGH SURVEYOR'S DEPARTMENT

Applications are invited for the post of ARCHITECTURAL ASSISTANT, A.P.T III (£656 to £784 2s. 6d. per annum).

HOUSING ACCOMMODATION will be provided if required and removal expenses paid.

Applications, stating age, qualifications and experience, with the names of two persons to whom reference can be made, to be received by the Borough Surveyor, Guildhall, Shrewsbury, by 1st May, 1957.

S. R. H. LOXTON,
Town Clerk.

Guildhall, Shrewsbury. 6012

COUNTY BOROUGH OF ROCHDALE
ASSISTANT ARCHITECT

Applications are invited for the appointment of an ASSISTANT ARCHITECT, at a salary within Grade IV (£727 15s.—£907 2s. 6d. per annum), commencing salary depending upon qualifications and experience.

The appointment will be subject to the National Scheme of Conditions of Service, the Local Government Superannuation Acts, and to passing a medical examination.

Housing accommodation will be provided by the Council in appropriate circumstances.

Canvassing is prohibited, and applicants must disclose whether they are related to any member or senior official of the Council.

Applications, stating age, qualifications, training and experience, together with the names and addresses of two persons to whom reference can be made, and endorsed "Assistant Architect," must be delivered to the Borough Surveyor, Town Hall, Rochdale, by the 9th May, 1957. 6022

RURAL DISTRICT COUNCIL OF CHELMSFORD

Applications are invited for the appointment of a Temporary ARCHITECTURAL ASSISTANT in the Housing and Estates Manager's Department within the salary range of A.P.T. I (£543—£625).

Applications, in candidate's own handwriting, stating age, present position, salary and qualifications and experience, and giving the names and addresses of two referees, to be made to the Estates Manager at these offices not later than Thursday, the 9th May, 1957.

C. A. BOHANNON,
Clerk of the Council.

R.D.C. Offices, New London Road,
Chelmsford, Essex. 6020

COUNTY BOROUGH OF BARNSLEY
BOROUGH ENGINEER AND SURVEYOR AND PLANNING OFFICER'S DEPARTMENT
APPOINTMENT OF PLANNING ASSISTANT (SPECIAL CLASSES)

Applications are invited for the above appointment at a commencing salary within Grades A.P.T. I (£543 5s.—£625 5s.), A.P.T. II (£609 17s. 6d.—£691 17s. 6d.), Special Grade (£707 5s.—£861), to be determined according to qualifications and experience as provided for in the N.J.C. Conditions relating to the grading of Special Classes of Officers. THE POINT OF ENTRY WITHIN ANY GRADE MAY BE FIXED ABOVE THE MINIMUM.

Applicants should have had previous experience in town planning and development control.

HOUSING ACCOMMODATION WILL BE PROVIDED IF NECESSARY, AND 50 PER CENT. OF REMOVAL TRANSPORT EXPENSES WILL BE PAID IN APPROVED CASES.

The appointment will be subject to (i) the Scheme of Conditions of Service for A.P.T.C. Staff; (ii) any other general conditions of employment in operation within the Corporation from time to time; (iii) one month's notice on either side, and (iv) to the Local Government Superannuation Acts, for which purpose the successful candidate will be required to pass a medical examination.

Applications, stating age, present and previous appointments, qualifications, experience, etc., together with the names of two persons for reference, should reach the Borough Engineer, Town Hall, Barnsley, by Tuesday, 7th May, 1957.

Canvassing will disqualify.

A. E. GILFILLAN,
Town Clerk.

Town Hall, Barnsley.
April, 1957. 6025

COUNTY BOROUGH OF SOUTHAMPTON
BOROUGH ARCHITECT'S DEPARTMENT

Applications are invited for the following permanent appointments:—

(a) SENIOR ASSISTANT ARCHITECT, Grade V (£814—£994).
(b) SENIOR ASSISTANT ARCHITECT, Grade IV (£727—£907).
(c) ASSISTANT ARCHITECT, Special Grade (£707—£861).
(d) JUNIOR ARCHITECTURAL ASSISTANT, Higher General Division (£184—£512).
(e) SENIOR ASSISTANT PLANNING OFFICER, Grade V (£814—£994).
(f) ASSISTANT PLANNING OFFICER, Special Grade (£707—£861).
(g) PLANNING ASSISTANT, Grade II (£609—£691).

Candidates should possess appropriate qualifications (Town Planning and Architectural qualifications for (e)), and state their housing needs.

Application forms from the Borough Architect, Civic Centre, Southampton. Closing date: 13th May, 1957. 6010

GOVERNMENT OF SARAWAK
ASSISTANT ARCHITECT, PUBLIC WORKS DEPARTMENT

To prepare working drawings and specifications for Government schools and check designs and plans submitted for reconstruction and extensions of state-aided schools and institutions. Contract appointment. Salary range £1,453 to £2,522 p.a. Starting salary according to experience. Gratuity £37 10s. for each three months' resident service. Quarters, if available, at low rent. Free passages for officer, wife, and up to three children. Generous home leave.

Candidates must be A.R.I.B.A. Experience in school design will be an advantage. Write Director of Recruitment, Colonial Office, London, S.W.1, giving briefly age, qualifications and experience, quoting BCD.112/24/012. 5982

BASILDON DEVELOPMENT CORPORATION
DEPARTMENT OF ARCHITECTURE AND PLANNING

Applications are invited for post of ASSISTANT LANDSCAPE ARCHITECT, within Grade A.P.T. V/VI. Salary range £815—£1,107.

Applicants must be A.I.L.A., and the appointment is to assist in design and supervision of landscaping relative to New Town development. Good draughtsmanship and administrative experience essential. Salary within the above range according to ability.

The appointment is superannuable and subject to satisfactory medical examination.

Housing available for renting.

Applications on the special form (obtainable from the Chief Architect) to the General Manager, Basildon Development Corporation, Gifford House, Basildon, Essex, endorsed with the relevant appointment, by Friday, 3rd May, 1957. 5973

NORTHERN POLYTECHNIC, HOLLOWAY, LONDON, N.7

The Governing Body invite immediate applications for appointment as full-time LECTURER in the School of Architecture from 1st September, 1957. The lecturer appointed will be required to be mainly responsible for studio instruction in Design and Working Drawings; to lecture on some subject of architectural practice in which he is particularly interested, and to have had some years' experience in planning, construction and equipment of commercial and industrial buildings. Salary scale £1,200 × £30—£1,350, plus London allowance.

Particulars and form of application can be obtained from the Clerk to the Governors. 6008

HARRIS COLLEGE, PRESTON

Principal: H. WILKINSON, M.Sc.Tech., Ph.D., A.Inst.P.

Department of Building and School of Art. SENIOR LECTURER IN ARCHITECTURE, to work in collaboration with the Heads of both departments in teaching architecture and allied subjects and developing courses. The College has strong support from local architects and is intended to develop as a regional centre.

The salary is in accordance with the Burnham Scale of Salary for Senior Lecturer: £1,350 × £50—£1,550.

Fuller details and an application form may be obtained from the Principal, Harris College, Corporation Street, Preston, to whom they should be returned by Monday, 13th May, 1957.

W. R. TUSON,
Clerk to the Harris Council.

Municipal Building, Preston. 6015

COUNTY BOROUGH OF MERTHYR TYDFIL
PERMANENT APPOINTMENT OF TWO SENIOR ARCHITECTURAL ASSISTANTS

Applications are invited for the above appointments at a salary in accordance with Grade A.P.T. V of the National Scheme of Conditions of Service.

Applicants must be Associate Members of the Royal Institute of British Architects, and must have had good all-round experience in the architectural work usually undertaken by the Local Authority. Planning experience would be an advantage.

Housing accommodation will be provided if required, and reasonable removal expenses of the successful applicant will be paid.

The appointment will be subject to the Local Government Superannuation Acts and to the passing of a medical examination. The appointment will be terminable by one month's notice on either side.

Applications, stating age, past and present appointments, qualifications and experience, together with copies of three recent testimonials, should be delivered to the undersigned not later than 12 noon on 18th May, 1957.

Canvassing in any form will disqualify.

T. S. EVANS,
Town Clerk.

Town Hall, Merthyr Tydfil.
15th April, 1957. 6014

BOROUGH OF WIDNES—BOROUGH ARCHITECT'S DEPARTMENT

Applications are invited for the appointment of ARCHITECTURAL ASSISTANT, at a salary within Grades A.P.T. IV/V, according to qualifications and experience, to work on a new College of Further Education and other school projects.

Applicants must be registered Architects, preferably Associate Members of the R.I.B.A., and with experience of contemporary school design and construction.

HOUSING ACCOMMODATION will be provided if needed.

The appointment will be subject to the National Scheme of Service as adopted by the Council, and superannuable subject to the successful candidate passing a medical examination. Applications, stating full particulars of age, experience and qualifications, present and previous appointments (with dates), together with the names and addresses of two referees, should be sent to the Borough Architect, Brendan House, Widnes Road, Widnes, not later than first post Friday, 10th May, 1957. Canvassing, directly or indirectly, will disqualify.

FRANK HOWARTH,
Town Clerk.

Town Hall, Widnes.
15th April, 1957. 6013

CITY OF SHEFFIELD
APPOINTMENT OF SENIOR ASSISTANT ARCHITECT, GRADE A.P.T. VI
Salary £902—£1,107

Applications are invited from suitably qualified persons for this appointment in the Education and General Section of the Department of the City Architect, Mr. J. L. Womersley, F.R.I.B.A., M.T.P.I.

The section has an extensive school building programme and a variety of "General" work which is expanding and includes interesting civic buildings. The person appointed will be required to design and supervise to completion major works of this nature.

Applications, stating age, education and training, qualifications and experience, present and past appointments (with dates and salaries), together with names of two referees, should reach me by 6th May, 1957.

JOHN HEYS,
Town Clerk.

Town Hall, Sheffield, 1. 5976

BOROUGH OF NEWCASTLE-UNDER-LYME requires a SENIOR ASSISTANT QUANTITY SURVEYOR in the Borough Engineer and Surveyor's Department. Salary in A.P.T. IV-V, according to qualifications and experience (£727—£994).

Applicants will be required in connection with taking off for new Schools and Housing contracts. Favourable consideration will be given to the provision of housing accommodation in suitable cases.

Application forms and conditions of appointment may be obtained from the Borough Surveyor, Lancaster Building, High Street, Newcastle Staffs., and must be returned to him not later than Thursday, 2nd May, 1957.

C. J. MORTON,
Town Clerk.
5983

SALOP COUNTY COUNCIL

There are vacancies in the County Architect's Department for the following appointments:—

(a) SENIOR ASSISTANT ARCHITECT, A.P.T. Grade VI (£902 by £41 to £1,107 per annum).
(b) ASSISTANT ARCHITECT, A.P.T. IV (£727 15s. by £35 17s. 6d. to £907 2s. 6d. per annum).

N.J.C. Conditions of Service will apply.

It is expected that housing accommodation in the form of a flat will be available for the successful applicant for appointment (a). Alternatively, assistance in house purchase will be available and a disturbance allowance or weekly separation allowance may also be paid to a married man taking up the appointment. For appointment (b) monthly rail fare and subsistence allowance not exceeding 30s. a week will be paid to a married man appointed, for a maximum period of six months whilst he is separated from his family.

Conditions of Service and application forms obtainable from County Architect, Column House, London Road, Shrewsbury. Closing date: 7th May, 1957. 5978

LONDON COUNTY COUNCIL
ARCHITECT'S DEPARTMENT

CIVIL ENGINEERING and DRAWING OFFICE ASSISTANTS required in Housing Engineer's Division with experience in the following:

Setting out for roads and sewers; design of roads and sewers and preparation of working drawings and contract documents; supervision of work on site; general drawing office duties.

Applicant must be prepared to work on sites outside the Greater London area if required. Rate of pay up to £817 a year according to experience. Subsistence allowances paid where applicable.

Application forms from The Architect (AR/EK/CE/4), County Hall, S.E.1 (632). 5903

CITY OF BRADFORD
APPOINTMENT OF SENIOR TOWN PLANNING ASSISTANT GRADE A.P.T. IV

Applications are invited for the appointment of Senior Town Planning Assistant (Post No. 14) in the City Engineer and Surveyor's Department at a salary in accordance with A.P.T. IV (£727 15s./£907 2s. 6d.). The post is superannuable.

The successful candidate will be required to have experience in dealing with applications for development for new housing, industrial and commercial building and advertisement control. Should be A.M.T.P.I. or equivalent and should preferably in addition be A.M.I.Mun.E., A.M.I.C.E., or A.R.I.B.A.

All applicants should have completed their National Service. No housing accommodation can be provided by the Corporation.

Applications on forms to be obtained from the City Engineer and Surveyor Town Hall, Bradford, 1 (quoting post number) together with three testimonials must be received by the undersigned by 9th May, 1957

W. H. LEATHEM,
Town Clerk.

Town Hall,
Bradford, 1. 6027

CITY AND COUNTY OF NEWCASTLE UPON TYNE
CITY ARCHITECT'S DEPARTMENT

Applications are invited from suitably qualified persons for the under-mentioned vacancies in the City Architect's Department:—

(a) PRINCIPAL ASSISTANT ARCHITECT (General Section). A.P.T. Division, Grade VI (£902—£1,107 per annum).
(b) PRINCIPAL ASSISTANT ARCHITECT (Housing Section). A.P.T. Division, Grade VI (£902—£1,107 per annum).
(c) SENIOR ASSISTANT ARCHITECT (Education Section). A.P.T. Division, Grade VI (£902—£1,107 per annum).
(d) SENIOR ASSISTANT ARCHITECT (General and Housing Sections). A.P.T. Division, Grade V (£814 17s. 6d.—£994 5s. per annum).
(e) SENIOR ASSISTANT ARCHITECT (General, Housing or Education Sections). A.P.T. Division, Grade IV (£727 15s.—£907 2s. 6d. per annum).
(f) ASSISTANT STRUCTURAL ENGINEER (Structural Section). A.P.T. Division, Grade IV (£727 15s.—£907 2s. 6d. per annum).

Further particulars and Forms of Application may be obtained from George Kenyon, A.R.I.B.A., A.M.T.P.I., City Architect, 18, Cloth Market, Newcastle upon Tyne, 1.

Closing date for receipt of completed applications: Friday, 17th May, 1957. 5981

JUNIOR ARCHITECTURAL ASSISTANTS required by Perth and Kinross Joint County Council for work on New Schools. Salary scale £565—£680, with placing according to qualifications and experience. Commencing salary for applicants having R.I.B.A. Intermediate standard or equivalent not less than £635. Particulars and forms of application from County Clerk, County Offices, York Place, Perth. Applications to be lodged by 4th May. 5975

Architectural Appointments Vacant

4 lines or under, 9s. 6d.; each additional line, 2s. 6d. Box Number, including forwarding reply, 2s. extra.

ASSISTANT ARCHITECTS AND SHOPFITTING DRAUGHTSMEN. Co-operative Wholesale Society, Ltd., invite applications for the following appointments · (1) Assistant Architects capable of preparing working drawings from preliminary details. (2) Shopfitting Draughtsmen with experience in Shop Equipment and modernisation of Interiors.
The posts are pensionable, subject to medical examination. Five-day week in operation. Applications, giving age, details of experience and salary required to W. J. Reed, F.R.I.B.A., Chief Architect, Co-operative Wholesale Society, Ltd., 99, Leman Street, London, E.1. 4977

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ASSISTANT wanted for small private practice. Write brief details to T. A. Bird, 13, Welbeck Street, W.1. 6715

HASKER & HALL, L./F.R.I.B.A., require ARCHITECTURAL ASSISTANT with 4 to 5 years' office experience.—Write or telephone, giving full particulars, including age and salary, to 13, Welbeck Street, W.1 (Welbeck 0061). 5824

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Cosmos Works, Brimsdown, Enfield, Middlesex. 5954

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COURTNEY, POPE LTD., require SHOPFITTING DRAUGHTSMEN. Write, giving details of experience and salary required to: Amhurst Park Works, London, N.15. 5704

RAMSEY, MURRAY, WHITE & WARD require recently qualified ASSISTANTS, with two to five years' practical experience, to work on interesting industrial and office buildings. Salary by arrangement.—Apply 32, Wigmore Street, W.1. 5929

ARCHITECTURAL ASSISTANTS may be required for interesting work in London from early June with opportunities for overseas later. Luncheon vouchers, five-day week, pension scheme. Applications giving full particulars of experience and salary required to Box 5878.

TWO ASSISTANTS required by a busy Manchester office to work on the detailing of school projects. Experience and an ability to work quickly will be considered more important than academic qualifications. For the Senior post the salary will be £1,000 per annum and for the Junior post £750 per annum. Box 5882.

ARCHITECTURAL DRAUGHTSMAN required for leading firm of Consulting Civil Engineers. Westminster. Five-day week, bonus and pension schemes. Phone Mr. Simmons, ABBey 1122 for appointment. 6017

HARRY S. FAIRHURST & SON require a SENIOR ASSISTANT ARCHITECT, with qualifications and a number of years' office experience, to work in Manchester. The scope of work is varied, and salary would be proportionate to experience and ability.—Apply in writing, including age and other particulars, to 55, Brown Street, Manchester, 2. 5946

SOUTHAMPTON.—ASSISTANT required in busy office working on a varied programme of commercial and industrial building. Permanent and progressive post for man with initiative.—Applications to W. H. Saunders & Son, L./A.R.I.B.A., 1, Carlton Crescent, Southampton. 5944

ARCHITECTURAL ASSISTANT. About Intermediate Standard. Competent Draughtsman: Sketch Schemes, Working Drawings, Surveys. Congenial type required by Brewery Company, East Midlands. Sports facilities and Superannuation. State Experience. Salary £500 to suitable applicant. Box 5965.

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ARCHITECT with varied practice requires capable ASSISTANT. Good draughtsman with knowledge of construction.—Reply, with details of age, experience and salary expected, to A. W. J. Mullins, L.R.I.B.A., 78, Thoro'fare, Woodbridge, Suffolk. 5939

ARCHITECTURAL ASSISTANT, Intermediate R.I.B.A. standard, required in Engineer's Office of large Brewery Company in the Midlands. Sound knowledge of building constructions, surveys, preparation of working drawings and details. Salary in accordance with age and experience.—Apply Box 5937.

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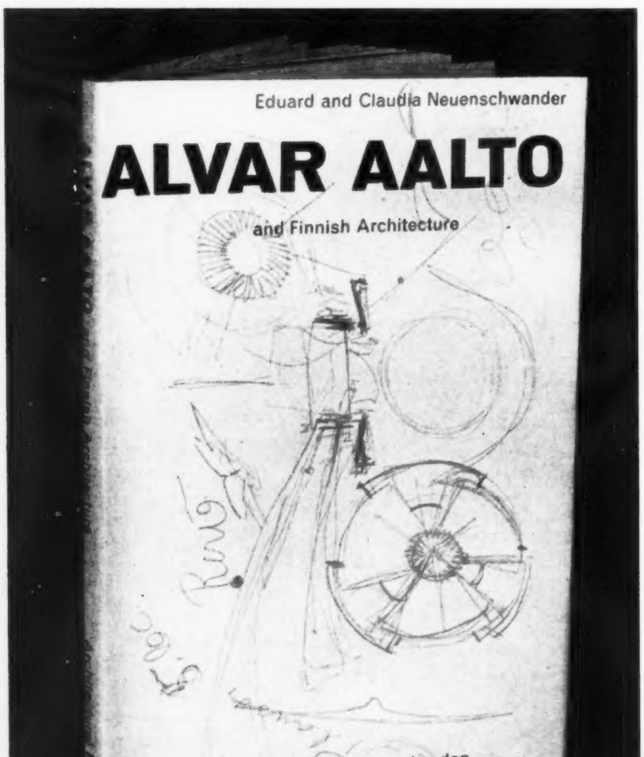

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