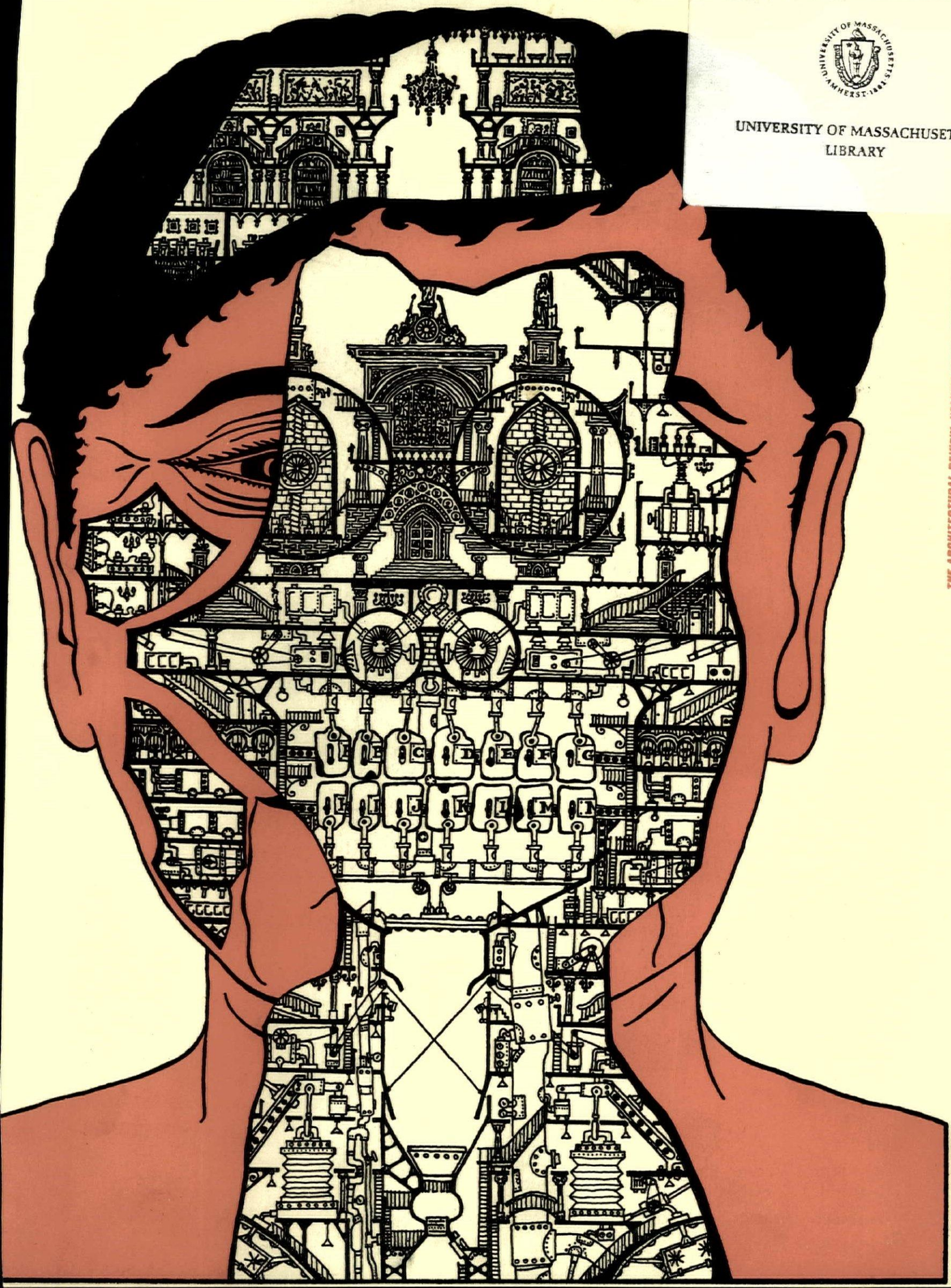

THE ARCHITECTURAL REVIEW VOLUME CXLIII NUMBER 854 APRIL

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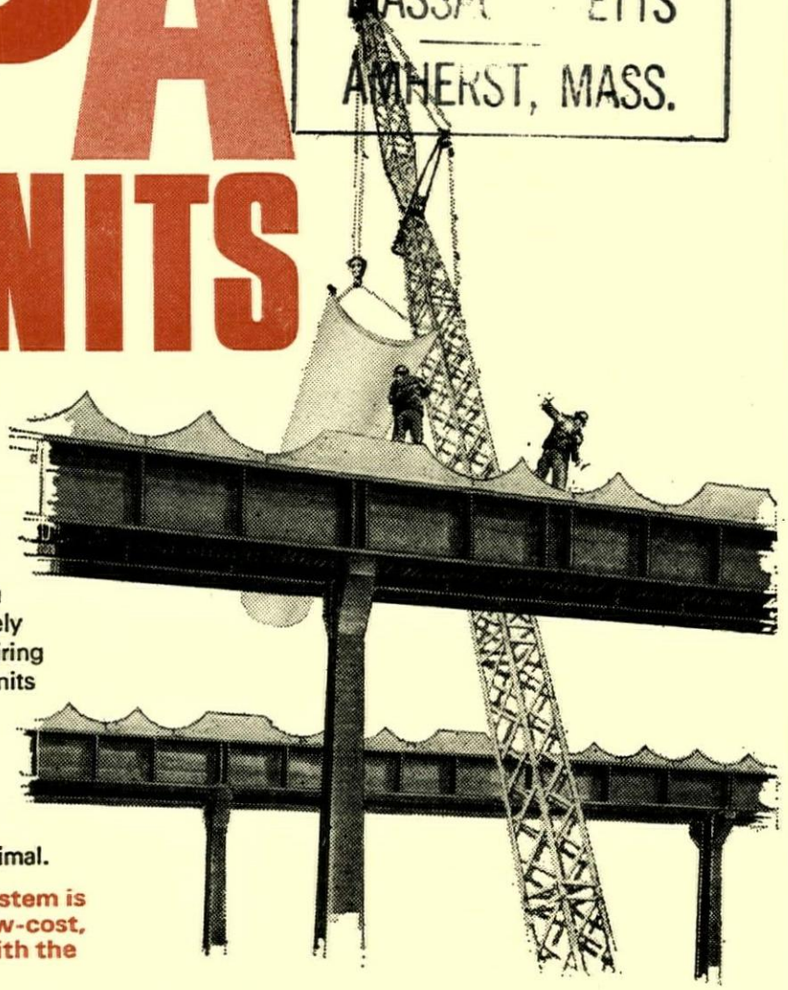
HYPA ROOF UNITS

cut maintenance costs



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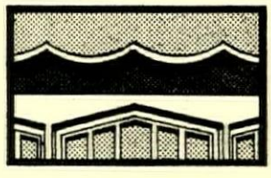

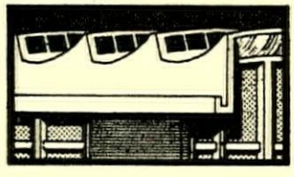

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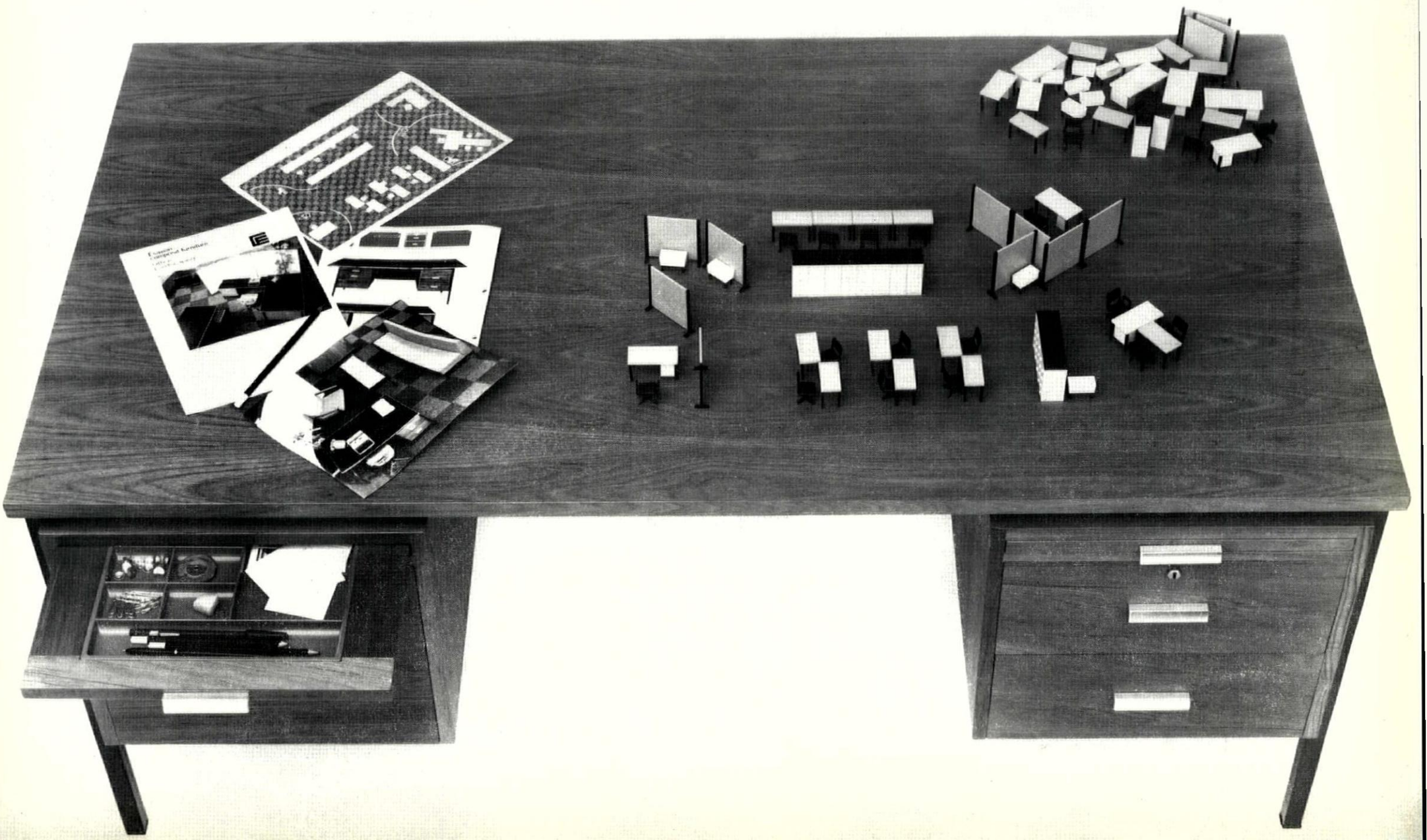

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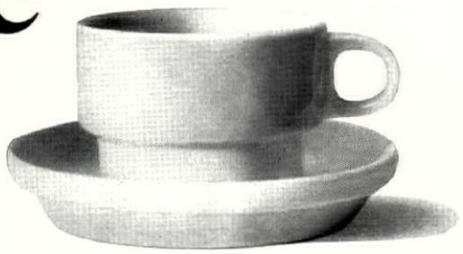

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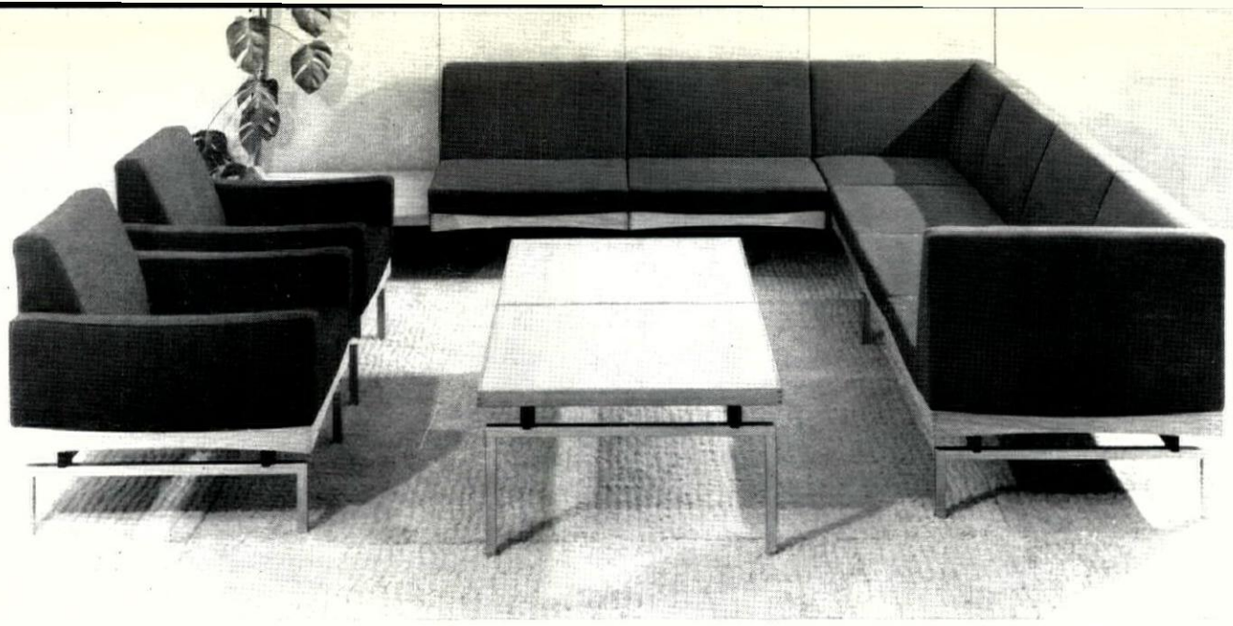

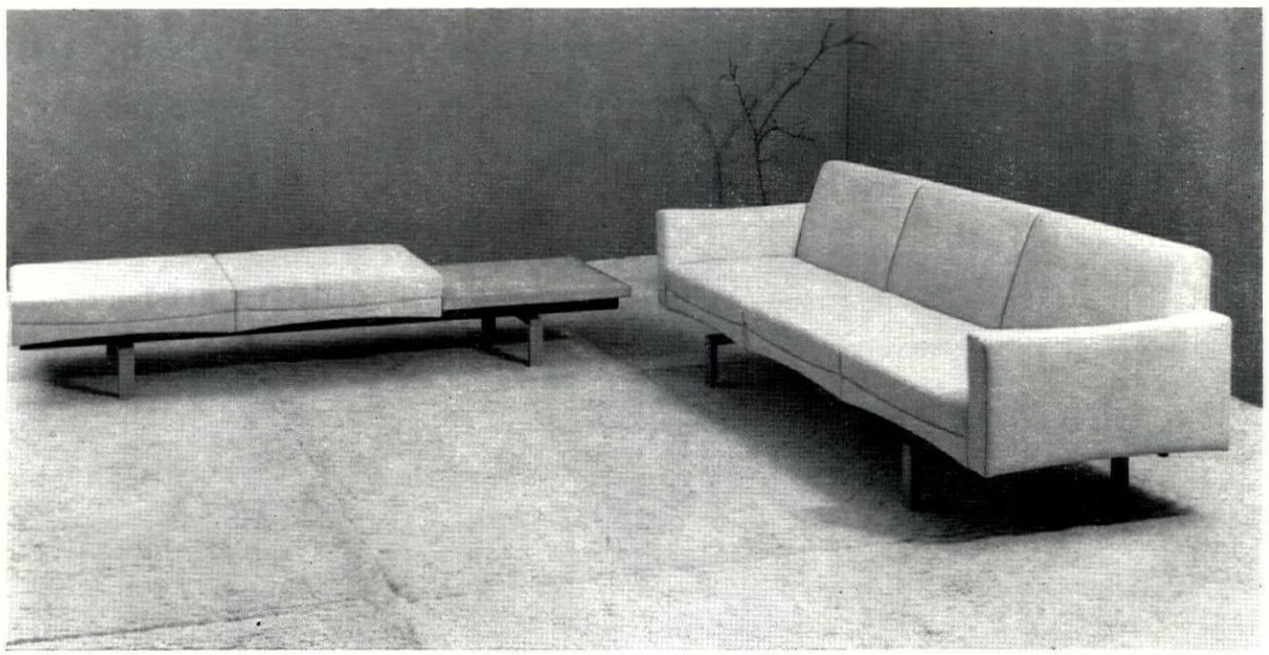

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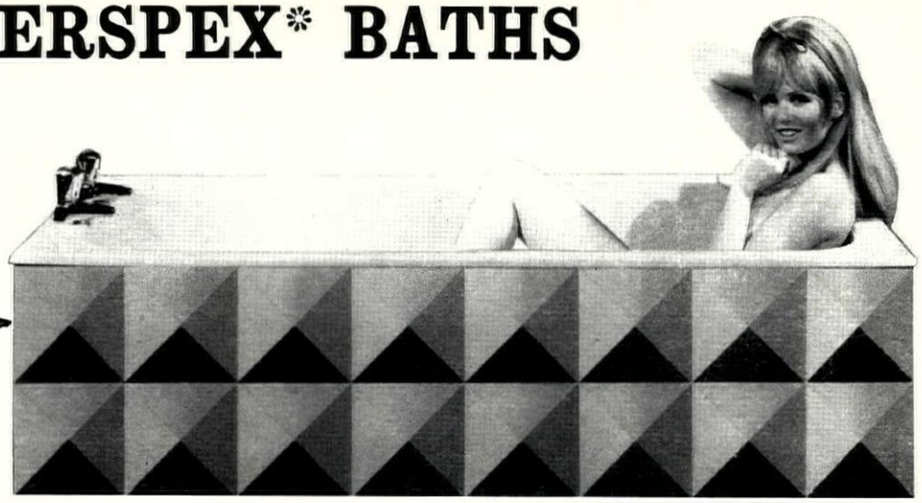

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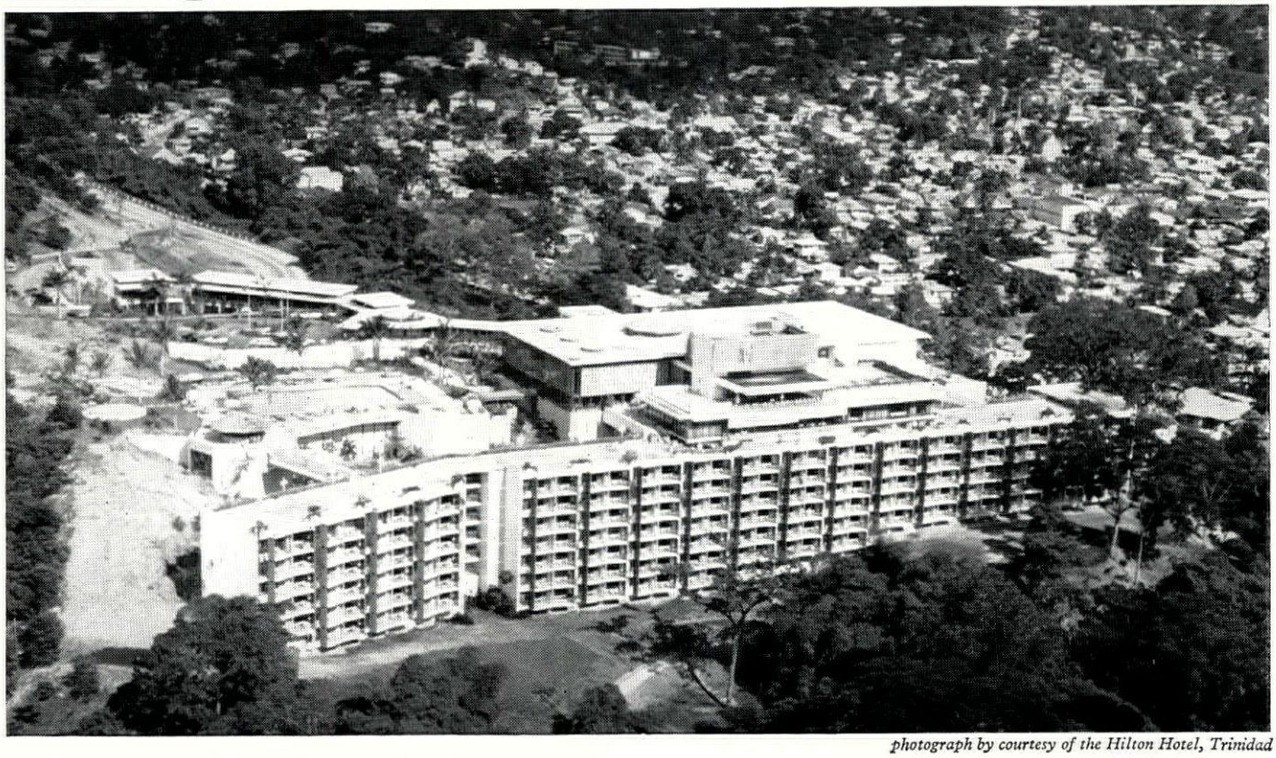

photograph by courtesy of the Hilton Hotel, Trinidad

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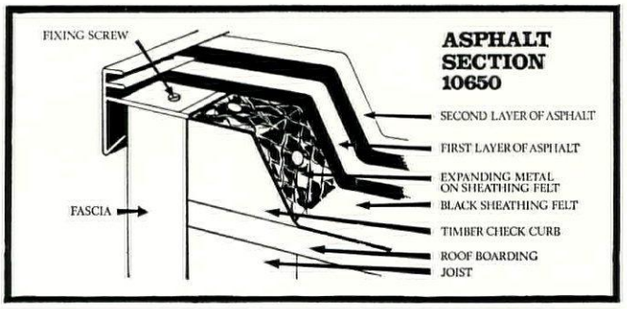

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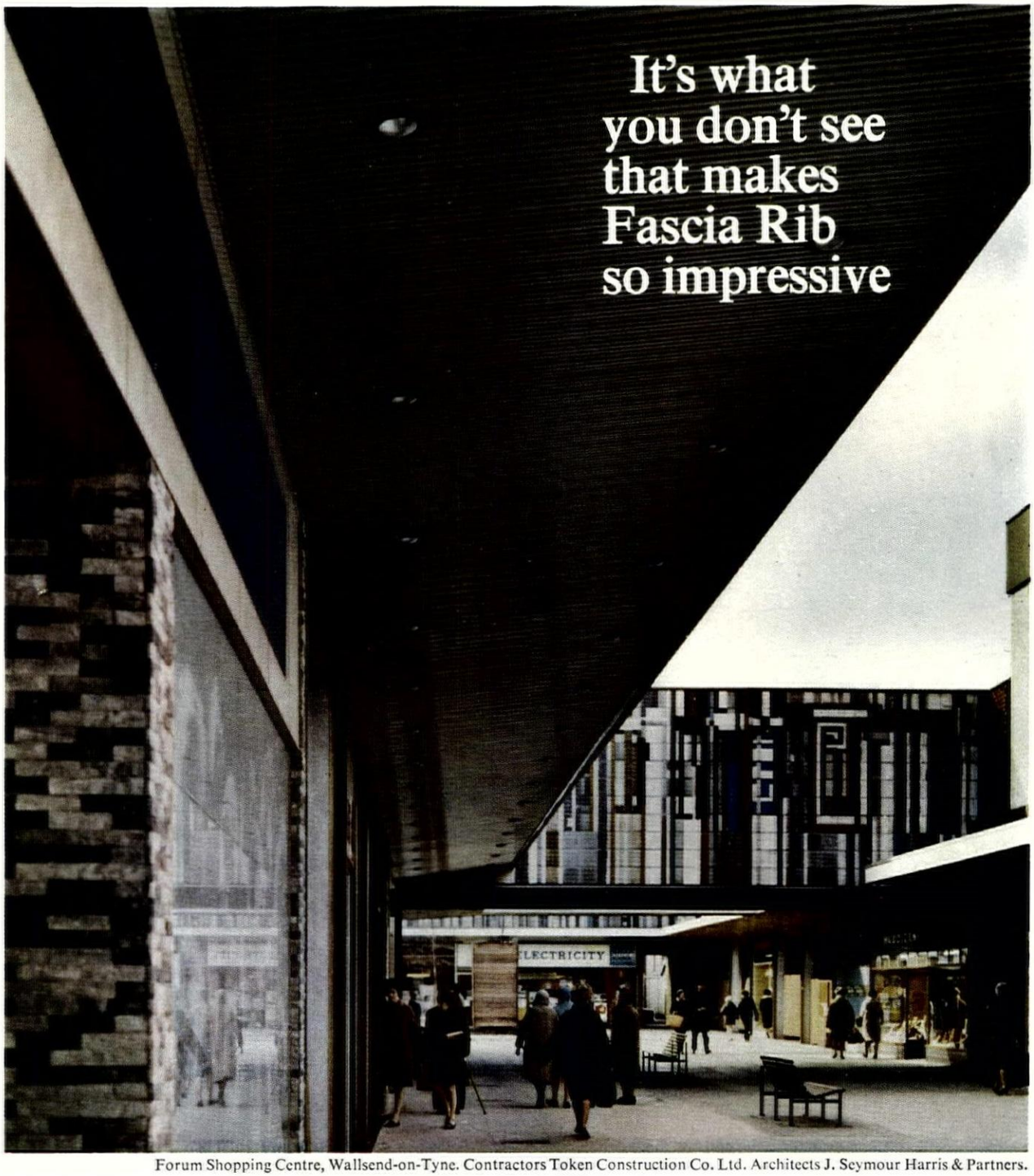

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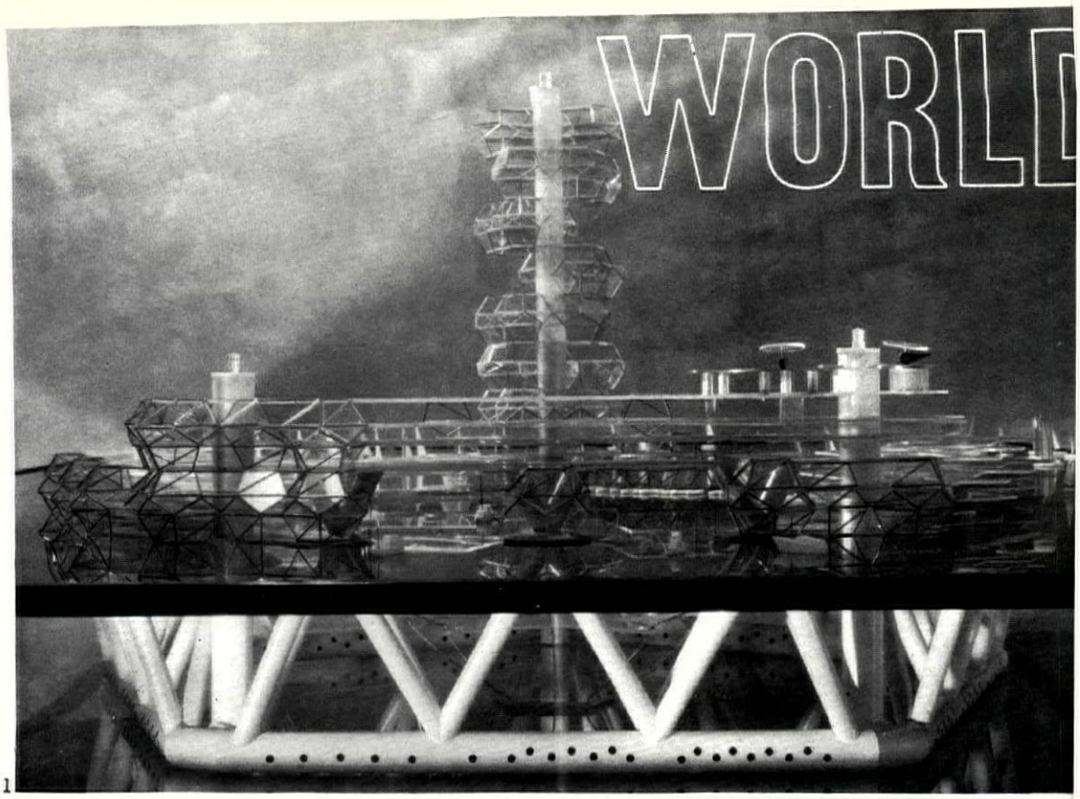
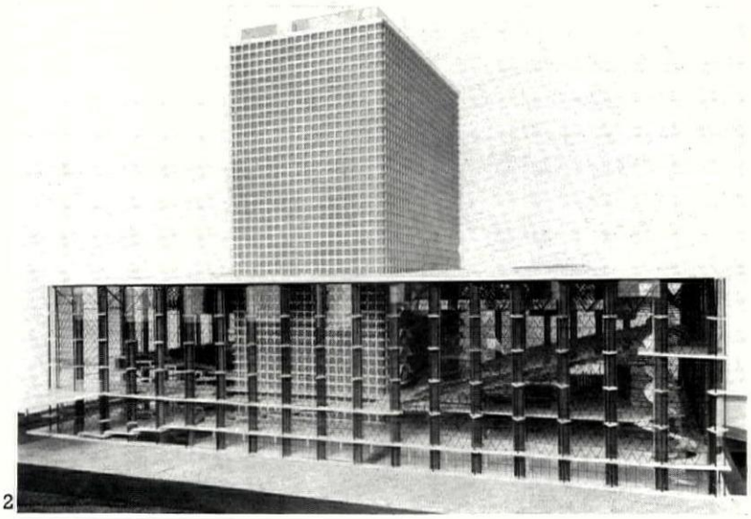


1

ALBERT

The premature death of Edouard Albert in January is a serious loss to French architecture. His distinctive style arose from a desire to use materials to their limit, and in designs he explored the possibil light-weight frame structures. H imaginative design, in collab



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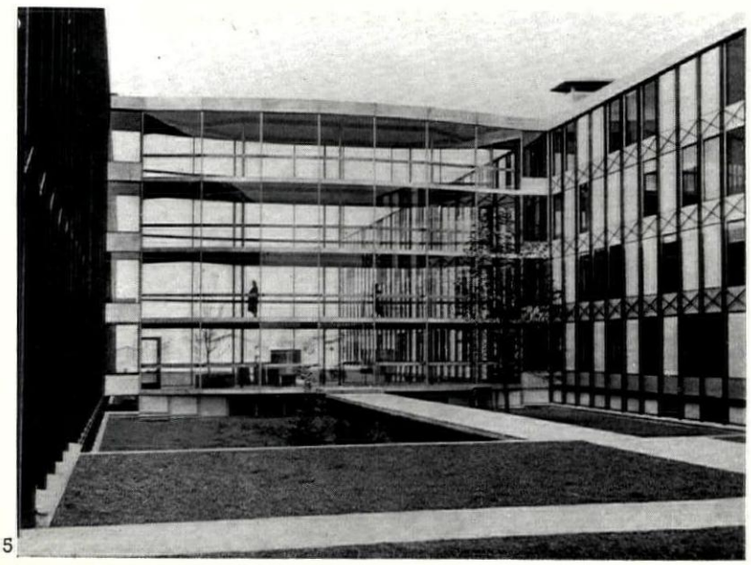

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THE ARCHITECTURAL REVIEW

9-13 QUEEN ANNE'S GATE, WESTMINSTER, SW1 WHITEHALL 0611 FIVE SHILLINGS

VOLUME 143 NUMBER 854
APRIL 1968

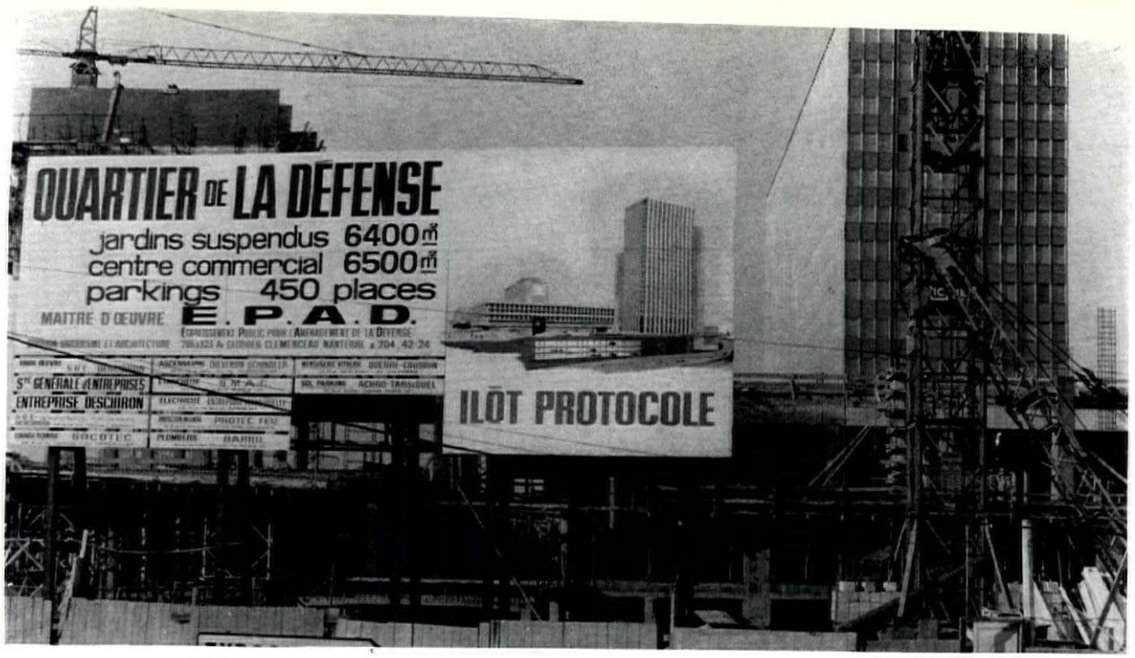
SUBSCRIPTION RATE: *The annual post free subscription rate, payable in advance, is £3 3s. 0d. sterling, in USA and Canada* $10.50, *in Italy Lira* 6940, *elsewhere abroad* £3 10s. 0d. *Italian subscription agents: Librerie Salto, via V. di Modrone* 18, *Milano; Librerie Dedalo, Via Barberini* 75-77, *Roma. An index is issued half-yearly and is published as a supplement to the REVIEW. Subscribers may have their copies bound in half-yearly volumes at the price of* £1 15s. 6d. *Postage* 4s. 6d. *extra on the completed volume.*

CONTENTS

one decorated by a different artist. The ground level is open and there is another larger court which contains a tower.

PARIS RAPE

That France can ill afford to lose an architect of Albert's calibre is made abundantly clear by the major developments now threatening Paris. The first two towers at the Défense (for designs of all seven see AR World, January 1966) are just about finished and the banality of the one (by P. Dufau), 7, is only out-matched by the crudity of the other (by Arsène-Henry and Schoeller), 8. By the Pont de Neuilly an equally depressing commercial centre (left on 9) has recently been completed by Jean de Mailly, but with one bright spot in the sophisticated curtain wall with rounded corners of Jacques Depusse's tower block, 9. The much more central Maine-Montparnasse development proceeds irrevocably to its bitter end, though it must be admitted that the view from the Place de Rennes, 10, is not quite as horrific as from the station side (see AR World January 1966), at least not without the high tower which has still to be built. The centre of Paris is threatened even more seriously by the removal of the market at Les Halles to Rungis near Orly, leaving thirty-two hectares ripe for redevelopment. Of the twelve projects so far submitted, several are disturbing to say the least—for example Faugeron's 'Carolingian'



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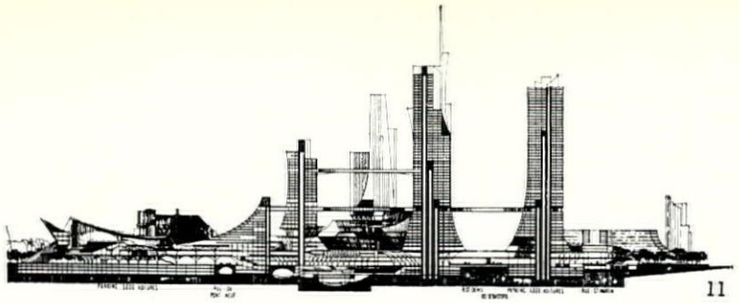
PARIS RAPE

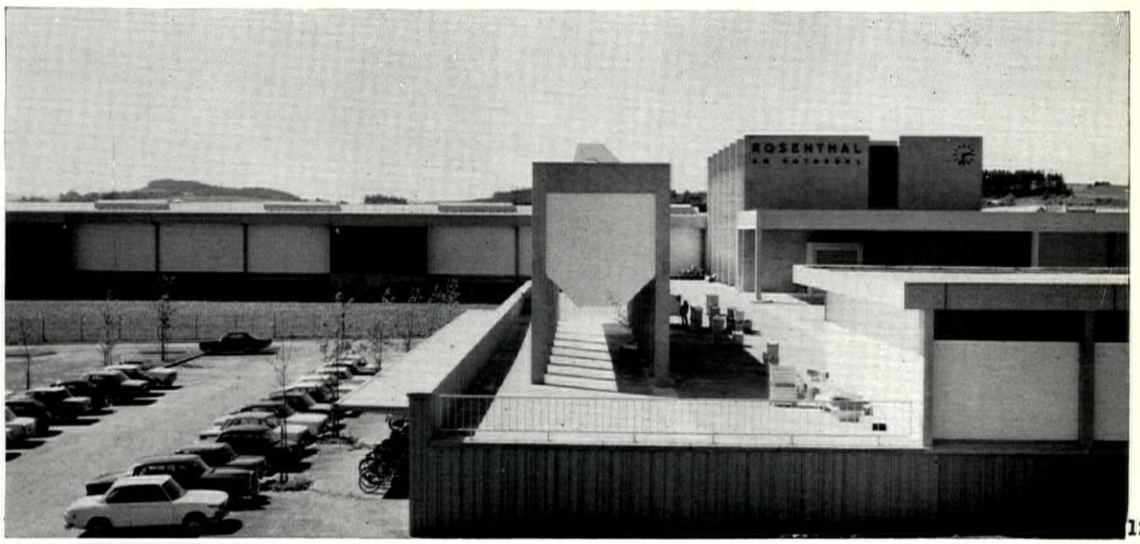
folies de grandeur, 11. De Gaulle himself was supposed to give his verdict last autumn. In the meantime *L'Express*, in an article by Jean-François Revel entitled 'Crime contre Paris,' and Pierre Vago in an impassioned leader in *Architecture d'Aujourd'hui* (No. 134), have been asking whether public opinion and the press, to say nothing of town-planners and architects, will once again be presented with a *fait-accompli*. They fear that another even more monstrous 'Maine-Montparnasse' is at this very moment being secretly drawn up for that sacred area between Saint-Eustache and the Fountain of the Innocents, between the Louvre, the Bibliothèque Nationale, the Marais and Notre-Dame.



11

GROPIUS SELB

Because of the continuous development of industrial processes today, Rosenthal demanded maximum flexibility from Professor Gropius in his design for their new china factory on the Czech border at Selb. Research established a square bay of 32 ft. as best both for assembly line and transport aisles, 13. To achieve flexibility, the production building (background in 12) was designed of prefabricated parts with a flat roof all at one level. Walls can be demounted and whole bays added. In front of the production area a group of separate buildings of different shapes and heights—silos, offices and a building for social activities, 14—combine freely to form an entrance court. To make the worker more efficient, various ideas, intended to stimulate, have been incorporated: an entrance with information boards catering for all interests, an interior sub-divided by partitions covered with coloured glazed tiles, and a greenhouse in the middle of the work area, 15. There is no doubt that the design of this building is based on needs, and the result is an absence of monumentality which is admirable. But whether the whole adds up to architecture, or indeed whether it is important that it should, is another matter.



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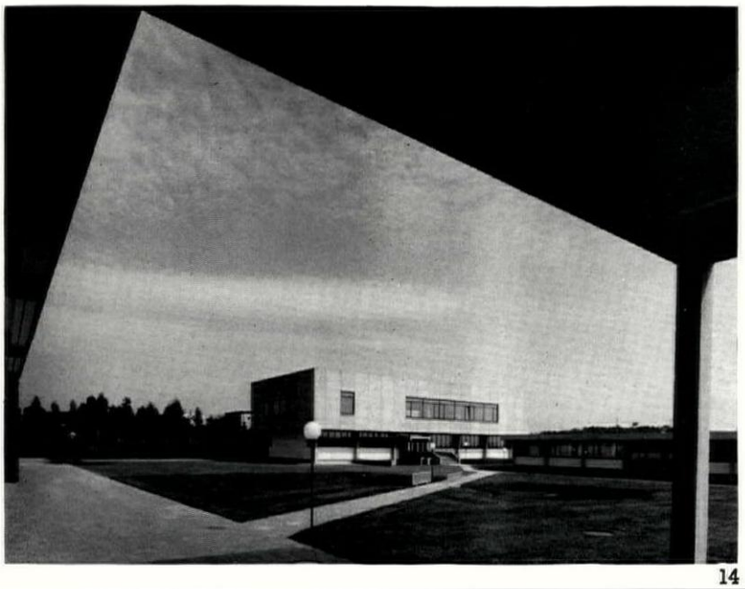

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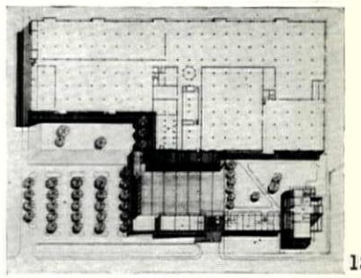

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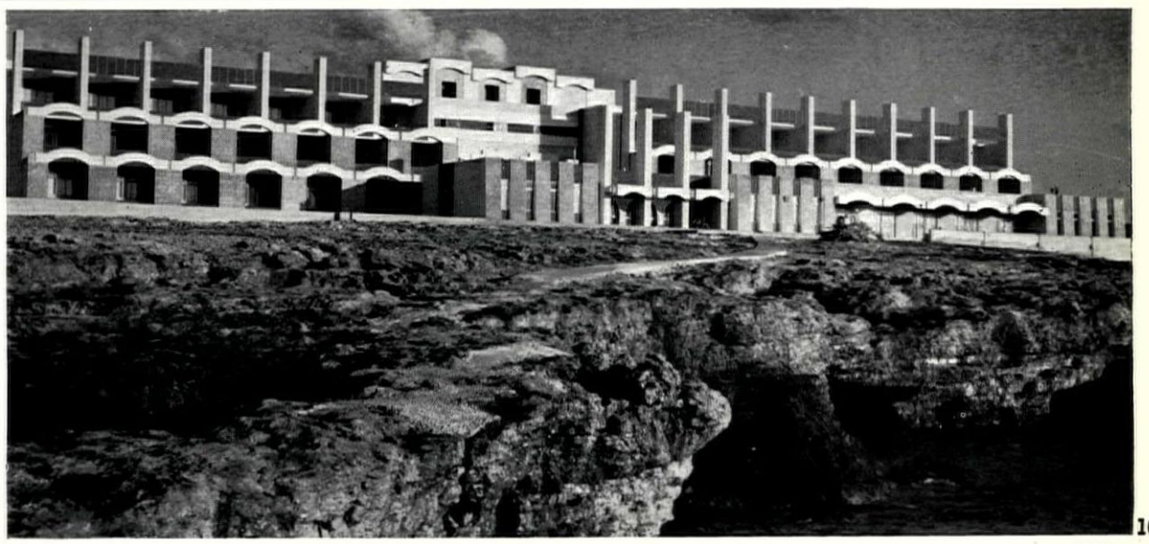
MALTA AND ENGLAND

Some of the forms used by Richard England in Malta, such as the arched lintol, derive from Maltese vernacular (see also AR World, December 1966). In the Ramla Bay hotel he has used this form to complete a projecting balcony structure, giving each balcony a sense of containment and framing the view out to sea, 16. More questionable is the projection of the dividing walls above into fingers pointing to the sky, when the walls are already high enough to support the fascia, 17. In terms of silhouette and rhythm this apparently meaningless gesture is



16

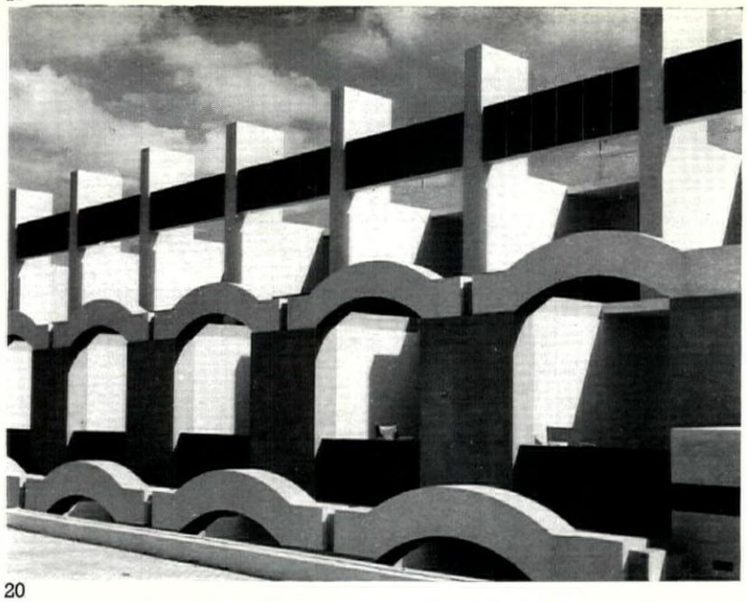
MALTA AND ENGLAND

18

highly effective from the sea side, but the loss comes around the entrance, 18, where a proliferation of fingers, no longer in silhouette, are mere rhetoric. Unlike Lafuente's Malta project for an hotel cut into a vertical cliff side (in AR World, February 1968), this is an hotel where one would wish to spend a holiday. The planning, as in all England's work, is clear and simple—at ground level is a central entrance area with lounges and bars, flanked by the manager's private quarters on one side and a restaurant and kitchen on the other; above are two floors of stepped bedrooms all facing the sea.

England's bold forms sometimes look as though they have not been fully translated from model stage to real life. There is something forced and unreal, for example, about the stepped balconies of the flats at St. Paul's Bay, 19, whereas the same flats from the other side have a relaxed simplicity which is totally convincing, 20. After that, the crisp detailing of the Sliema furniture showrooms comes as a surprise, 21. Instead of rough concrete or rendering, we now have exterior cladding of travertine and two floors of continuous steel louvres. As the architect has pointed out, this was an urban problem and no relationship to landscape had to be considered. In fact this building stands in the same relationship to the Ramla Bay hotel as does the neo-classical Italianate architecture in Valetta to country vernacular. But reservations must be made about the expression of projecting structure without its meaning being made clear at least at corners.

17



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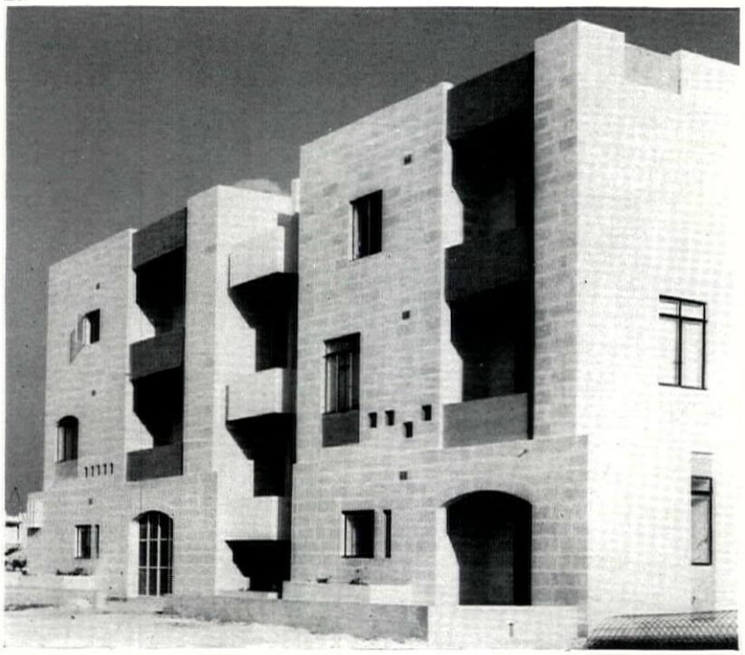

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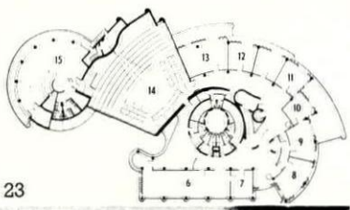
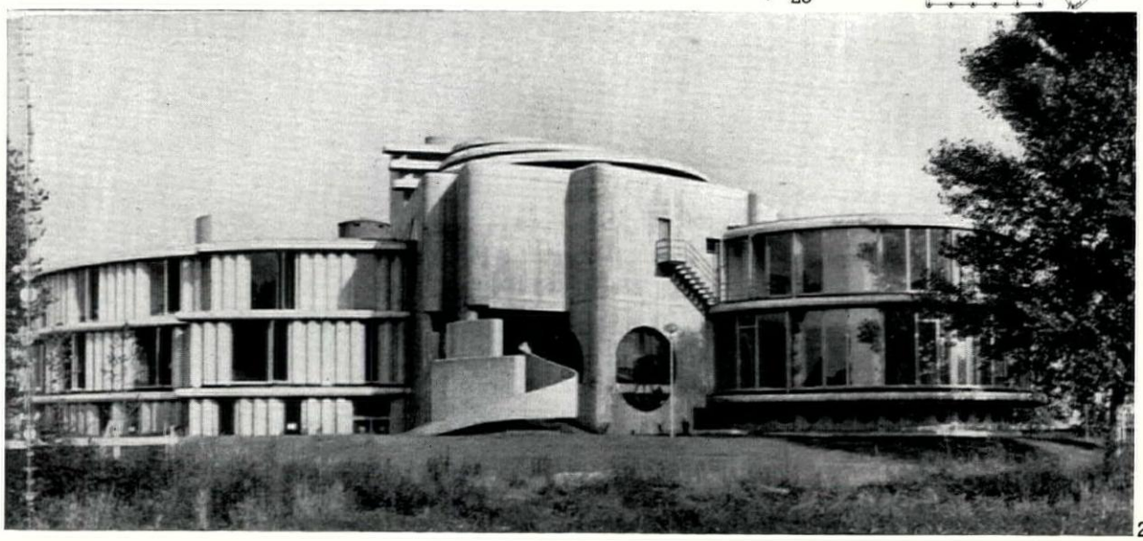
SEGRATE



23

The new civic centre at Segrate, an industrial town near Milan where the population has nearly quadrupled in the last six years, takes account of this trend and combines administrative, social and cultural functions, 22. The plan, 23, is in three parts—the main administrative area with a central circular service core, linked to a circular exhibition and library block by a council chamber. Beautifully sited, the building itself nicely echoes the slight swelling of the ground in its massing, 24. A combination of round and angular forms is skilfully handled, as in the flamboyant curve of the ramp cutting deeply under the council chamber. The rounded corners and circular windows of the council chamber also combine with corrugated walls and other round features to make a unified whole out of the different parts.



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VIEWS AND REVIEWS

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TRIBUTE TO KORN

The publication of a volume of writings as a way of honouring a distinguished man is a German practice, as the term for such a volume, *Festschrift*, indicates; so it is highly appropriate that the Architectural Association should have chosen this means of marking the retirement of the German-born Arthur Korn from the AA teaching staff at the age of 76.

The result is *Planning and Architecture: essays presented to Arthur Korn by the Architectural Association* (Barrie & Rockliff, 63s.), and the list of contributors gathered by the editor, Dennis Sharp, is an indication of the variety of people in the architectural world who are Korn's friends and admirers. They include William Holford, Maxwell Fry, Sigfried Giedion, Edward Carter, Ludwig Hilbersheimer, Percy Johnson-Marshall, Raymond McGrath and more than a dozen others.

Their articles do not add up to a very coherent book and most of them are only vaguely related to the ideas Korn himself has stood for, but it is better for people to write about what they know and if, in the earlier part of the book, Korn appears only as a background figure, that is only a reflection of the quality of his own influence. Although as an architectural philosopher and teacher his influence within the AA has been profound, he has never been one to push himself out of this private into a more public world. The latter part of the book contains articles about Korn himself and his work as an architect in Germany. In one of these Raymond McGrath writes about *Glas in Bau*, a book by Arthur Korn published in Berlin in 1929, and describes it as 'a unique collection of the architecture of the 'twenties—that precocious, confident and generally austere period in the development of modern architecture.' This opinion is fully substantiated by the book itself, which has been reissued (in its first English translation) as a companion volume to the *Festschrift*, under the title *Glass in Modern Architecture* (Barrie & Rockliff, 55s.).

GERMAN THEATRES

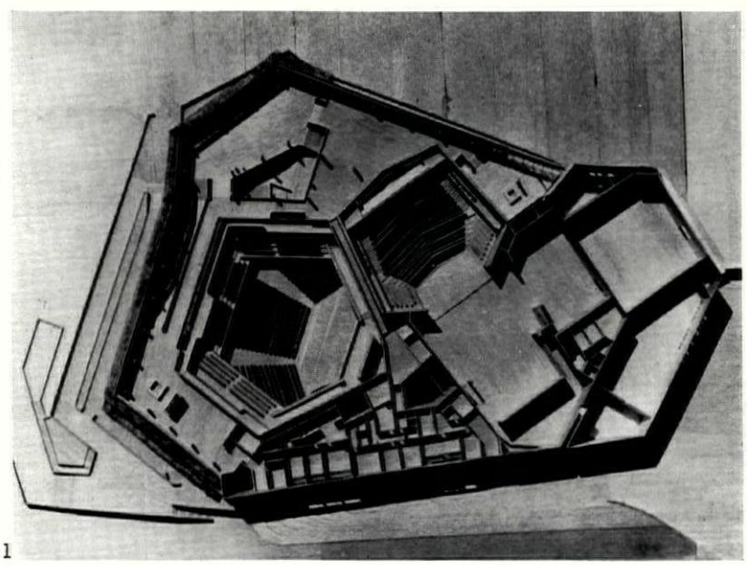
Theatres have been—and still are being—built in Germany on a larger scale than anywhere else, and the German activity in this field makes the British look pitiful in spite of the decision to go ahead at last with the National Theatre on the South Bank. In West Germany alone 207 theatres have been repaired or partially or, in some cases completely, rebuilt since the war. Seven large new theatres are now under construction, at a total cost of £29m. (compare this with the fuss made here about finding £7½m. for the National Theatre), and £35½m. is paid out every year in subsidies to the 165 theatres run by the various *Länder* or by local authorities.

This impressive programme, and the problems of theatre-design arising from it, were the subject of an exhibition at the Royal Festival Hall in February. Organized by the *Institut fur Auslandsbeziehungen* of Stuttgart, and designed by the Berlin architect Fritz Bornemann, the exhibition included models, drawings and photographs of a dozen recent German theatres. Among them were Ingolstadt, 1, with its two auditoria, completed in 1966 (architect, H. W. Hamer) and Mannheim, 2, built in 1957 (architect, Prof. Weber).

TREE PLANTING

A flood of practical guides on tree planting, transplanting, preserving and pruning has appeared in the last six months. The Arboricultural Association has produced a guide to the legal jungle of preserving trees called *Tree Preservation Orders* (price 9d., post paid) which includes notes on the new legislation embodied in the Civic Amenities Act. Accompanying it in the same series is *A Guide to Tree Pruning* (price 3s., post paid). Both are obtainable from the Secretary, D. R. Honour, 38 Blythwood Gardens, Stansted, Essex.

From the Civic Trust comes a range of publications on tree transplanting. *Moving Big Trees* (price 5s.; 6s., post paid) shows the visual results of the Trust's campaign to transplant more trees and the continuation of its work by the National Coal Board, using a larger machine imported from the USA (see the article 'Transplanting Semi-mature Trees' in the February AR). More of a working document is *Practice Notes on the Transplanting of Semi-mature Trees* (price 3s., 4s.; post paid). So too is *Tree Planting* (price 5s.; 6s., post paid), which contains a useful directory on where to obtain advice on tree planting and transplanting, a list of the Trust's own publications and films, a description of the various kinds of tree moving equipment, a bibliography on trees and a guide to commercial firms and nurseries holding stocks and capable of transplanting trees. As a record of a sustained practical exercise *The Civic Trust Trees Campaign* (price 3s.; 4s., post paid) is an excellent factual record of success—and failures too—and, coupled with a paper issued by the Trust at a conference on the Civic Amenities Act last year, *The Preservation and Planting of Trees*, is essential reading for any local authority or architect with a large development on the drawing board. Except for the conference paper, these are obtainable from the Civic Trust, Walter House, Bedford Street, WC2.



1

1, model of the Ingolstadt theatre by H. W. Hamer. 2, the National Theatre, Mannheim, by Weber.

2

HAM AND HIGH AND CLAPHAM

John Gay, the author of *London Observed*, and Leonard Clark, a poet, have combined to produce a charming *Prospect of Highgate and Hampstead* (Highgate Press, 30s.). John Gay's photographs are evocative and witty; Leonard Clark's text is compact and full of perceptive comment and historical flashbacks. John Betjeman has prefaced it and here he shall have the last word—'this book affectionately embodies the lasting, likeable and subtly different characters of Highgate and Hampstead.'

At Clapham, another of London's engulfed villages, the Secretary of the Clapham Antiquarian Society, Eric Smith, has written a brief topographical and historical guide to the Common, its houses and a few of its more interesting former residents. Illustrated almost entirely with old photographs, prints and drawings, it manages to convey the serenity of the Common a hundred years ago. Towards the end is a page given to details of the two local societies—the Antiquarian and the Civic. These societies, acting in concert, recently brought out a comprehensive survey and report on buildings of architectural merit or townscape value in Clapham. Perhaps Battley Brothers, the publishers of *Clapham: an historical tour*, will go on to publish this obvious counterpart with modern photographs. If so, Clapham will be exceptionally well served. The guide is available from Battley Brothers Ltd., The Queensgate Press, 90-94 Clapham Park Road, London, SW4, price 7s. 6d.; the survey from the Hon. Secretary, The Clapham Society, Harry Graham, 19 Crescent Grove, SW4, price 5s.; 6s. post paid.

CRICH TRAMWAY MUSEUM

The Tramway Museum Society, who run live trams on tracks laid by members in their open-air museum under Crich Stand in Derbyshire, have decided that their trams should start in a small industrial town setting of about 1910, the heyday of the tram.

At the moment there are very few buildings on the site with any architectural pretensions, and the plan is that the present buildings and any new that are needed should fit together to make an authentic tramway scene, with the buildings, the street furniture and the transport on the streets all working to this end.

With this aim in mind they are anxious to acquire suitable buildings for their nineteenth-century townscape capable of re-erection at Crich. It is important that they should be the normal day-to-day items such as would be found in any small town in England in 1910; not necessarily major works of art, nor of any specific period earlier than 1910. Buildings they are looking for include a large prefabricated conservatory, to be used for catering; another large building (for example a small chapel

or village hall) which could be used for exhibitions and meetings; shopfronts of a suitable character; a two-storey building of somewhat greater architectural pretensions, to be used as a members' building; a two-storey Victorian pub; a bridge of cast iron or stone spanning approximately 12 feet.

The Museum at Crich is one of the most remarkable in the country, including as it does moving and working exhibits. The members of the Society, entirely by themselves and unpaid, have preserved and restored over forty trams of various periods, have laid three-quarters of a mile of tram track, have built corrugated asbestos tram sheds for all their trams and even a generating station for the electricity to run the trams. Such enthusiasm deserves support, and particularly any help AR readers can give them in finding buildings to furnish their setting.

CORNISH SCULPTURE PARK

There seem to be hopes of reviving the project for a sculpture park at Kennal Vale, Cornwall, which was launched in 1966 (after being initiated by Dame Barbara Hepworth) and then shelved because of the economic crisis. The county council is considering the possibility of merging the project with its own schemes for improving cultural facilities in the county with the help of the increased funds lately made available for such purposes by the Arts Council. The county's scheme envisages a combined theatre and concert hall, and this could appropriately be provided as an enlargement of the original Kennal Vale scheme which, besides the sculpture park, included an art gallery, lecture room and open-air theatre.

Kennal Vale—seven miles from Truro, seven from Falmouth and six from Redruth—is an unspoilt valley of 27 acres containing beech-woods, open spaces, granite outcrops, cliffs and cascading streams, and was considered by the trustees of the project (who include Alan Bowness, Peter Gimpel, Dame Barbara Hepworth, Henry Moore, Norman Reid and Peter Nilson) to be an ideal place for displaying sculpture in the open air.

LIMELIGHT ON CEYLON

Mr. Geoffrey Bawa, the best architect in Ceylon (see the portfolio of photographs of his recent work in AR, February 1966) was awarded earlier this year the Pan-Pacific Citation of the Hawaii Chapter of the American Institute of Architects. This award, given annually (in conjunction with the State Foundation on Culture and the Arts) to architects in countries bordering on the Pacific rim area, has been in existence for nine years. The first winner was Kenzo Tange of Tokyo; last year's winner was Miles Warren of Christchurch, New Zealand.

POLISH GUIDE

A most useful book in English about ancient Polish architecture has just been issued by the Polonia publishing house in Warsaw, with the somewhat misleading title *Guide to Architecture in Poland*—misleading because the book excludes contemporary architecture and pays very little attention even to that of the nineteenth century. It could more accurately have been called a guide to Poland's historic architectural monuments, since it also contains very little about the vernacular architecture of town or countryside.

Within its limitations, however, the book is very well done and should be known to every visitor to Poland. It consists of an introductory essay summarizing the course of Polish architecture, a list of about 3,500 buildings, arranged in towns or villages alphabetically, with very brief notes about each, and a series of excellent maps on which every town or village represented is marked. There is a good number (nearly 400) of very small photographs, but no plans of buildings. The authors of the guide are Jerzy Z. Lozinski and Adam Milobedzki. The English translation is by Agnieszka Glinka. No price is given.

3, *these two shop fronts in Sloane Street, London, make good use of the existing pilasters and fascias. The interior of the Hooper Bolton shop is illustrated in this month's ID section on pages 285-286.*

correspondence

LIVERPOOL UNIVERSITY

To the Editors.

SIRS: Mr. Ian Nairn's comment on the new Liverpool University administration building in his 'Outrage' column in your January, 1968, issue, will mislead those who do not know the facts. For example:

(i) 'Georgian terraces.' The east side of Abercromby Square comprised six stucco-fronted houses with an irregular roof line. Only one of these was built before 1836 and three of them had large projecting bay-windows of standard Bayswater Victorian type. The east side was therefore in marked contrast to the other three sides of the Square, which are all of a dark red brick with stone trimmings.

(ii) St. Catharine's Church was burnt out by enemy action during the last war and dry-rot from the ruins infected adjoining houses. The portico alone survived. The University spent an appreciable sum in making this stable just after the war, and much thought was given to retaining the portico either as an entrance to a new university building or by its re-erection elsewhere. This proved quite impracticable.

(iii) The whole matter of replacing the east side of the square was most carefully examined, and received the approval of the Royal Fine Art Commission in 1964. The height of the new building has been kept down to the general eaves and line of the rest of the square, and the colour of its brick facing comes very close to that of the other buildings.

4, *derelict houses on the east side of Abercromby Square, Liverpool. See letter above.*

I enclose a photograph showing the state of the houses on the east side of Abercromby Square prior to their demolition.

Yours, etc.,

H. M. BURCHNALL

(Registrar, University of Liverpool)

book reviews

LAKES AND HANTS

THE BUILDINGS OF ENGLAND: CUMBERLAND AND WESTMORLAND. *By Nikolaus Pevsner. Penguin Books.* 25*s.*

HAMPSHIRE AND THE ISLE OF WIGHT. *By Nikolaus Pevsner and David Lloyd. Penguin Books.* 42*s.*

'Langdale Pikes, situate at the western extremity of Westmorland . . . form a vast amphitheatre, where the simple beauties of nature unite, in effect, with the loftier and more sublime creations of the Almighty hand. . . Feelings of reverence, of astonishment, of undefined pleasure, flow through the heart, as we fix our earnest gaze upon the surrounding hills.' Thus *Westmorland, Cumberland . . . Illustrated* (1832). In 1843 the *Illustrated London News* commented in its issue of September 2 that never before had the northern lake districts been so crowded with tourists, of whom the most distinguished called upon Mr. Wordsworth.

A geological, a literary, a social phenomenon: the Lake District. In the beginning was the 'ancient hard knot' of Ordovician and Silurian rocks, out of which grew stone-axe workshops, Roman forts, dry walling, fifteen-foot crosses. And, after considerable history and hard hill-and-dale life, visitors in search of 'feelings of undefined pleasure' and Mr. Wordsworth. So an architectural inventory of these two counties is full of overtones and undertones, heard or unheard—Plaw's domed cylinder Belle Isle on its island in Windermere, evoking contemporary French architecture as well as the discovery of Picturesque siting; Netherby Hall without any Lochinvar, though William Burn, in the baronial rebuilding of 1833, must have thought of him.

A welcome innovation, hoped for in a previous review in this place, follows Dr. Pevsner's indispensable summary of architectural history and the scholarly contributors on geology, prehistory, and the Roman period; namely an introduction on building materials by Mr. Clifton-Taylor. Here he mixes science with sensibility, being concerned with the look of stone in use as well as its sources in the ground—for instance in describing the pinkish-grey stone of Dalemain, near Ullswater. But no clue is given to the type of stone used for those great crosses in Cumberland. Of course the fascination of these, especially the seventh-century Bewcastle shaft, with its amply modelled sacred figures and sophisticated scrollwork, lies in their importance as works of art—European art—which no one is better fitted than Dr. Pevsner to assess. Still, the sort of stone used might provide some answer to a question he poses about their extraordinary state of preservation after thirteen centuries of Cumberland weather.

Another question concerns the origi-

The 'Earl Haig' at Hounslow. Architect: J. C. G. Sharman, ARIBA. Installation by Lamertons (Contracts) Ltd.

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AR/4/68 ®

nality of the little neo-Lombard church at Wreay (more fully in AR, July, 1967), apparently designed by the amateur Miss Losh soon after 1835, well before the better-known English churches in this style, such as Wilton, were begun. Yet such churches could have been designed in England at any time from 1835 on, out of the plates volume of Thomas Hope's posthumously published *Historical Essay on Architecture*, illustrated from Hope's drawings (pre-1831) mainly of German and Italian churches in what he called 'the resumed style of the ancients.' Much of Miss Losh's building is there, with the precise quality of those plates, yet using them in a free way. How amusing that a Father of the Grecian Revival should have fathered a Lombard revival too. Still, other Englishmen such as Professors Whewell and Willis were interested in German churches and Italian Gothic in the 'thirties. Locally, moreover, Wreay is not many miles from Warwick's twelfth-century semicircular apse and Carlisle's fourteenth-century foliage in the cathedral chancel. We can know little of the whole context of a new idea, but influential books and familiar local forms may be the likeliest jigsaw pieces. However, Dr. Pevsner can have little space for this sort of speculation. What we must appreciate, and never take for granted with the increasing number of counties 'done' in the Buildings of England series, and ready to be slung into the holiday bag, is the tremendous concentration of mind required to produce these complicated inventories.

And now *Hampshire*, the fattest one yet (64 more pages than *Lincs*). David Lloyd contributes Southampton and Portsmouth, the towns and villages between them and up to the Sussex border—not quite yet one conurbaton—in sympathetic, careful detail. His loving descriptions of waterside groups of buildings along the creeks and harbours make one rejoice that these places still exist. He is also good at describing complex modern groups in process of change, such as Southampton University. Dr. Pevsner's account of Bournemouth, so rich in Victorian churches, was greatly and minutely assisted by Nicholas Taylor. Whether the proportional representation of cities in this series ought to be, for example, the same for Southampton as for Norwich, I just don't know; yet the coverage for Bristol was rightly longer than either and only equalled by Birmingham so far, London aside of course. The sheer size of this *Hants* volume must be due to the combination of its coastal towns with the international interest of Winchester, the necessary inclusion of the Isle of Wight, and the number of country houses.

A reviewer confronted with all this can only throw off a few squibs, damp or not. With the account of Winchester is a summary by Martin Biddle of the excavations of the Old and New Minsters preceding the Cathedral, with a postscript on 1966 finds and illustrated by an unusual stone panel found in 1965, a fragment perhaps of a late Saxon frieze. On the basis merely of this photograph, without seeing detailed reports or the object itself, it does look surprisingly like some Sasanian carved reliefs (is the stone local?). Not like a copy of a silk design either, but after work in the same medium.

From Winchester College of many centuries later, some sophisticated woodcarving of 1680–3 attributed to Edward Pierce includes, above a doorcase, consoles flanked by inward-turning volutes—that feature of architectural ornament often credited to Thomas Archer as chief Borrominibringer but dated here ten years before he was in Rome. Which probably just means that woodworkers used Borromini's engravings before architects did. Both Saxon panel and Stuart volutes may prove how travel-prone the minor arts were.

Dr. Pevsner poses a question about Nash's church-tower mausoleum of 1816 at Cowes, 'so unlike Nash,' he says, so radically simple as to seem almost twentieth-century. Yet how it does resemble Belanger's slaughter-house towers—nothing evocative here; for example one illustrated in that odd book, Kaufmann's *Architecture in the Age of Reason*, which mentions a publication of 1814 by Belanger on these. Increased communication with Paris after Waterloo may have brought these designs to the client's, or the ever-adaptable Nash's, notice. The whole matter of Nash's work at Belleview (Northwood) House near the church for the same client needs study, as Dr. Pevsner says.

And finally a literary point: is not Luttrell's Tower, overlooking the Solent and described under Eagle-hurst, the original of that New Forest bachelor's tower in Peacock's novel *Gryll Grange*? It most delectably sounds like it. PRISCILLA METCALF

5

5, the Warwick gittern. For a closer look, see the frontispiece overleaf.

GREAT PLANS

MONUMENTAL WASHINGTON: *The Planning and Development of the Capital Center. By John W. Reps. Princeton University Press, and Oxford University Press* 1967. £5

Hear the title of this book and you envisage a sumptuous portfolio of richly coloured photos. But it means exactly what it says—Washington the monumental, government city, the enshrined capital. Read it and you find an engrossing history of the great plans, from L'Enfant through the McMillan study to the Owings project for Pennsylvania Avenue. There are a hundred illustrations, many of which are new to most of us; they inform, astonish and appal by showing not only the lay of the land and what happened, but what well might have happened. It is an important book, a splendid follow-up to its predecessor, Professor Reps's *Making of Urban America*.

The central feature is a detailed presentation of the 1901 plan undertakeby Burnham, McKim, Olmstead and Saint-Gaudens at the request of Senator McMillan. That the city waited and made mistakes that long after L'Enfant's original 1791 projection, that there has been a long interval, too, for good planning since, might seem to be due to the enduring strength of the first scheme and a reluctance to tamper overtly with a plan approved by the founding fathers. It is, on the contrary, due to the intelligence and perseverance of architects, and architects emboldened to battle. Led by Glenn Brown, a vigorous AIA opposed projects at the turn of the century that would have done irreparable harm, and under McMillan's sponsorship an appropriate professional committee was formed.

If proof were required that the architect, with his zeal for site and passion for detail, is the ideal man to project and to insist upon the meticulous carrying out of ambitious planning, it is here recorded in the work of Burnham and McKim. Burnham, who was to be the architect of the new railroad station, did not want the terminal on the Mall like the old one because it would have continued to wreck the top of its vista. He and his colleagues persuaded the railroad and the government, and the present site north-west of the Capitol resulted. They also wanted an 800-ft. width for the Mall and argued with the White House and Congress until precedent was established beyond all doubt. Speaking to the AIA in 1905, President Theodore Roosevelt said: 'The only way in which we can have artistic work done for the Nation, State or municipality, is by having such a growth of popular sentiment as will render it incumbent upon successive administrations, or successive legislative bodies, to carry out steadily a plan chosen for them, worked out for them, by such a body of men as that gathered here.' Those who suppose that times have changed for the better since need only have sight of the new Theodore Roosevelt Memorial and recall absurd difficulties encountered by the Pennsylvania Avenue Commission.

Among the men Roosevelt addressed was Charles Moore, author with Olmstead of the masterly McMillan report printed by Reps almost entire. As chairman of the Fine Arts Commission until 1937, Moore saw the plan through. Yet it was unfortunate, as Reps remarks, that Moore was doggedly opposed to modern architectural design and, like McKim and Burnham, favoured only Greek and Roman models. Here lies the inspiration for Washington's failure to produce any modern buildings of character. Bureaucratic loopholes continue to permit aberrations of the monumental on Capitol Hill. A tendency to catch up with the twentieth century, encouraged by the Kennedy and Johnson administrations, and projected work such as Lundy's new Tax Court, only begin to compensate for the fact that Washington's most distinguished modern building lies at Dulles airport an hour away.

The brief Professor Reps has given himself cannot extend beyond the monumental, but Washington has other roles to play. It is a city of 800,000 and the central city of a growing metropolitan area. The Pennsylvania Avenue plan goes beyond the monumental to relate the official city with the business city and the National Capital Planning Commission's comprehensive plan projects the city's future in all three roles up to 1985. Neither is able to proceed fast enough and there is as yet no site for foreign missions, an essential element in the city. While the Commission of Fine Arts could write in the 'thirties that 'it is better to wait a quarter of a century rather than resort to any compromise plan' and say that public taste is of slow growth, the current public situation requires solutions other than the monumental. FRANCIS MASON

PRINCE'S PARKS

PARKS IN ENGLAND. *By Hugh Prince. Pinhorns, Shalfleet Manor, Isle of Wight.* 12*s.* 6*d.*

Mr. Prince is lecturer in geography at University College, London. His book is 56 pages long and consists of an introduction on the changing size of parks, scenery of parks and resulting general landscape, and then maps and lists of the parks made or improved by Charles Bridgeman, Kent, Capability Brown, Richard Woods and Repton. The lists include the names of the clients. According to the lists Bridgeman is connected with 23, Kent with 24 (of which 15 are doubtful), Brown with 188 (41 doubtful), Repton with 222 (eight doubtful). Brown's and Repton's were enormous practices indeed. Woods is the least known of the six. He worked chiefly in Essex and can be followed from 1758 to 1788. S.T.S.

CITY SAGA

2,000 YEARS OF LONDON. *By Michael Hanson. Country Life.* 90*s.*

This engagingly illustrated book is what its title suggests—a pictorial history of London with emphasis on its streets and buildings rather than on the life that inhabited them. But well selected though the pictures are—mostly prints and engravings, giving a sense of how each epoch looked at buildings as well as how they built—this is a good deal more than a picture-book. The text is lucid and knowledgeable, and although it does not pretend to original scholarship it contains a quantity of relevant information and gives an admirable picture of the growth and development of London, the influences that shaped it and the architecture that enables us to trace those influences today.

The latest in the important series of Council of Europe exhibitions is on Gothic art from the beginning to *circa* 1350. It opened on April 1 in the Louvre in Paris. England is scantily represented. It is therefore especially tragic that the British Museum refused allow the Warwick gittern, shown here, to go to Paris; for it is not only the best piece of English medieval woodcarving, but the best piece of ornamental woodcarving of its date in the whole of Europe. The date must be the end of the thirteenth century. The gittern is the medieval form of the guitar. The Warwick example is 2ft. long and until recently was at Warwick Castle. It was restored and remodelled in 1578.

Christian Norberg-Schulz

LESS OR MORE?

Architects' publications are at present dominated by studies on topics taken from sociology and psychology, economy and ecology, mathematics and communication theory. The only subject which, paradoxically, is missing, is *architecture*. (Not considering, of course, the direct presentation of new projects and buildings.) By the word architecture, I have in mind the concrete means an architect uses to solve the tasks he is facing, that is: architectural *forms*. Architects are obviously afraid of approaching this problem; it is, for instance, maintained that it would be irresponsible and egocentric to discuss 'form,' when a majority of the world's population is starving, and for the same reason it is said that we should stop talking about 'architecture with capital A.'

This attitude is understandable, but nevertheless it stems from a basic misapprehension. Although the architects of a hundred years ago became victims of a *l'art pour l'art* approach which destroyed their contact with the concrete problems of society, it would be wrong to conclude that they had better stop being architects. It helps very little to become amateurs in other fields, where much better qualified people are available. It is still the architect's task to shape man's environment, and *his* speciality is the knowledge of, and ability to make, the necessary forms.

This idea of the architect's profession is not unrealistic and egocentric. In an epoch dominated by the strict economy of underdeveloped countries, it is particularly important *not to commit errors*. The architect, therefore, has to be a highly qualified professional, master in his field. If he ceases to be that, society will no longer need him. One might perhaps object that his ability to create forms is not enough; that he should also know society's needs in order to be able to make *relevant* forms. This is certainly true; I do not talk about form for form's own sake. I just want to stress the fact that intelligent programmes are of little avail unless the architect can translate them into concrete forms.

In my opinion, therefore, the weak position of the architect in society is not mainly due to too great an interest in form; rather does it stem from the fact that he does not really master this aspect, which ought to be his speciality *par excellence*. For the first time in history the architect is today a poor professional, so that it is only to be expected that engineers and bureaucrats should take over. Hence it is urgent that we give back to architecture the capital A it has lost.

In Robert Venturi's new book *Complexity and Contradiction in Architecture*, which Vincent Scully has characterized as the most important publication in our field since Le Corbusier's *Vers une Architecture* of 1923, he says: 'The architect's ever diminishing power and his growing ineffectualness in shaping the whole environment can perhaps be revised, ironically, by narrowing his concerns and concentrating on his own job.'

The problem of form can be approached in many ways. Current studies are mostly of a rather abstract kind, taking up problems such as modular co-ordination and tri-dimensional geometry. Again we meet the reluctance to approach architectural form in a direct and concrete way. By 'architectural form' I mean the articulation and characterization of masses and spaces. This *physical manifestation* of the building task must necessarily remain the basic property of architecture.

My spontaneous reaction to Venturi's book is therefore quite obvious: *At last an architect who has the courage to write about architecture!* Its importance does not mainly consist in his attempt at proving that 'less is bore,' but in the fact that he dares to analyse spaces and façades as *forms*. By organizing his observations in defined categories, they become still more valuable, and he makes in fact a substantial contribution to the development of an architectural grammar.

Complexity and Contradiction is a small book, crowded with stamp-like illustrations and with a text treated as a sequence of captions. It does not offer a systematically worked-out theory, but discusses some interrelated phenomena which, so far, have been overlooked in modern architecture. These phenomena are denominated 'complexity,' 'contradiction,' 'ambiguity' and 'both-and.' We understand that they refer to the fact that an architectural form often has to be very complex to satisfy the different aspects of a multifarious building-task. Venturi thus talks about 'the richness and ambiguity of modern experience.' But at the same time he points out that 'complexity' and 'contradiction' do not mean 'incoherence,' 'arbitrari-

ness' or 'subjective expressionism.' What he aims at is 'the difficult unity of inclusion rather than the easy unity of exclusion.' This definition corresponds to my own attempt at understanding architectural form as 'the concretization of an intermediary object'; that is, a complex of logically incongruous phenomena which cannot be satisfied by a simple form (see my *Intentions in Architecture*).

It would, however, be wrong to interpret this 'complexity' as something which excludes 'simplicity.' Venturi explicitly says that 'the recognition of complexity does not negate the desire for simplicity.' Obviously it would be silly to choose a solution which is more complex than the task-structure. It is only important to realize that simplicity *as such* is a meaningless ideal. The 'cult of the minimum' of orthodox modern architecture, therefore, is anything but realistic.

Venturi justifies complex form by referring to the 'several levels of significance' of most phenomena. A form usually has several 'meanings,' and has to be understood in its total context. Venturi gives particularly illuminating examples, analysing façades which *both* express the private scale and character of the rooms behind, *and* the quality of the public space outside. Orthodox modern architecture, maintaining the ideal of 'either-or,' taught us that buildings should always be designed from the inside out. Venturi, however, says that 'designing from the outside in, as well as the inside out, creates necessary tensions, which help make architecture.' The idea of 'levels of meaning' corresponds to my concept of 'formal levels', a concept which is particularly fertile in relation to urban form, as illustrated by Venturi in several examples.

Venturi also approaches the question of 'conventional elements'. Here he touches upon a difficult, but very real, problem. We are today again facing a tendency to 'borrow' forms uncritically from a more or less distant past. Venturi shows, however, that the exclusive purism of orthodox modern architecture was no solution to the underlying problem. Conventional elements are always necessary. To create a form does not mean inventing something completely new. The task of the architect is rather 'the organization of a unique whole through conventional parts and the judicious introduction of new parts when the old won't do'. The 'devaluation' of forms in the nineteenth century was not a result of the application of conventional elements as such, but of their use without a consistent formal system.

The problem 'outside-inside' is given particular attention in Venturi's book. In this connection he quotes Eliel Saarinen, who said that 'Building is organization of space in space.' This does not necessarily imply that the outside and the inside have to *correspond;* a group of spaces often consists of 'dominant spaces' of varying shape and 'residual spaces' between them. Venturi here refers to Aldo van Eyck's illuminating statement of 1962: 'Architecture should be conceived of as a configuration of intermediary places clearly defined. This does not imply continual transition or endless postponement with respect to place and occasion. On the contrary, it implies a break away from the contemporary concept (call it sickness) of spatial continuity and the tendency to erase every articulation between spaces, i.e., between outside and inside, between one space and another (between one reality and another). Instead the transition must be articulated by means of defined in-between places which induce simultaneous awareness of what is significant on either side. An in-between space in this sense provides the common ground where conflicting polarities can again become twin phenomena.' The building is thus understood, once again, as the product of many 'forces,' and therefore as a complex form which differs fundamentally from the simple, abstract prisms of orthodox modernism.

Venturi's descriptions are short, but precise. He can illustrate an important point with the use of few words, and has chosen to make his book a continuous series of pictures and captions which are somewhat loosely joined together. As an example, I may quote his brilliant analysis of the Villa Savoye: 'The Villa Savoye with its wall openings which are, significantly, holes rather than interruptions, restricts any flowing space rigidly to the vertical direction. But there is a spatial implication beyond that of enclosure. Its severe, almost square, exterior surrounds an intricate interior configuration glimpsed through openings and from protrusions above. In this context the tense image of the Villa Savoye from within and without displays a contrapuntal resolution of severe envelope partly broken and intricate interior partly revealed. Its inside order accommodates the multiple functions of a house, domestic scale, and partial mystery in a sense of privacy. Its outside order expresses the unity of the idea of house at an easy scale appropriate to the green field it dominated and possibly the city it will one day be part of.'

Like most writers on architecture, Venturi has probably experienced how difficult it is to escape misapprehensions. One of his terms, which is particularly open to misapprehension, is the basic concept of 'contradiction.' There undoubtedly are relations which logically appear as contradictions but which existentially form a meaningful whole. In *Intentions in Architecture* I tried to show that the purpose of art is to 'concretize' such complexes. There are also, however, contradictions which do not in any way unify, as implied by William James when he said that it is one of man's basic aims not to contradict himself. An uncritical use of the term 'contradiction' would open the way to such meaningless relationships. Venturi warns of this early in his book, when he says that 'contradiction' does not mean 'incoherence'. Let me repeat his warning.

Venturi's observations ought to be carried further as soon as possible. His formal descriptions mainly follow the path indicated by art historians such as Wölfflin, Frankl, Brinckmann, Wittkower and Sedlmayr. It is, however, possible to develop a more systematic theory of form, as a parallel to current system-theories in other fields. Venturi refers to Le Corbusier's statement that 'There is no work of art without a system', and he sometimes approaches architectural forms as simple or complex (combined) systems which reflect different functional structures. Only through a further development of this approach can our profession regain its foothold.

We need more architecture, not less.

MAMMAL HOUSE, LONDON ZOO | *architects* DESIGN RESEARCH UNIT | *photographs by Henk Snoek*

1, the main entrance seen from the canal bank.

The construction of the new Mammal House marks the half-way stage in the rebuilding and modernisation of the London Zoo. Its main aspect is to the north overlooking the canal, with the Outer Circle of Regent's Park to the south. It is approached across the canal by a new footbridge, with a second approach along the canal walk from the east.

Designed to house the London Zoological Society's large collection of small mammals, the Charles Clore Pavilion contains 110 cages and three outside enclosures. The building is basically a single-storey structure with a basement and a small first floor. Nearly all of the ground floor and basement are given to accommodation for the animals and viewing space for the public. Accommodation for keepers on the ground floor consists of a mess-room, a changing room with lockers, provision for clothes-drying, a shower and a lavatory, and an equipment-servicing and storage room. On the first floor are the curator's and secretaries' offices, cages with observation rooms and accommodation for new animal arrivals.

Simple brick walling and paving have been used throughout. The main circulation routes are lined with a glazed conservatory. Externally the top lighting means

2

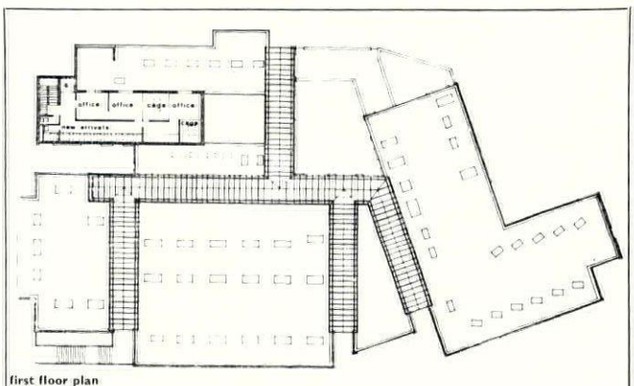
2, 3, the west wing. Dark grey bricks are used internally and externally. Sloping glazing avoids reflections and staining by animals.

3

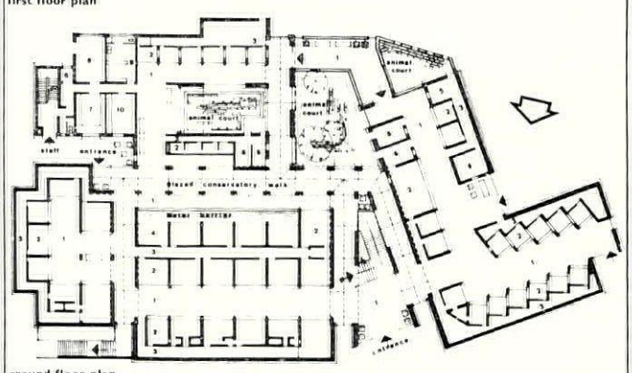
that the walling is virtually uninterrupted and a splayed plinth links these dark walls with paving of similar colour which surrounds the building. The glass ends of the conservatory-walk open up vistas through the building.

200 burrowing, jumping, running and climbing animals —marmots, martens, civets, genets, mongooses, binturongs, lemurs, marmosets, bobcats, lynxes, and wombats—to mention but a few, are accommodated in the pavilion. Almost half the animals are normally active from dusk to dawn. All these are exhibited together in a large nocturnal section, 'The Moonlight World,' in the basement. Special lighting reverses their days and nights so that they are most active during public visiting hours. When the zoo closes, the lighting gradually increases in intensity and the animals fall asleep. Some non-jumping mammals are housed in open cages separated from the public by a 5ft. wide water barrier. A warm-air curtain at the cage front insulates the animal smells and the cage temperature from the public area.

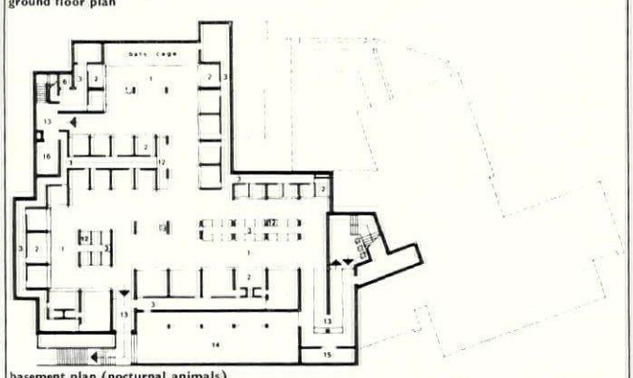
Assistant-in-charge, M. G. Green. Structural engineer, Flint and Neill. Quantity surveyors, C. Ball and Partners. For contractors see page 324.



first floor plan

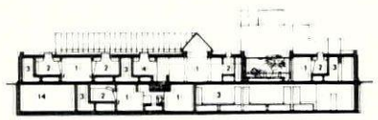


ground floor plan



basement plan (nocturnal animals)

long section



cross section

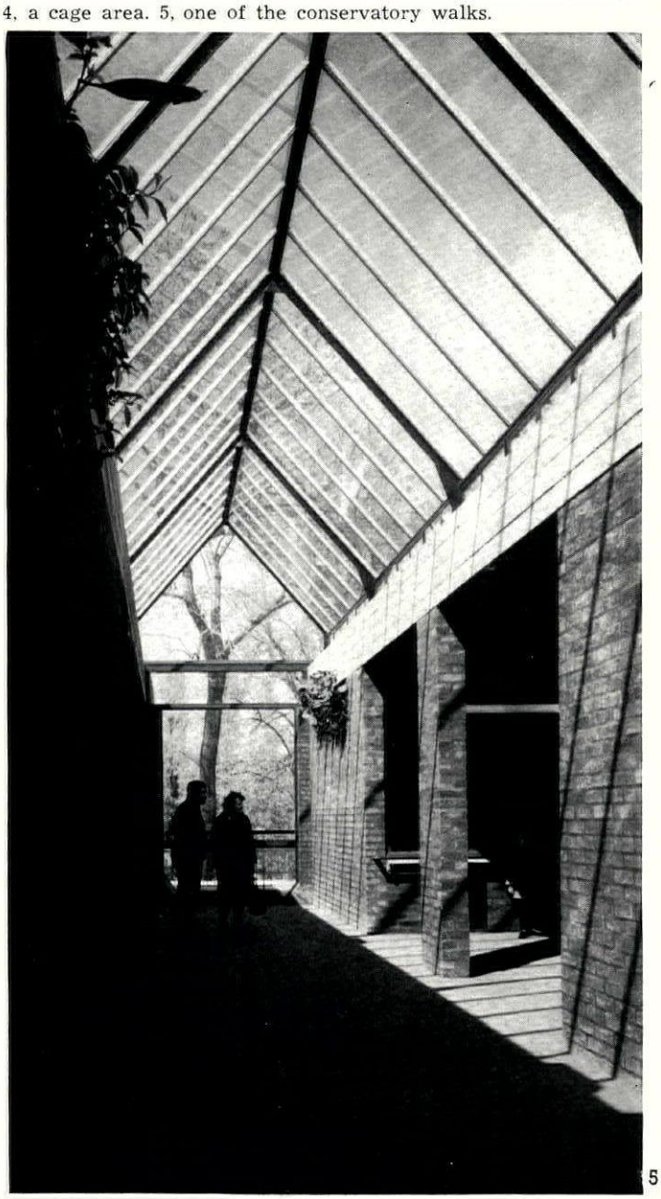
MAMMAL HOUSE, LONDON ZOO

key

1. public area
2. cages
3. keepers' service area
4. open cages with water barrier
5. dens to outdoor animal courts
6. lift
7. animal food preparation
8. facilities
9. staff changing
10. staff
11. staircase to nocturnal animals
12. burrowers and rodents
13. light lobby
14. plant room
15. electrical gear
16. boiler room

4

4, a cage area. 5, one of the conservatory walks.



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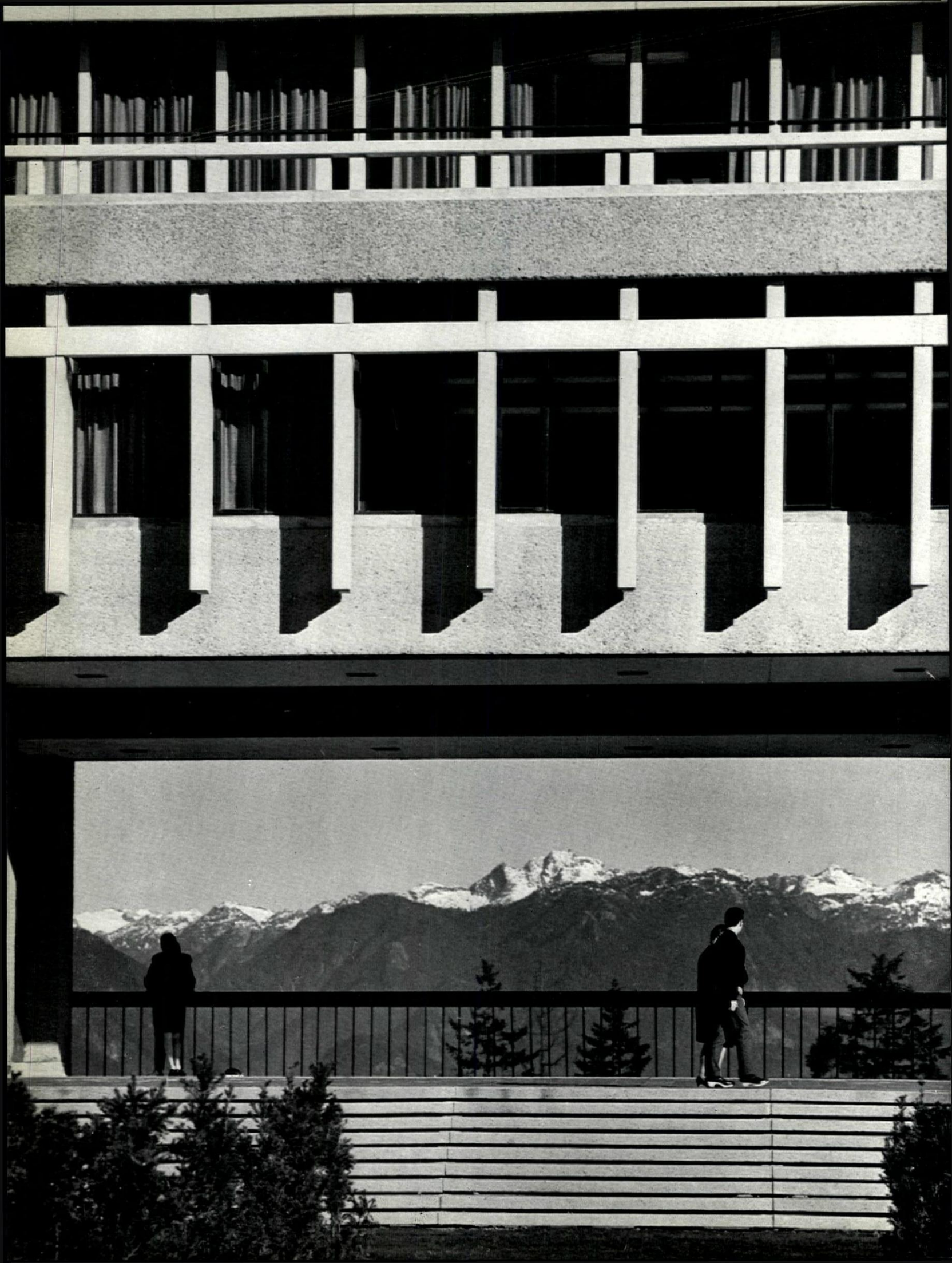


Opposite: 'the Simon Fraser "cloister" . . . possessing a kind of Romanesque severity, a single-minded spirit bent on concentration, contradicted only by the open view of distant horizons'. In the article below, Abraham Rogatnick dwells on the Mediterranean influences of this Canadian university. The buildings are further illustrated on pages 266-275.

criticism

Abraham Rogatnick

Architects: Erickson & Massey

Simon Fraser University, British Columbia

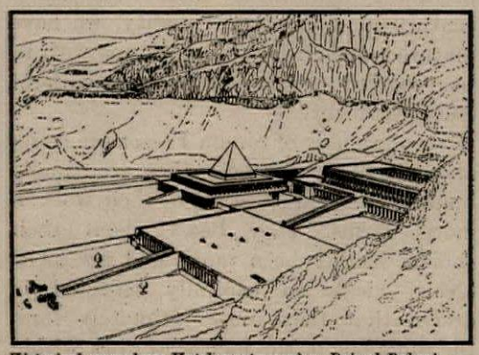
'. . . *Where Thy Gentle Wings Abide*'

The music of Beethoven should accompany one on the climbing motor road to Simon Fraser University near Vancouver; the experience is so heavy with sweet melancholy and romantic expectation. First there is the majestic sequence of the tall evergreens, darkened by persistent rain and softened by the misty grey of water-laden air. Then there is the pleasurable feeling of ascent and the pure exhilaration of approaching higher places. When a bit of fog hangs mercifully over the lower levels to mask the monotony of the streets from which one has just emerged, the sense of travelling in Elysian realms is even more acute. After the first long rise, the road begins to bend and turn and enter more intimately into the play of the mountain contours. Fleeting glimpses of the higher wooded slopes and peaks across the inlet waters to the north, or back down to the planar urban pattern extending almost infinitely into the fading horizon, emphasize the depth of the isolation into which one seems to enter, and make one ever more aware of a tense anticipation of what is just ahead. Then, still climbing, there is a large, slow, curving-to-the-left around a tantalizing wooded prominence—and all at once, the first glimpse of the goal.

Like the approach to the Parthenon or the Acropolis itself, the path is indirect. What first appear are side views of strong concrete forms still undefined and foreshortened in long line of perspective. In the distance, the loftiest element, the academic block, is all but hidden as it floats above the structures stretched along the summit. All looks white, serene and joyous, yet mysterious—even sacred—in its proximity to the sky. '*Freude, schöne götterfunken. . .*'

Lhasa? Deir-el-Bahari? Monte Alban? Forum Romanum? Pergamum? Depending upon the experience of the visitor, nearly every radiant exemplar of world architecture has been mentioned after the first few draws of delighted breath.

It is no surprise to learn that Arthur Erickson, a sensitive traveller and a poetic interpreter of history, has had a personal involvement with nearly every one of these fabled far-off places, and has steeped himself deeply in the times from which they came. However, he believes that few specific models were in his conscious mind when the design of the complex on Burnaby Mountain was in its formative stage. It was only in retrospect that he began to see his life of romantic experiences passing before him, first from the drawings, and then from the buildings themselves. One of the earliest—and perhaps most conscious—of these connections was made between the academic quadrangle, with which he crowned the complex, and his memory of the Plaza Mayor at Salamanca. It was the shock of the very squareness of that public square which awed him and left an exaggerated impression on his remembering eye. In that eye, it was a

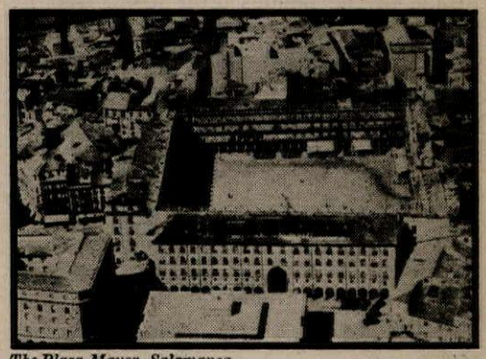


Historical exemplars: Hatshepsut complex, Deir-el-Bahari

space that emphasized nothing but itself, its geometric simplicity reinforced by the long low lines of the surrounding rooftops and the paved, unending emptiness of the ground. It seemed like a place where, according to Erickson, 'nothing happened,' nothing arrested the eye, nothing suggested a hierarchy of attention. It existed in a kind of suspended and infinite tranquillity, Narcissus forever gazing at his own reflection, or better still, the symbol of detached, untiring meditation.

In fact, the Plaza Mayor at Salamanca is not a perfect square, nor does it lack its focal points. The facades do alter at the entrances and indicate a consciousness of the world beyond. However, in lifting up the square ring to reveal the paths that enter and move out along the mountain ridge, Erickson modified the introverted character of the quadrangle and brought the Simon Fraser version closer to the model than his image of that model would allow.

The emphasis on paths throughout the Simon Fraser complex is one of its most prevailing themes. From the flat, protected space that one must enter after leaving car or bus, one ascends a flight of steps to an open court wherein a single jet of water plays above a low, square basin (the Lion Fountain in Granada?) into the high, wide, glass-roofed *galleria*, where a complicated space-frame of steel and wooden members spans over, fracturing the light that filters

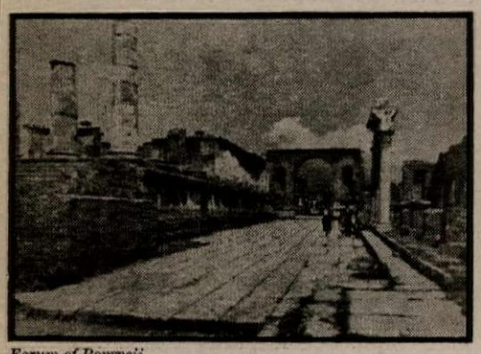


The Plaza Mayor, Salamanca.

through to fall below; then up on to another platform and down into a stepped arena open to the sky. Behind this rise the monumental stairs ascending to the great square halo on the summit, inscribed around a tranquil destination. Within this super-cloister an endless repetition of a concrete louvre motive loses the staccato of strong rhythm, and fades into nearly silent texture, unobtruding on the senses and undisturbing to reflection.

Erickson likes to think of the Simon

Fraser 'cloister' as possessing a kind of Romanesque severity, a single-minded spirit bent on concentration, contradicted only by the open view of distant, changeable horizons seen beyond the confines of the moment. The metaphor which he likes the least is that of Rome; but nonetheless, the comparison insists on being made. The academic quadrangle hovering over one end of the mall, the succession of grand structures strung out irregularly and flanking the axis of the monumental public space, at least murmurs of the Roman Forum, especially that view toward the Tabularium that has become familiar from our text-book reconstructions. However, if the scale of Simon Fraser calls up a place less bombastic than the Rome evoked by neo-classic narrators, the forum of Pompeii may suit. And although Simon Fraser's symmetry is not as stubborn as at Baalbek,



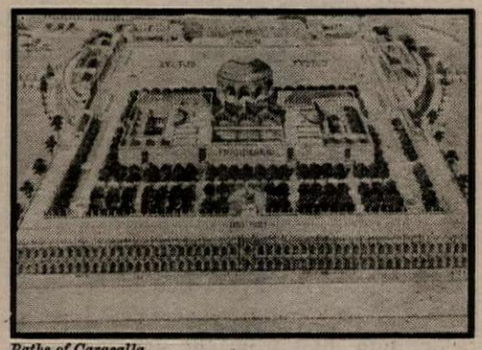
Forum of Pompeii.

the two must surely claim a kinship in their spatial sequences.

Erickson admits to Pergamum in the table of reminiscences elicited by the buildings on Burnaby Mountain. He talks about a certain colonnade which seemed designed to aid in peripatetic cogitation. Again, however, the point of comparison seems tame. Why not the candid scenographic drama of the famous altar itself; that is, as reconstructed in Berlin? The steep ramp of stairs roaring up to the mysterious colonnaded facade of the temple or temenos (the mystery is not revealed until the top step is reached) is remarkably near in arrangement to the flight of steps leading from Simon Fraser's mall to the academic sanctuary above. All we need to complete the picture are some tortured sculpted combatants squirming on the surface of the bastions of concrete which flank the stairs.

Although the ascending, winding roadway, already mentioned, brings the Acropolis of Athens into mind, on closer view, the simile begins to fade into abstraction. It is the evocation of acropolis in general which stays, the sacred village upon that upper plane, whose temples shimmering in the evening light at once excite the envy and the admiration of the earthbound city far below. It is that higher place in which the chosen dwell, at once exclusive and inviting, the true city, the spiritual essence of the urban ideal, of which the town beneath can only be a parody. Wherever it appears, it celebrates its own serenity and order. Even death and sacrifice are but unruffled episodes in the quietitude of these most holy realms. It can be Monte Alban, where something is given to the gods, as well as Mount Sinai, where something is received. Most of all, it is mountain, whose principal lure to those who climb it is discovery. Erickson cites his mountain-climbing memories as perhaps the most impressive of those experiences which inspired the approach to the design of Simon Fraser.

Mountains, dreams and history! Can one be blamed for wanting at this point to rub one's eyes and shake one's head to ward off symptoms of hypnosis and for wanting to ask some haunting questions for our times? Can they be truly relevant, these references to history? Are they really adding richer meaning as they once did to



Baths of Caracalla.

our architectural pleasure? Are we wandering again among the ruins mooning melancholically for other times and places? Are these late 1900's ready to re-justify the wish to wallow in indulgent dreams of pseudo-history? Even Miss Duncan and her gauzy girls prancing in Arcadia seem so far away from us. Or are they? Is it possible that, after purging ourselves of literary symbolism for more than half a century for fear of its banality, we have matured enough to come to terms with it, to recognize its uses and to use it without embarrassment?

If the designers of Simon Fraser are frank about historic references, they are equally unabashed when speaking of their work in moral terms. They boast about their choices having been motivated by social ideals, ideals so carefully reflected in design that they must ultimately form the functions of the men who work within it. 'Manners makyth man;' and architecture, if it can affect behaviour, will make the manners. 'The architect's job is to challenge what exists . . . the problem was to break down the artificial barriers . . . (to induce in) the student the kind of reverence he should have for the culture . . .' says Erickson, speculating further that if the surroundings lack the power to refine our sensibilities, 'I don't think we reach a maturity in some part of our mind.' Gordon Shrum, the first chancellor of Simon Fraser University, the man who was charged by the Province of British Columbia to pronounce the ringing words of creation, and the man who chose the site, agrees with Erickson. Shrum confesses, 'I always wanted the university on the mountain-top because I believe that students benefit from beautiful surroundings.' Geoffrey Massey candidly observes that, 'Architects are all amateur sociologists.' Should one add, 'moralists, crusaders and motivational behaviourists' as well?

The 'barriers' that Erickson spoke of are those which he sees existing between the so-called disciplines traditionaly associated with the university. The clear and finite individuality of these disciplines, he feels, belongs to another age which understood the world to be more compartmentalized that we know it now to be. The implication is that geographers and chemists, physicists and philosphers, must somehow be induced to work more closely, to intermix and let their edges merge in order to help along our painful progress to a better future. Down with neatly separated halls, each dedicated to one inviolable discipline! They only reinforce an outworn feudalism. One world, one university, one building!

Aside from giving universal shelter in a climate of high rainfall, does Simon Fraser's singleness of structure operate as an influential symbol which will change the world of higher education? One can't be sure as yet. However, what may be more important is the impression that it does. Moving along the single corridor which zigs and zags within the square doughnut of the academic quadrangle (once again the perfect symmetry of the square comes to the aid of Utopia), the titles on the office doors and the sounds that emanate from classrooms pass along like a university directory. Dr. Shrum has said: 'We want all the students and staff to feel they belong to the same institution.' One can hardly doubt that they do. And the heart must leap in anyone who believes that such a feeling must ultimately manifest itself in some new brotherhood of arts and sciences. Neologisms like 'inter-media' come easily at Simon Fraser, and there is indication that the actions they imply may more and more be manifest.

A sense of high euphoria pervades the air among the students and the faculty who scurry, lounge or saunter among the variety of grand and humble spaces of the complex. One can even imagine a quiet pride, an inner wish, to strive—at least a little—for a perfection, to deserve one's presence in this carefully created place.

The spell continues to be cast. Students gathering within the Simon Fraser setting simply *do* resemble noble Romans coming to the Forum to hear the deliberations of their leaders. They assemble like Greek citizens participating in their own democracy, like young heroes gathered within earshot of an Aristotle. The agora-mall,

tempering the climate through the aid of its protecting roof, eases the North American pace into a tempo much more Mediterranean and closer to our languid dreams of Athens. However we may smile in the face of all this classical nostalgia, the image will persist, and the effects continue to surprise. One cannot but see a new comportment in the youth at Simon Fraser moving along the walkways, reclining on the benches, balustrades and cornices, making tableaux on the stairs while an unselfconscious orator speaks bravely at a lectern. Have they been in some way dignified, these pale and pasty young Canadians in jeans and mini-skirts and ratty canvas shoes? Are they really standing differently, reposing differently, walking differently, greeting one another with some new and graceful gesture? Are we dreaming, or is each one calmly taking up that perfect posture to fit himself harmoniously within the pediment? We are once again within the vestibule of Michelangelo's Laurentian Library, where the plodding, slumping scholar with muddy skirts and slipping spectacles becomes a prince upon the act of climbing those fine stairs.

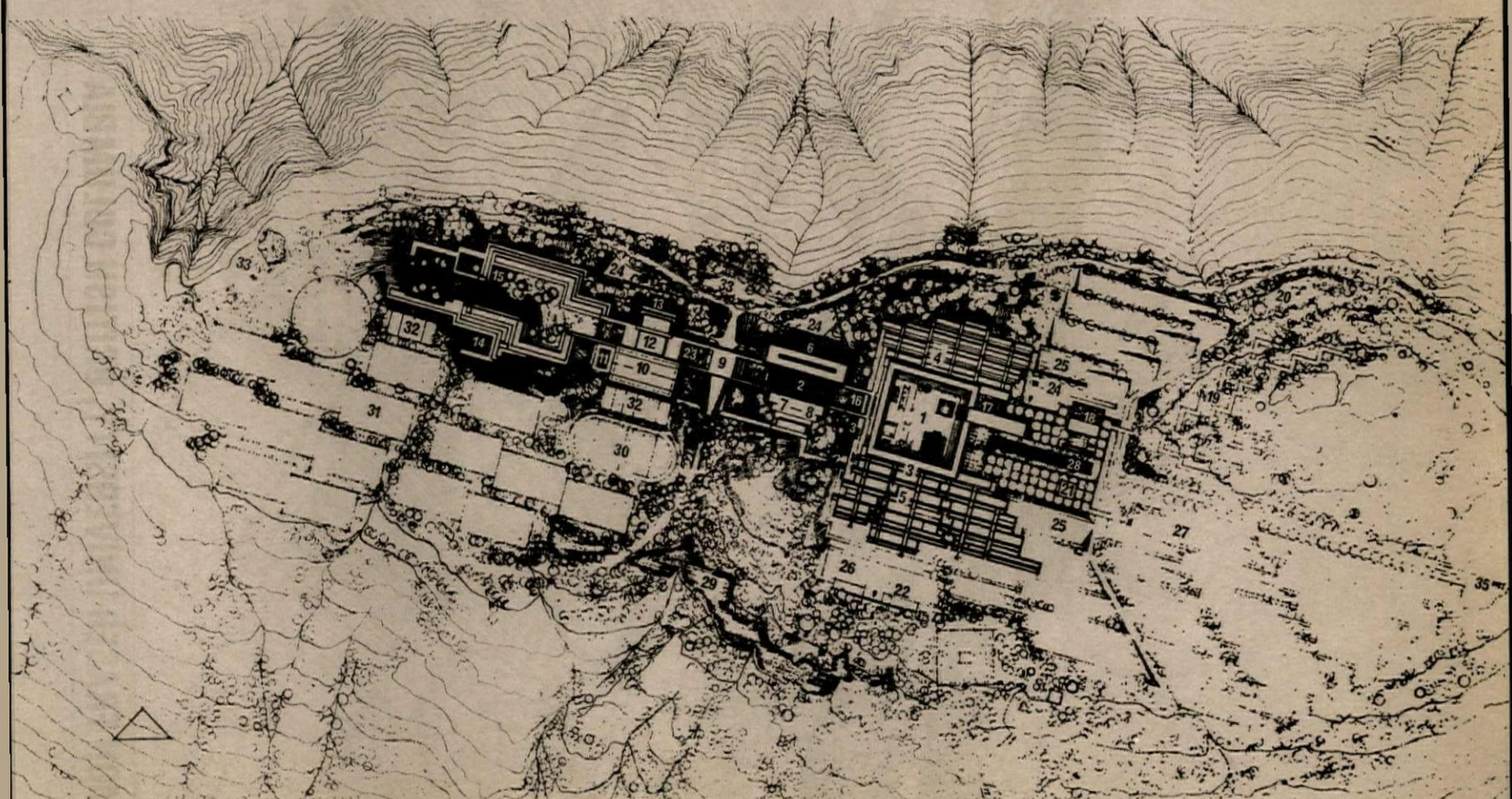
The architects of Simon Fraser suggest that the very way of teaching has altered in response to their design. Should this be true, the proof of such a cause-effect relationship could make the eye of the designer moist, and that of the professional educator turn red with rage or worry. Unless they ahppen to agree, this power of the architect to help (if it exists) could quickly be translated as the worst of meddling. No loud complaints have yet been heard from those involved at Simon Fraser. All indications are that everyone is marching in the same crusade. If questioners there be, they remain discreetly silent, and travel uncomplainingly in the endless circle of the square.

Perhaps the most intriguing observation we can make in reference to the design of Simon Fraser University is not on that which is, but on that which is not yet existing. Probably the most impressive single aspect of the Erickson-Massey design which won the admiration of the competition judges was its elegant expansion scheme, which proposed construction of a robust spine of core functions along the ridge from which the other buildings, predicted and unpredictable, could spread freely out and down the mountainside. It was the accomplishment of this idea which established the undisputed quality of the winning scheme, and reaffirmed the deftness with which the architects had grasped the functional-aesthetic meaning of the site.

The spectre of the plan designed to solve a problem of the future proving obsolete before the corner-stone is laid has made us desperate to search for other kinds of planning, to learn the wisdom of the 'open end' so common in cathedral building times. At Simon Fraser, something of this wisdom shines from the simple system of design for that which still is undesigned; a central spine laid out upon the summit becomes at once the source and culmination of all that grows or changes. Whatever may be added should hook on easily without dismay to what has come before. Events to test the theory have not been slow in coming. This year, with a sudden surge of student population a quick increase of classrooms was required. To meet this need, a happy symbol of our century of movement was introduced in the form of mobile trailers. These, drawn up to the peripherals, were left like foundlings on the doorstep. Yet, curiously, they fit and seem like members of the family. However, other, less surprising, accretions made since the university was opened have not been greeted without some disappointment. The filling station placed quite logically along the exit road (though not designed by the architects) has elicited its share of wrinkle-nosed grimaces. So, obviously not *everything* can be added with impunity, even something as appropriate and vital as a place for motor service where motors are. The romantic dream here turns to agony, and reveals a weakness in the theory of automatic growth, a weakness which may lie more in the mind and the emotions than in the architectural design. Perhaps the lack is only in an attitude of tolerance which needs to grow and change together with the building, both adding to each other's strength with passing time.

site plan of Simon Fraser University

key
1. academic quadrangle
2. mall
3. faculty offices
4. classrooms
5. laboratories and science classrooms
6. library
7. large theatre
8. small theatre
9. transport centre
10. gymnasia
11. swimming pools
12. student centre
13. ballroom and banquets
14. men's residences
15. women's residences
16. dining hall
17. administration
18. faculty club
19. faculty housing
20. president's residence
21. heliport
22. maintenance
23. coffee bars and restaurant
24. visitors' parking
25. faculty parking
26. staff parking
27. students' parking
28. east gate and pool
29. lagoon
30. track and field
31. playing field
32. tennis courts
33. lookout
35. Simon Fraser monument



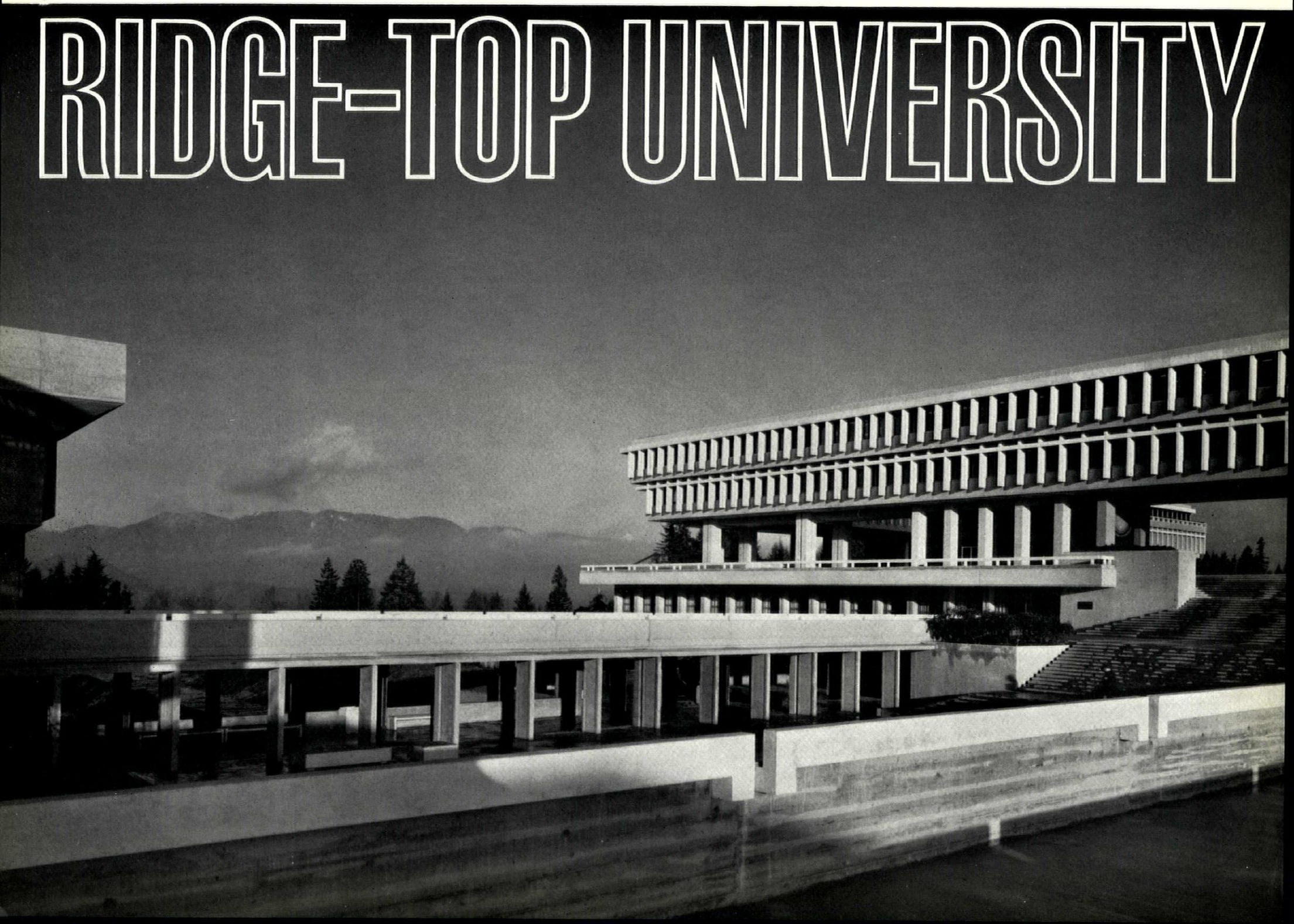
aerial perspective from the south-west

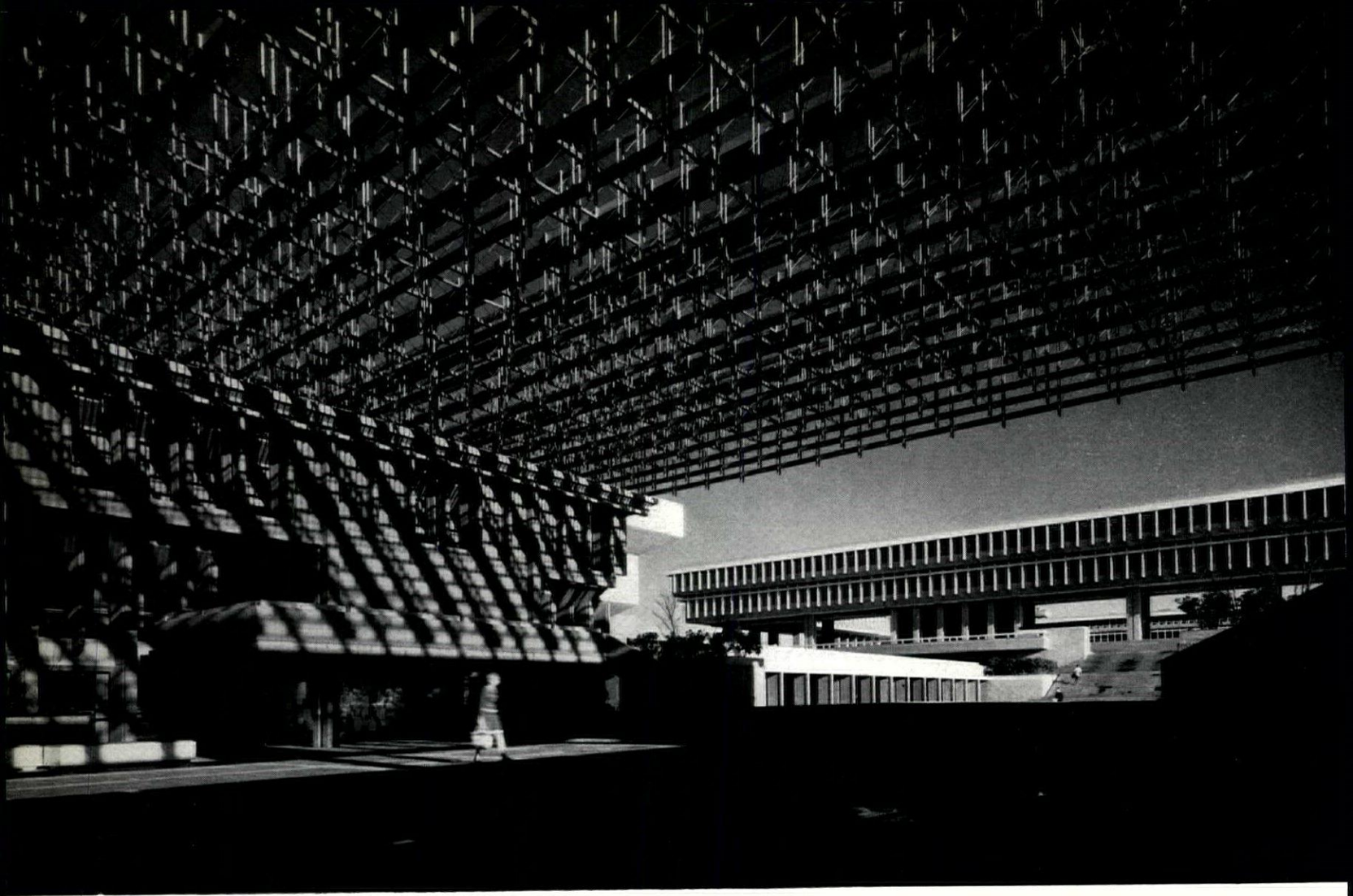
SIMON FRASER UNIVERSITY, BRITISH COLUMBIA

architects **ERICKSON AND MASSEY**

photographs by John Fulker and Art Hupy

RIDGE-TOP UNIVERSITY





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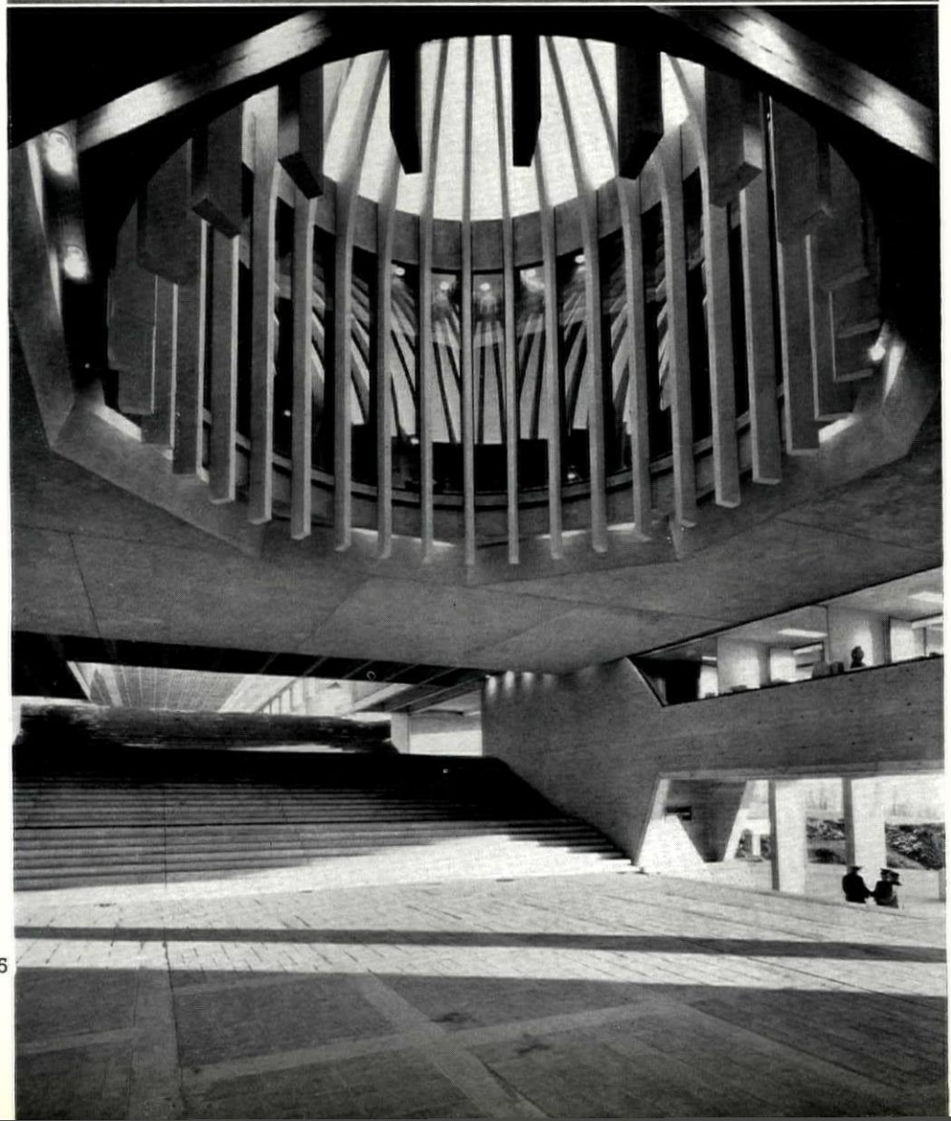

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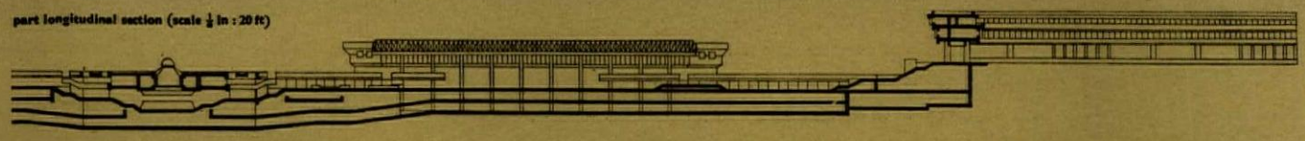
SIMON FRASER UNIVERSITY, BRITISH COLUMBIA

1 (page 267), looking across the central mall with the academic quadrangle on the right. 2, the glass-covered part of the central mall, with the library on the left, looking towards the academic quadrangle. 3, looking in the opposite direction towards the main entrance. 4, inside the covered mall, with the library on the right. 5, the dome over the main entrance. further down the mall. 6, the science complex below the academic quadrangle. 7, approach to the main entrance and transport centre.

6

7

8, the steps up to the academic quadrangle from the central mall, with the open court in the foreground. 9, the southern side of the covered mall.

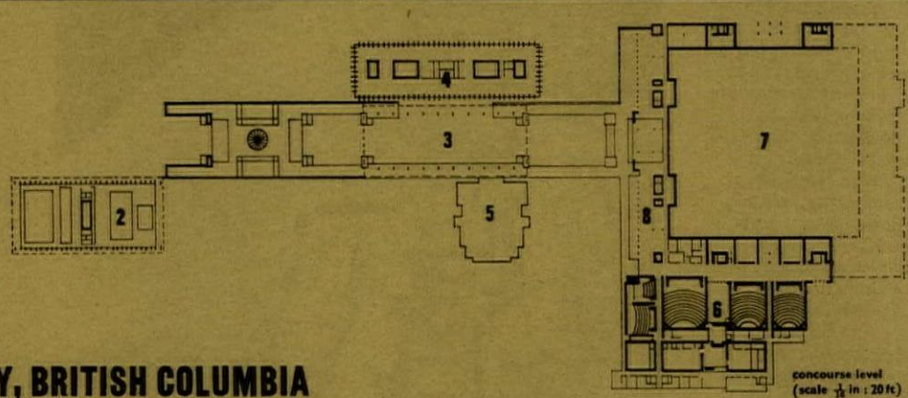


TRANSPORTATION CENTRE **CENTRAL MALL** **ACADEMIC QUADRANGLE**

This is a new university and was the subject of a competition held in 1963. It is being built in phases, of which the first two are now complete. The first phase was designed for 2,000 students, but with some of the spaces large enough for the eventual much greater number. The second phase accommodated another 2,500, but the number of students enrolled was 5,200, the extra 700 being fitted in by the use of trailers for temporary classrooms and by converting lounge spaces into offices. Construction of the third phase (consisting of a classroom block, with lecture theatres, offices and laboratories, and an addition to the science complex) is ready to start but is held up through shortage of Provincial Government funds. The eventual number of students planned for is 18,000, reached over a period of 15 years. Like the other two universities in the province of British Columbia (the University of British Columbia in Vancouver and the University of Victoria), Simon Fraser is primarily for commuting students. Residential accommodation is being planned for about 10 per cent. The site, of 1,200 acres, consists of wooded land on the crest of Burnaby Mountain, just outside the city of Vancouver. It commands wide views over mountains and water and has a mild climate, although there is heavy rainfall and deep snow in winter. Erickson and Massey's winning layout accepted the ridge-like nature of the mountain-top site as the main influence on their design and developed a linear plan that could still be adapted to variations in educational policy. Its central feature is a covered link, or mall, between the residences at the west end of the ridge and the main academic quadrangle at the east end. The mall is designed as a focus of student life, being big enough for the maximum number of students and protected from the weather. It also gives direct access to other buildings like the library, theatre and restaurants. Planning is compact, to avoid separation of disciplines and encourage exchange of ideas between staff and students. Laboratories are together because of the high cost of services and their different use of space. The classrooms, which range from large rooms seating 500 to small seminar rooms, are placed on either side of the academic quadrangle. A science complex forms a separate block, and library, theatre and restaurants, at the heart of the complex, are again clearly differentiated from the recreation area (gymnasium, swimming bath, students' union) which is linked to the residential area.
There are thus five main building groups, and in the 1963 competition other awards were given to four firms of architects, each of whom was invited to design one of the main groups within Erickson and Massey's overall framework, Erickson and Massey themselves being responsible for the central mall as well as the design co-ordination, site development and landscaping. These five groups are briefly described below.

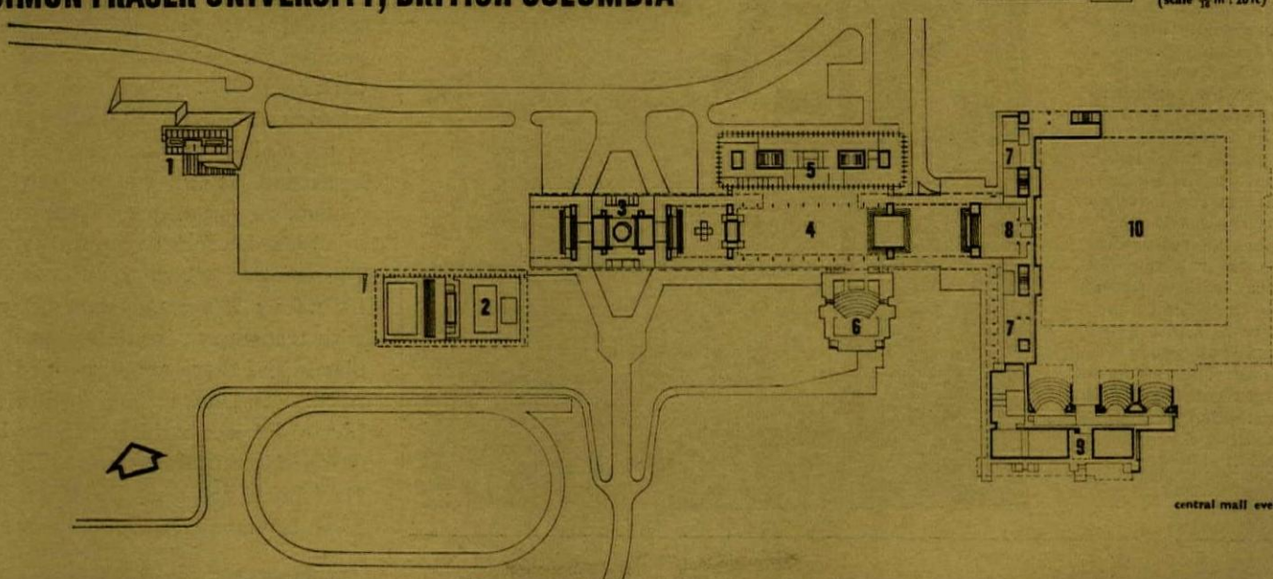
CENTRAL MALL AND TRANSPORTATION CENTRE: This is the heart of the campus, in the form of a series of courtyards: a quiet entrance courtyard, the glass-covered central mall and an open court at the foot of the steps to the academic quadrangle. Besides being the main student meeting-place, it serves as a parking-garage and

key
student concourse level
1, student residence
2, gymnasium
3, central mall
4, library
5, theatre
6, science complex
7, academic quadrangle
8, student concourse
central mall level
1, student residence
2, gymnasium
3, transportation centre
4, central mall
5, library
6, theatre
7, lounges
8, cafeteria
9, science complex
10, academic quadrangle



concourse level (scale 1/16 in : 20 ft)

SIMON FRASER UNIVERSITY, BRITISH COLUMBIA



central mall evel

SIMON FRASER UNIVERSITY, BRITISH COLUMBIA

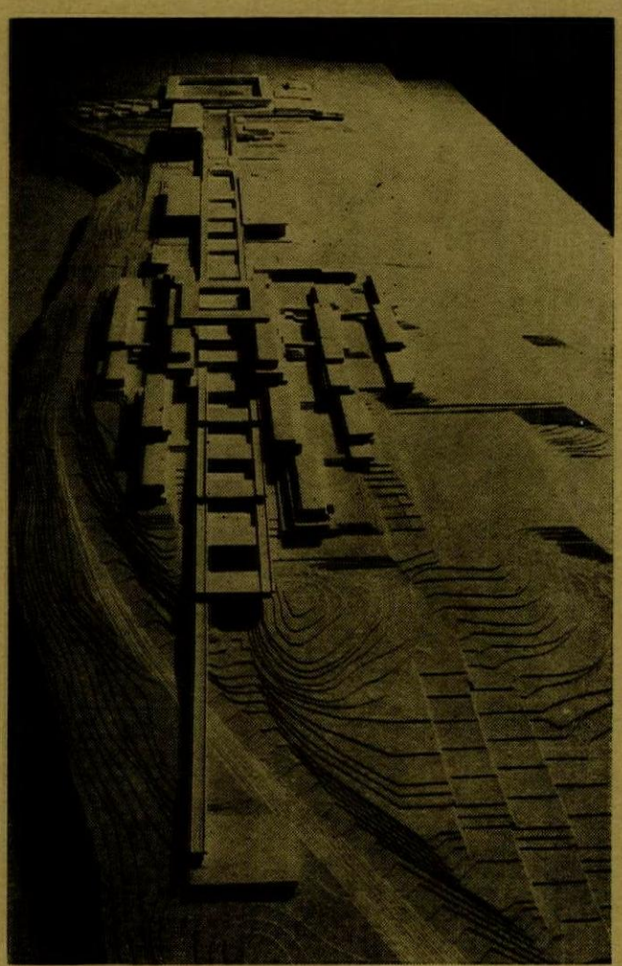
a transportation centre and includes offices and a student lounge. The roof, designed in consultation with Jeffrey Lindsay, consists of glazing supported on a space frame of roof-trusses prestressed by horizontal spreaders. The upper and lower chords of the 133ft. trusses are of laminated, pressure-treated fir; the tie-rods and fasteners are high-tensile stainless steel. The covered area is 297ft. by 133ft.
Architects, Erickson and Massey. Structural engineers, Otto Safir & Co. Mechanical engineers, D. W. Thompson & Co. Electrical engineers, Simpson McGregor & Scott.

ACADEMIC QUADRANGLE: There are two floors, raised on columns above a court, the first floor containing classrooms of various sizes and the second private and general offices. The upper floor oversails, giving each side a length of 440ft. Within the square is a garden and meeting-place surrounded by terraces. Beneath the terraces facing west are student and faculty lounges. On the south side at the same level is a large concourse on to which open all the lecture-theatres in this building and in the adjoining science complex. The space under the main external stair leading to the mall is occupied by a student cafeteria seating 350, below which are the kitchen, services and storage. Construction of this and the other buildings is in-situ reinforced concrete, with some precast concrete used for sun-breakers, railings, etc.
Architects, Zoltan S. Kiss. Structural engineers, Otto Safir & Co. Mechanical engineer, J. D. Kern. Electrical engineer, E. A. Simpson.

SCIENCE COMPLEX: This contains five major lecture-theatres and laboratories; a similar complex for the Arts faculty will later be added on the north side of the academic quadrangle. The lecture-theatres, which together accommodate 2,100 students, have steeply sloped seating and an amphitheatre-type plan which allows no student to be more than 80ft from the lecturer. They are equipped with screens which enlarge notes written by the lecturer, and amplification systems. The laboratories are arranged along spinal corridors and use 50ft. post-tensioned concrete beams to allow flexibility in the placing of partitions, etc.
Architects, Rhone and Iredale. Structural engineers, Bogue Babicki. Electrical engineers, Simpson, McGregor & Scott. Mechanical engineers, D. W. Thompson & Co.

LIBRARY: This is on the north side of the mall. It holds 125,000 books and will later be enlarged to hold 250,000. The exterior walls have alcoves for faculty-study carrels. The library is entered from the mall, with two floors below mall-level and two above. It is planned round a central core containing services. Surrounding the core are free-standing book-stacks enclosing study carrels, of which there are 620. The ceiling structure is a 4ft. square grid of recessed panels with the lighting contained in the soffit, giving clear spans. It is of exposed concrete, sand-blasted. There are under-floor ducts for television and audio transmission and in the basement is an audio-visual department from which television film-strips and audio-tapes can be distributed throughout the university. The library building also accommodates the heating plant for the university.
Architects, Robert F. Harrison. Structural engineers, Choukalos, Woodburn and McKenzie. Mechanical engineers, D. W. Thompson and Co. Electrical engineers, Rich-Webster and Co.

THEATRE, GYMNASIUM AND SWIMMING-POOL: The theatre is adaptable to different types of production. It has 520 seats within the curved, stepped auditorium, 10 seats on removable stepped platforms beside the stage area and at least another 100 with a full arena-type production. Dressing-rooms and rehearsal rooms are beneath the stage and workshop areas. The structure is reinforced concrete with steel roof-trusses.
Architects, Duncan McNab, Harry Lee and David C. Logan. Project architect, David Logan assisted by Peter Batchelor. Structural engineers, Read, Jones and Christoffersen. Electrical engineer, R. M. Campbell. Mechanical engineer, John M. Bean. Acoustical consultants, C. A. Tiers and J. E. Breeze. Staging consultant, Ron Pollock.
The gymnasium and swimming-pool building runs parallel to the mall, between the academic buildings and the student residences. It is entered from the parking area to the north at locker-room level and from a promenade overlooking the playing-fields to the south at the main gymnasium level. The building will later be extended to the west to provide separate men's and women's gymnasiums. Offices, lecture-rooms, etc. are in in a glazed core between the gymnasium and the pools. The building is roofed with prestressed concrete beams 135ft. long. The gymnasium and pool areas are enclosed with translucent insulating wall-panels of reinforced plastic and there are suspended acoustic absorbers.
Architects, Duncan McNab, Harry Lee and David C. Logan. Project architect, Harry Lee assisted by Peter Orme. Structural engineers, Thorson and Thorson. Mechanical engineer, D. M. Drake. Electrical engineer, R. M. Campbell. Acoustical consultant, C. A. Tiers.



New proposals have been made by Erickson and Massey for the future development of the western end of the site to accommodate 5,000 instead of 1,500 residential students in the form of a concentrated urban community, with shops, restaurants and recreational facilities. These would tie in with the extension of the mall, and would be mainly apartments, single, married or shared. The model shows the whole linear development as now revised and extended, with the replanned residential area in the foreground. A central facilities building is placed across the extension of the mall, and parallel residential units on either side rise from two storeys at the edge of the site to multi-storey units alongside the mall. The residential area could be further extended to the south-west in the area allotted to the expansion of playing fields.

10

10, view down the central mall from the academic quadrangle. 11, looking west along one of the upper promenades, with the gymnasium on the left.

11

12

13

14

SIMON FRASER UNIVERSITY, BRITISH COLUMBIA

12 (facing page), the garden in the academic quadrangle; the jade rock in the pool was found in Fraser Canyon. 13, the top of the steps up to the quadrangle. 14, steps in the central mall with the library beyond.

1 (opposite, top), air view of Tenterden looking east. 2 (opposite, bottom), presumably a sloping grassy bank and an avenue of trees separate buildings from road on the north side of the High Street. 3 (below), memorable image: the centre of the town where the High Street narrows (see 18-23). The drawings are by Gordon Cullen.

TOWNSCAPE

Kenneth Browne

EYES ON TENTERDEN

A recent report published by the Kent County Council entitled* Tenterden Explored *is particularly relevant in view of the present York conference on historic towns and cities.† Every delegate should study this sensitive evaluation of a town's architectural and townscape qualities, for it sets a high standard for a local authority publication and is an eye-opener in the truest sense.*

Tenterden, a prosperous small town in the Weald of Kent, is set astride the main road from Margate to Hastings. It is a linear town of great character as yet comparatively unspoilt.‡ But how long can it remain so?

Recognizing its importance, Kent County and Tenterden Borough Councils recently commissioned Frederick MacManus and Partners to prepare a special architectural and townscape study, as a guide to an overall plan and to subsequent development control. They called in Gordon Cullen to do the townscape appraisal and the result is a brilliant joint effort which describes in a unique way the anatomy of a town centre of high quality.

CHARACTER

The casual visitor to Tenterden is struck by its long attractive High Street, the parish church centrally placed yet slightly back from the main street and discreetly screened by shops (see above). Most of all perhaps he enjoys the dramatic widening of the same street to the west with broad grass verges to either side and a fine avenue of trees (recently mutilated by bad branch lopping), the footpaths looping away on their own separate course. Also he will be disturbed by the heavy traffic. But impressions are inadequate when it comes to safeguarding a place—the whole thing must be understood; how it fits together, what is especially important. Until then planning is blindfolded.

* Available from KCC Supplies Dept, Maidstone.
† Historic Towns and Cities Conference: University of York, March 31 to April 4, 1968. A conference intended primarily for local authority officers and council members.
‡ Also one of the seven towns in Kent listed by the Council for British Archaeology.

DETERIORATION

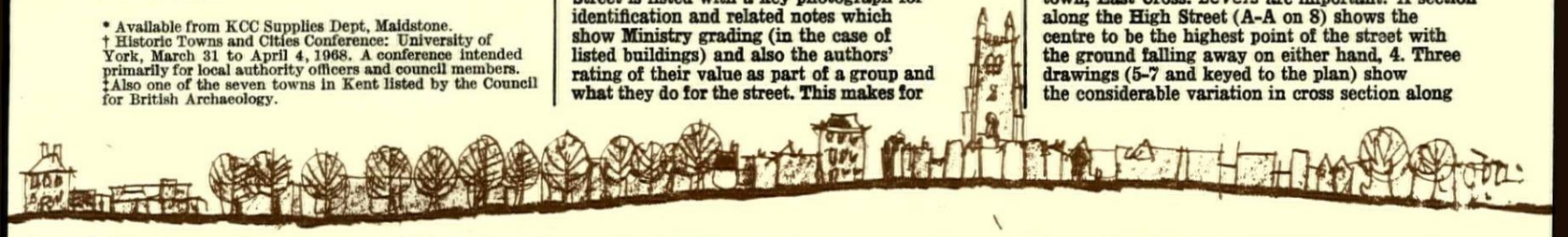
The town's problems: first of all it is bisected by through traffic which is bound to increase. Second, the character of many of its buildings is being wrecked by brutal conversion, particularly the insertion of full-width plate glass shop windows which destroy the buildings' apparent connection with the ground. Thirdly, the shopping area is spreading and private houses on either side of the centre are being turned into shops and their attractive front gardens replaced by bleak forecourts. At the same time, the area behind the High Street, particularly to the south, is virtually derelict.
As the authors ruefully remark ' while Tenterden has no example of 20th century architecture worth mentioning, the 20th century is busy destroying all the other periods . . .' One of the chief causes of misunderstanding is a preoccupation with individual buildings while remaining ignorant of the town as a whole. For the beauty and character of a town is derived not just from its special buildings but from the way buildings relate to one another, the spaces they create and the vistas and rhythms set up between them.

ANALYSIS

Having placed the town historically and regionally and traced its growth and development, the report gets down to a very full and careful architectural appraisal of the buildings. For instance every building in the High Street is listed with a key photograph for identification and related notes which show Ministry grading (in the case of listed buildings) and also the authors' rating of their value as part of a group and what they do for the street. This makes for instant recognition when there is a planning application involving change. Then follows the townscape analysis by Gordon Cullen under the following headings: landscape setting, shape, entrances, town centre, close range. The forms are dissected and reassembled with all the art of a skilful surgeon.
As the authors say, they were asked to define what makes Tenterden the unique place it is now, so the fact that many of the effects are accidental or intuitive becomes irrelevant. They must be recorded in order that future development will use the findings as a springboard, not destroy through ignorance.
The study ends with a carefully considered conservation policy for the town. Since the report is 117 pages long only a sample can be shown here, but the next two pages give some idea of the method employed. Penetratingly observant, it gets beneath the charm—the picture postcard Tenterden—to how it all works. For example:

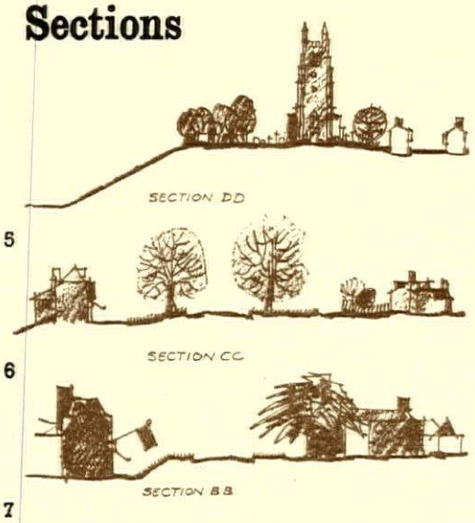
SHAPE

The linear plan is described and its component parts defined, 8. Each has its own distinctive character which is subsequently analysed in detail. At the centre the High Street narrows to approximately 50 ft., while to the west lies the most spectacular part of the High Street which, constricted at either end, here widens to a spacious 200 ft., tree-lined and with grassy swards on either side. To the east is a pleasant triangular space making a good entry to the town, East Cross. *Levels* are important. A section along the High Street (A-A on 8) shows the centre to be the highest point of the street with the ground falling away on either hand, 4. Three drawings (5-7 and keyed to the plan) show the considerable variation in cross section along



4, section along the High Street.

Sections



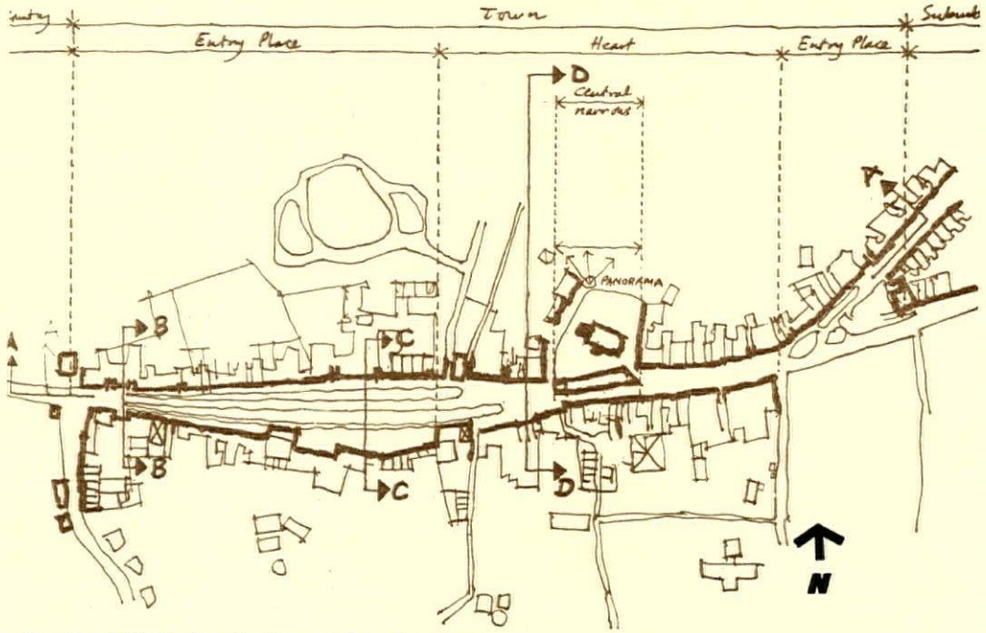
5

6

7

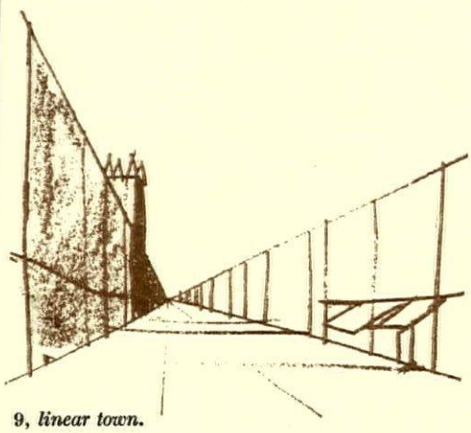
the street with, at the west end (B-B), the northern pavement considerably lower than the road and the grass verge sloping up between them (see also 2). C-C shows the section at the widest point and D-D at the centre of the town where the ground now rises slightly to the north (i.e. the church is built at the highest point of the town), then falls steeply to the railway below.

Plan



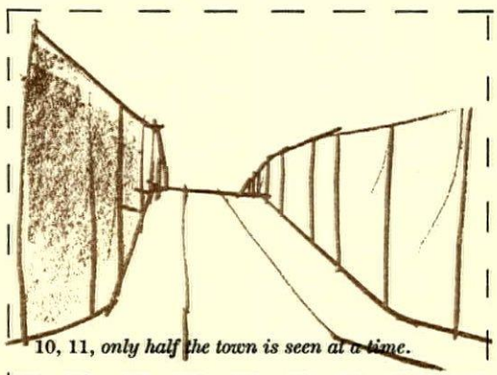
8, *plan of centre of Tenterden showing position of sections.*

Diagram

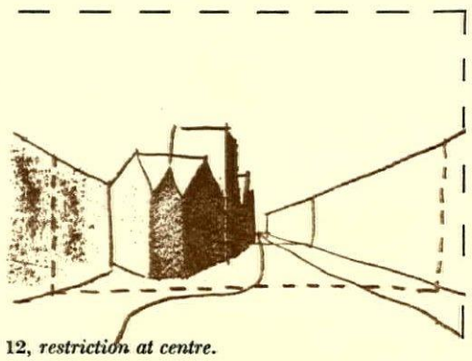


9, *linear town.*

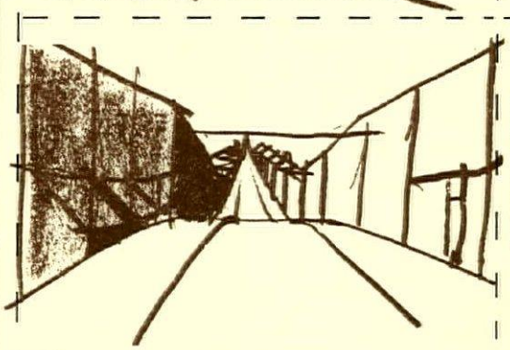
Reality



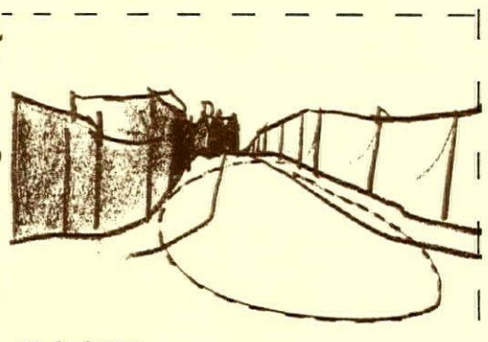
10, 11, *only half the town is seen at a time.*



12, *restriction at centre.*



11



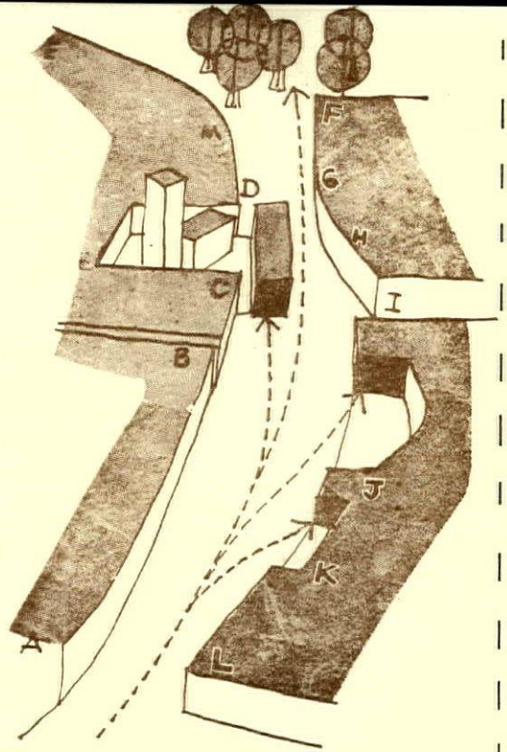
13, *backwater.*

DIAGRAM V REALITY

Later the views along High Street are studied at ground level. Actual form is defined by contrasting it with the diagrammatic picture which a linear town, main street 1,000 yds. long, church on left, would suggest—Tenterden as it might have been but for accidents of topography and growth, 9. How the actual departs from this image is then shown. First, since the centre is raised you only see half the town at a time, 10 and 11. Thus the centre appears to be the end from which ever side you approach. A further modification is that at the centre the road width is restricted, 12. This does two things. First the linear flow is impeded, creating a sense of backwater, 13. Second a sense of *compression* is created closely followed by one of *release*. This emphasizes the sense of CENTRE, of bustle and juxtaposition of people and goods. By contrast, the sudden release coincides with well-treed vistas. In effect the town centre has been intensified and then juxtaposed to the great landscape elements of sky and foliage. Highly successful, this effect must be kept. In short, no building on the vistas, preserve and plant trees and retain the narrow centre.

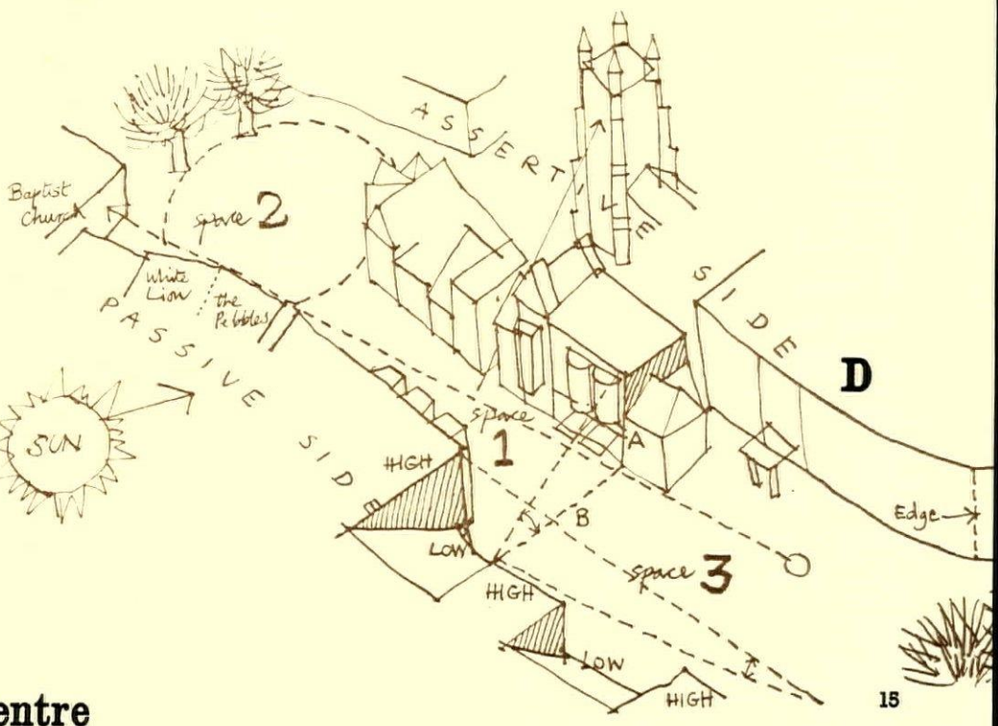
GROUPS

Later another refinement of the town structure is considered. While the town consists of rows of buildings, they tend to fall into groups—not groups that are architecturally homogeneous but simply groups of continuous buildings. For instance in 14 (looking east down the High Street) you can read L-F as a continuous, coherent group, seen as a single wall, although it forms part of six different places. It is also possible to read F-H as a group and also I-G. In other words, the same length of building can be in two different groups depending on where you stand. To be noted also is that the continuous curve D-E forms part of two enclosures (High Street east and East Cross). This is important when considering alterations or repainting. Then in studying the central narrows, 15, we are made aware of an assertive and a passive side to the street. Again, looked at from the east end of the street the central constriction appears quite spacious, 16. Yet on entering it, this is no longer so—it appears both narrow and compressed, thereby heightening the sense of being in the centre. Why? It is a question of angle of vision and foreshortening. At a distance, A and B read their true elevational values while the angle of vision to the roofline is flat, 17. But from inside B is foreshortened, losing value, and A seems much higher since the angle of vision has been greatly increased. Thus, space and size are not absolute but depend for effect on the position of the observer.



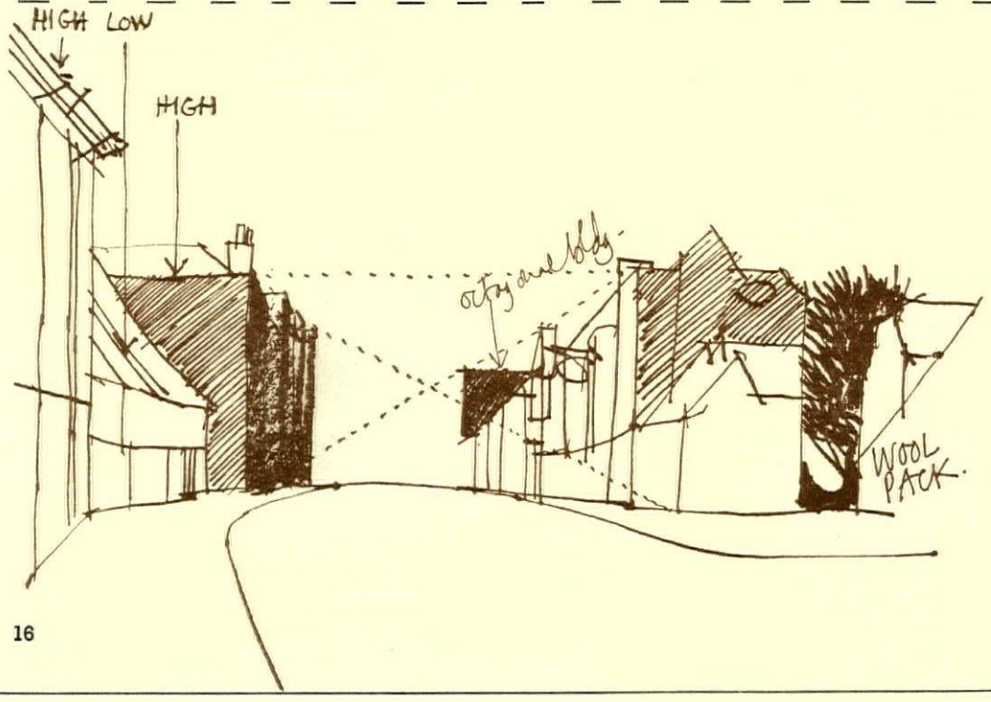
14

Groups



15

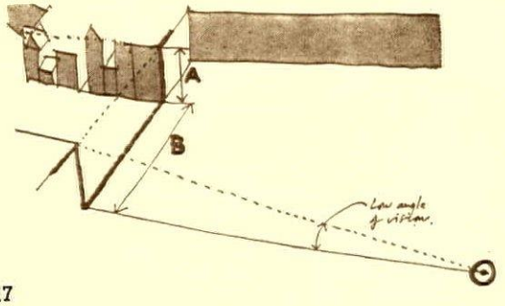
Centre



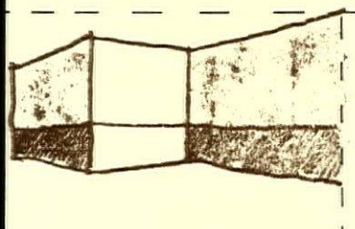
16

14, *the street walls fall into groups of continuous buildings.*
15, *the centre narrows down, with an assertive and a passive side to the street.*
16, 17, *proportions of space and size depend for effect on the position of the observer.*

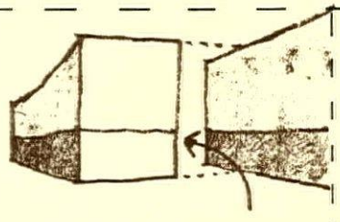
Proportions



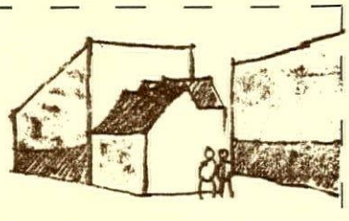
17



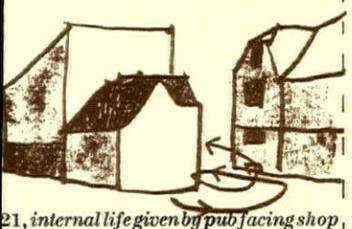
18, *T-square answer.*



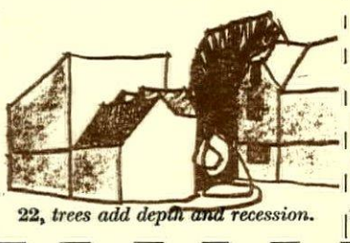
19, *life given by gap.*



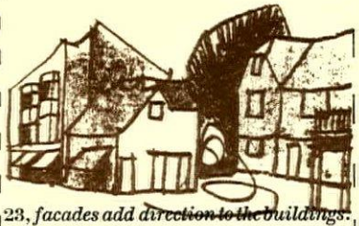
20, *small projecting building gives scale.*



21, *internal life given by pub facing shop*



22, *trees add depth and recession.*



23, *facades add direction to the buildings.*

Turning the corner

Later we are made to look carefully at an important corner (by the 'Woolpack,' D on 15) where an alleyway leads through to the churchyard, to see how it works. First we see the T-square solution, 18—a lifeless diagram, but all too common. Then 19, with the space enclosed in the angle given life by a gap—no longer a dead corner collecting old newspaper—we can pass through it. And 20, with the impersonal blocks given scale by the small building projecting from the front line of buildings. Next the corner itself is given its own internal life by the public house which commands it and which corresponds with the shop opposite, 21. Then the blackness of the tree-shade beyond gives depth and recession to the facades, 22. Finally, 23, the facades are given direction.
The street faces out to the busy road, the shop turns the corner and gives on to the space. The pub shares this but gives life to the alley and the town hall porch extends the space—the final picture is composed (see 3 on page 277).

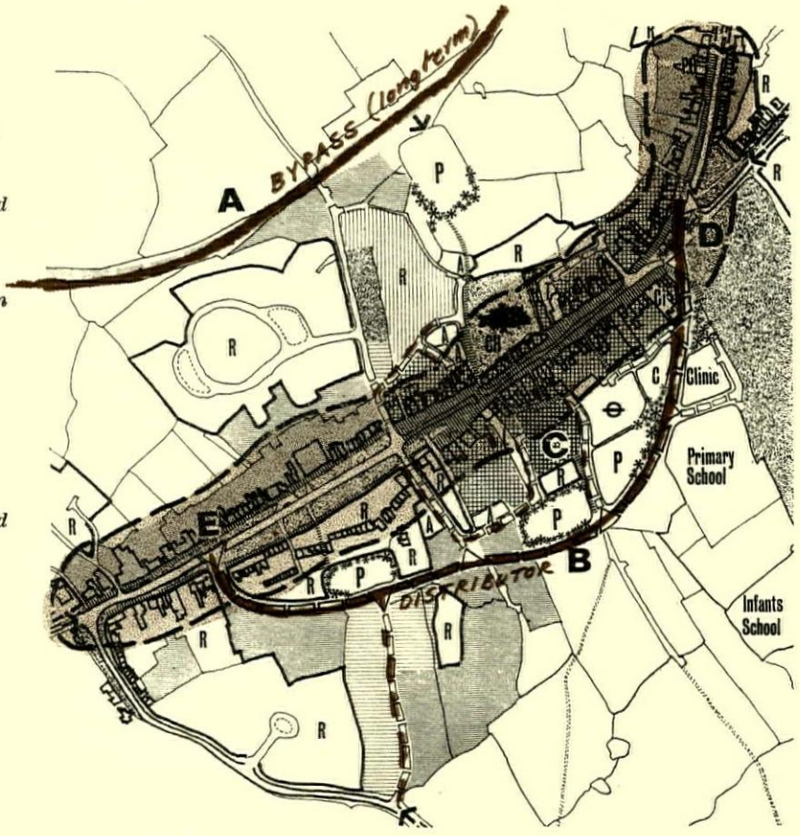
County Council Plan

Simultaneously with the consultants' study, the county council published its plan. This was in draft form so that public comment could be made before any final decisions were taken. The preamble points out that though the town is harassed by through traffic (on A28) which should be diverted, the road also acts as a residential spine road and as the main shopping street in the town centre. The fact that shoppers are enabled to reach the central shops by car is one of the trading attractions.
The main proposals are briefly as follows:

CONSERVATION
(i) The area shown coloured on map 1 is to be designated as a Conservation Area.
(ii) Outside the main shopping area, no further conversion of any building is to be permitted if it will result in adverse change of external appearance.
(iii) Grass verges and trees in High Street and the small garden at East Cross are to be preserved.

TRAFFIC AND PARKING
(i) A by-pass for Tenterden is intended in the long term, possibly taking advantage of the disused railway line, A. Car parks will be provided adjoining the by-pass with foot access to the centre.
(ii) A new distributor road, B, south of the High Street is to be provided, serving a number of car parks as well as service roads giving rear access to the south side of the High Street. Footpaths will link through to the High Street.
(iii) The High Street is to be turned eventually into two culs-de-sac, to restrict use by vehicles, with area shown hatched reserved principally for pedestrians.

SHOPPING
To meet future demands a site, C, will be allotted adjacent to the main shopping core, served by pedestrian links to High Street and car parks. Small scale shop units only will be allowed in order to retain the intimate character. Further intensification of commercial use is to be resisted along the High Street and no commercial intrusion allowed in existing residential areas in the town centre.



Map 1 *the Kent County Council's town centre plan (proposed Conservation Area in brown tint; hatched area of High Street reserved mainly for pedestrians). A, long-term proposed by-pass on route of disused railway line. B, proposed distributor road. C, new shopping area. D, East Cross. E, junction of distributor road and High Street. P, car parks.*

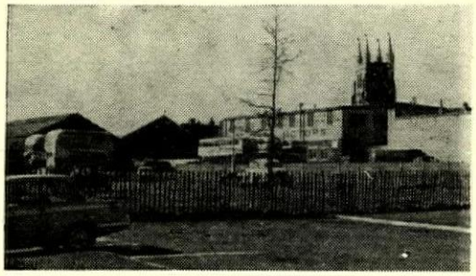
Comments

The basic intentions appear sound, namely to take through traffic away on a by-pass, to provide a loop road to car parks in backland with a way through via new shops. Also the suggestion to block off the central narrows and pave it so that shoppers can still get by car near to the centre but not through.
But since the by-pass to the north seems unlikely to be built for at least 20 years, Tenterden may well have gone past saving by then. Surely this means that the proposed relief road to the south, B, will have to be made capable of carrying through traffic with consequent wide intersections, in fact as shown on the map 1. This would have the following great disadvantages.
(a) It would spoil the delightful space at East Cross previously listed as something to be preserved under the conservation heading.
(b) It would sterilize valuable land at the back of the houses on the south side of the town.
(c) It would make a gaping hole with swept corners and probably a roundabout slap in the best (treed) part of the High Street on re-entering it—indeed the curves on the plan suggest this.
(d) Car parks near the by-pass to the north would be inconvenient, for the ground rises steeply to the town and it would mean an uphill trudge.

SUGGESTION
Would it not be wiser to scrap the idea of a future by-pass on the railway route, which anyway would not absorb the traffic from the Hythe and New Romney roads, and to build a by-pass now on the route shown in map 2 ? This would not touch the town but would pick up all the roads to the south. Then, with through traffic relieved, the local loop road serving the car parks could be much narrower and slower, largely using existing roads. On the site it seems an obvious choice. Also the construction of this road would probably pay for itself through betterment of the land use.

SHOPS
The wisdom of developing future shopping here, well placed between car parks and High Street (as the council suggests), is apparent, much better than further spread along the High Street itself. Today this is scruffy backland, 24, but the opportunity is there, for the backs of the High Street buildings are often better than the fronts, having been less altered. Also there are many down-at-heel but good buildings here. This is the chance for a new shopping square or squares, 25. Tenterden is not the place for multiples but for small-scale shops. Having accepted Tenterden as a special place, the aim should be to attract small clean industries, such as furniture making, appropriate to its character.

QUERY
A question mark remains—how do you ensure that those qualities described in the consultants' report are in fact guarded when the diagram plan is translated into reality; when the development applications come in. Surely, having got the feel of the place through the intensity of their scrutiny, the consultants should be retained to advise on 'where we go from here'—to show how things could be and to guide future developments in the town.



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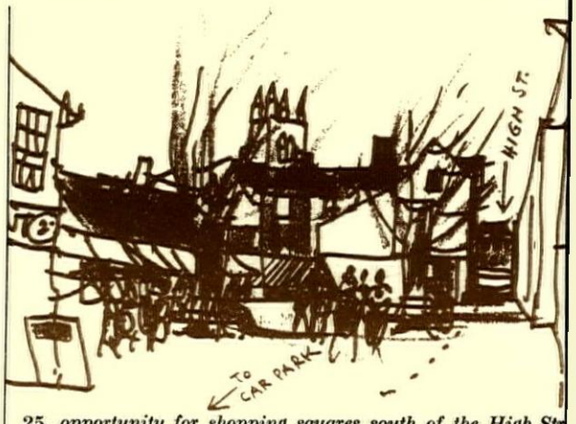


25, *opportunity for shopping squares south of the High Str*

Map 2 *suggested alternative route for by-pass (F) which picks up all the roads into Tenterden. The local loop road (G) serving new car parks largely uses existing roads.*

Jewels on display

The three jewellery shops illustrated here suggest three fundamental problems: the relationship of exterior to interior, the 'expression' and the organisation of the interior. The first is also the problem of attracting the passer-by. An earlier jeweller's shop by G. H. and G. P. Grima (ID in AR April 1967) was caged in with a heavy sculptured screen, 7, which gave no inkling of the cool and spacious interior. It was mysterious but hardly inviting. The Hooper Bolton shop in Sloane Street is the exact reverse: all glass towards the street, 8, but with a hot and cosy labyrinthine interior, 9-11. The original idea, evident from an early sketch (see page 285) was to project the suspended ceiling as a shop fascia over the forecourt. This, if carried out, would have mirrored the continuous travertine floor treatment and strengthened the effect of interpenetration. The narrow frontage prevented the full exploitation of transparency, which was possible in the 'Jones' jewellery shop in the Brompton Arcade, 4-6, with its two adjacent sides exposed to the street. The effect from outside is indeed very striking, with its motif of hanging and rising black tubes relentlessly pursued. But the problem comes inside the shop, where there is too much light and too much exposure for a function which is primarily optical and small-scale. The entrance lobby here only improves the security arrangements, whereas in the Hooper Bolton shop, by leading one past and away from the glare of the shop front, it also provides what Peter Jay describes on page 287 as a desirable area of intermediate brightness between outside and inside.

Secondly the 'expression' of an interior, something that most architects would agree should come naturally from the brief, can easily crush the delicate nature of jewel display. In the 'Jones' shop in Brompton Arcade a simple geometry and a predominant verticality is easily recognisable within the elaborate but bold design. The result is calmer than in the Hooper Bolton shop, which has an angular ceiling pattern and a strong and unresolved duality of vertical and horizontal elements. It is perhaps a pity that the architects did not attempt, in the manner of Soane, a vertical interpenetration of space between the ground floor and the subsequently converted basement. No such conflict exists in the much smaller John Donald shop, 3, which is a model both of simplicity and stylishness. It is simple because the customer is never aware of the disruptive vertical elements of clerestory and staircase at the back of the shop. It is stylish because the appropriate theme of the splayed corner is carried through tellingly but unobtrusively—the plan itself, the showcases, the long mirror, the castellated balustrade—and is beautifully relieved by a round mirror fitted flush in the wall by the entrance door.

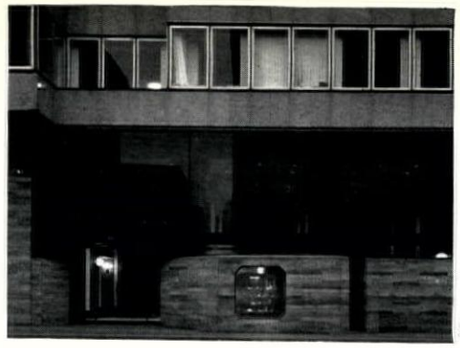
Also illustrated here is the new setting for the Crown Jewels at the Tower of London, 1, which poses a somewhat different problem because it must cater for large crowds and exceptional security. It is these requirements that appear to have been met rather than those of a first-class display. A new chamber has been built under Waterloo Barracks, and the ground floor is used for the display of robes and silver around which large queues are made to snake before descending into the lower chamber. (There is no lift for the disabled.) More serious is the rigid form of the display in the lower chamber itself—an island which acts as the supporting structure and which makes it possible for all cleaning to be done from one central position. As a Space, however, the lower chamber goes for nothing, and one remembers the jewels, of course, but also the four gloomy corners.

The setting for the Crown Jewels also poses the problem of materials and their suitability in an acute form. From the all-brick background of the ground floor (even the doors have been faced with brickwork) one moves down to the jewel house itself, which has walls of precast concrete panels with exposed aggregate of Cornish granite and a ceiling of concrete with a rough board finish. The Ministry's chief architect explained that rough concrete was practical because people cannot draw on it. In the earlier jeweller's shop by G. H. and G. P. Grima, already referred to, brick walls and Tyrolean plaster finishes were used extensively. Even if one could accept these as background for jewellery, it would still remain difficult to accept them side by side with the deep pile carpet also used in the same shop. The background colours and textures are altogether more apt in the Hooper Bolton shop, though even here there are jarring details which are hard to explain like the white plastic light switches and socket plates.

Lastly and most important of all there is the organization of the interior. A jeweller's shop has three duties towards its customer; to provide good display, comfort for looking at individual pieces and satisfactory conditions for seeing a jewel being worn. These requirements are to some extent conflicting, especially in a restricted space. For instance a showcase can have its own concealed lighting, but should ideally be surrounded by a darker area and therefore cannot be too close to seating or viewing areas where strong lights are again required. In all three shops it proved difficult to look at the display without being distracted by glare from lights that were intended for other purposes. In eleven out of the fourteen showcases for the Crown Jewels (designed by Garrard and Co. before the architects were called in) there is a thick central mullion dividing the display in two and so making it impossible to look at one half without being distracted by the other. The height of the showcases meant that special care had to be taken to conceal the light source. The egg-crate above the cases was tilted forward but with the result that objects in the front could not be lit at all. In case 8, containing the pieces used at the Coronation, the egg-crate has been kept vertical, but with equally unfortunate results, 1. The egg-crate is lit up as well as the jewels, because spotlights are used with too wide a beam. The architects, who were not responsible, have now been asked to redesign the lighting in all the cases.

In the same architects' shop for John Donald there is an interesting solution where a very small hexagonal egg-crate was covered with a plastic sheet after being found to cast a shadow pattern, 10. This produced a diffused light of lower intensity which is suitable for gold and silver pieces.

The background material in the showcases is also often at variance with good viewing conditions. In the basement of the Hooper Bolton shop the floor, walls and ceiling are all lined with the same dark mustard carpet, yet in the showcases where this kind of simplicity is required, one finds a busy background of turquoise and orange. In the 'Jones' shop several cases are lined with a cream velvet (apparently by Bueche Girod) which is not only ineffective as a background for almost any piece of jewellery, but also shows every speck of dirt. The most successful background is the one which provides the greatest contrast with the diplayed object—the bottle green velvet in the John Donald shop—and the purple and dark brown Melton type cloth for the Crown Jewels.

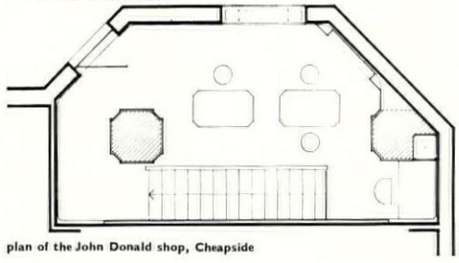


2

Jewellery shop, Cheapside, London

Architects: Stefan Buzas and Alan Irvine

2, exterior of the John Donald shop in Cheapside. The entrance is on the right of the display window. 3 (opposite), interior; floor cases and balustrade are of wenge—a dark smoke-coloured wood. On the right of the round mirror is the sliding topaz-coloured rough-glass panel of the display window.



plan of the John Donald shop, Cheapside

Jewellery shop, Brompton Arcade, London

Architects: Michael Brown Associates
Job designer: Tony Sully

4, the 'Jones' shop in Brompton Arcade. The wall is of antique-silvered glass, the seating and surround to the floor case are upholstered in brown leather, and the carpet is a burnt orange colour.
5 (opposite), display cases in the 'Jones' shop; the perspex dome on the right reflects lighting and is not an ideal cover for a showcase. The cylindrical cases are of black p.v.c.

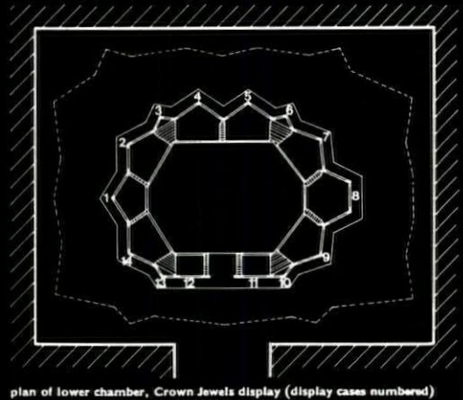
4

ID
INTERIOR DESIGN

CONTENTS

Crown Jewels display, Tower of London

Architects: Stefan Buzas and Alan Irvine

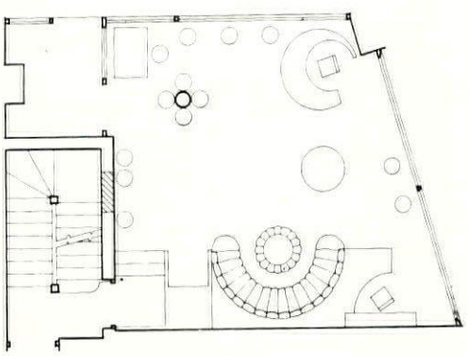


plan of lower chamber, Crown Jewels display (display cases numbered)

1, pieces used at the ceremony of Coronation, displayed in case 8. The cases were originally designed without reference to their contents and St. Edward's staff, which cannot be accommodated, is displayed in an adjoining case. For further illustrations see the article on display lighting, page 288.

3

5



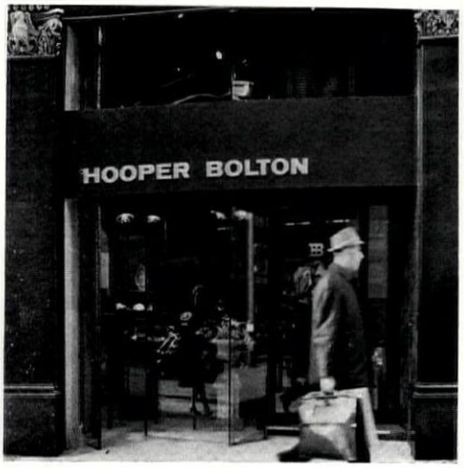
plan of the 'Jones' shop, Brompton Arcade

6, *the 'Jones' shop, Brompton Arcade : the cylindrical light fittings, like the showcases, are covered with black p.v.c. Also suspended from the ceiling are expanded metal sheets.*

6

7

7, display window of the jewellery shop in Jermyn Street by G. H. and G. P. Grima, contrasting with the exterior of their Hooper Bolton jewellery shop in Sloane Street, 8, where the edges of the glass front are left exposed and rough cut.

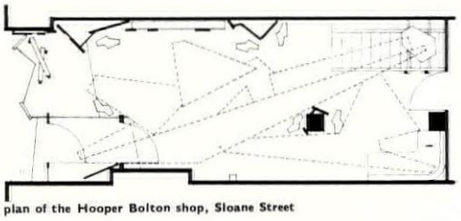


8

Jewellery shop, Sloane Street, London

Architects: G H and G P Grima

9, 10, interiors of the Hooper Bolton shop. The effect is kaleidoscopic : marble, wallpaper, silk, leather, gold foil, tiles and carpet. The showcases are suspended on black tubes on bar. The ceiling in 10 is finished in gold foil and the wall on the left is faced with Italian glazed tiles.



plan of the Hooper Bolton shop, Sloane Street

original design for the Hooper Bolton shop, showing the suspended ceiling projecting over the forecourt

10

9

11 (*opposite*), *display case in the Hooper Bolton jewellery shop* (*see page* 284). *The wall behind is covered with sheep's hide, used on the reverse side.*

Display lighting

Peter Jay

With the majority of routine lighting applications we are concerned to show things as they really are, but in display lighting we normally want to heighten the impact made by some things and implicitly to reduce that made by the background and setting. The conditions which promote comfortable vision of things as they really are have been fairly well documented. They are : (a) there should be adequate illumination of all objects that we may wish to see; (b) light colours, especially white, should be used where possible, particularly on the ceiling; (c) there should be no sharp contrasts between one object and another and (d) so far as possible, the contrast between the sources of light, (whether lighting fittings or windows) and the surround, should be controlled either by baffles or by ensuring that the surrounds are as light as possible, for instance by splaying window reveals and painting them white.

The requirements for display lighting are quite different : it is important that the objects of special interest should be lighted considerably more brightly than their background, and that each brightly lighted object should, so far as possible, be surrounded by an area of darkness to heighten the contrast. However, considerable skill is needed to ensure that display lighting is fully effective, since in other circumstances apparently similar arrangements can give rise to a feeling of gloom. It would appear that the conditions for drama and excitement are that the contrast between the objects on display and the surroundings should be as sharp as possible, 1, and that there should be at least one bright object in our field of view whichever way we look. Gloom seems to be associated partly with low illumination, and partly also with variations of illumination over a wide range without sharp gradients, 2. The easiest objects to display are therefore those of light colour, and especially silver and gold, which will sparkle and glint, particularly if they are provided with backgrounds of low reflectance. It is no accident that jewellers' display cases are usually lined with black velvet.

It also follows that it is very difficult to create dramatic lighting in daylight since this is necessarily diffuse, and sharp gradients can hardly be achieved except from direct sunlight. An exception may be a small isolated roof light with deep reveals above a piece of statuary; the shaft of light can then be very largely confined to the statue itself. If the floor is dark the amount of light reflected from it will be small and the contrast of the statue with its surroundings may be maintained at a suitably high level. However, side windows are very difficult to handle from this point of view since the surroundings in a display area will be necessarily dark, and if people are allowed to view the window directly it will cause glare.

Even with electric sources it is surprisingly difficult to achieve really sharp gradients of illumination, since where a sharp-edged beam is required from a spotlight, an elaborate optical system is necessary, which makes the equipment both bulky and expensive. It is generally more practical to employ commercial equipment which gives quite a soft-edged beam, and to provide additional masking to confine the light to the area in which it is required. The extreme example is the show case with deep louvres in the top, 3, but incandescent spotlights require more space and emit a fair amount of heat, while fluorescent tubes (which can easily be tucked in and give out little heat) tend to give diffuse light which may be a nuisance, 4. One expedient is to use polished spectacular louvres in a false top which direct the light almost vertically downwards and prevent it spilling out on to the floor, 5. The tops of display cases are normally below the eye level of people standing, but the possibility of glare and distraction to those sitting down must always be considered in designing any system of screening.

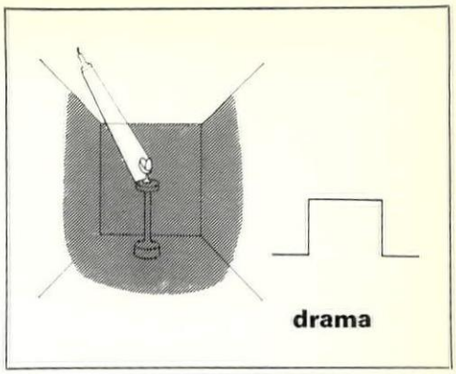
It is also important to remember that if anybody is to see something clearly, the illumination must come from quite close to their direction of view. This means that an object on display in an island position will require at least two sources and often three, and considerable care is necessary to ensure that the spotlights which illuminate one side do not glare in the eyes of people looking from the other. For this reason the spotlights are normally arranged to shine from as steep an angle as possible, but in this case they may cast heavy shadows.

In order to ensure high contrast, it is obvious that objects should be seen against dark backgrounds. The proportion of light reflected by a surface is called its *reflectance*, and the contrast between a lighted objected and unlighted surroundings increases very rapidly as the reflectance of the surroundings is reduced. For instance, the reflectance of a white surface is about 0.7, and that of a medium grey about 0.2; the contrast of a lighted object against grey surroundings is not three-and-a-half times greater than against white surroundings, but over nine times greater. This is because light reflected from the objects on display will strike the walls, ceiling and floor, and the light they reflect will itself strike other parts of the room. If the surroundings are dark in colour they will absorb most of the light reaching them, but if not they will re-reflect much of it and their effect will therefore be cumulative.

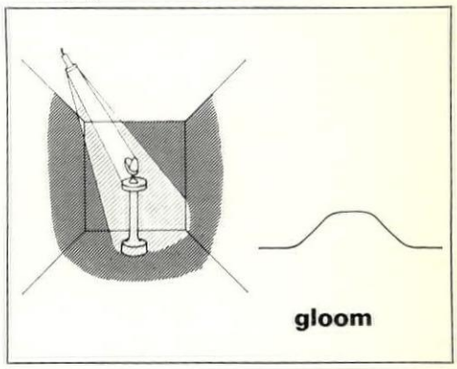
The need for surroundings of low reflectance does not necessarily imply grey or black. Colours of high chroma, such as deep reds and greens, can be just as effective in promoting large contrasts and at the same time impart a sense of colour to the scene.

The ratio of the area of the background to the area of the objects on display has a direct effect on contrast, and a large object in a small room will always stand out less well than a small object in a large room, other things being equal. Objects should therefore be well separated, an obvious design requirement which affects factors quite other than lighting. It follows that the ideal display space is large, with walls, ceiling and floor of low reflectance but perhaps high chroma. The illumination should, as far as possible, be entirely confined to the objects on display and the showcases. Considerable care will be necessary in arranging the entrance to such a space, since by day the general illumination will be much lower than outside. It is essential that there be some space with intermediate illumination so that people's eyes have time to become adjusted to the predominantly dark interior. A lobby between outside and inside is obviously desirable (see page 285).

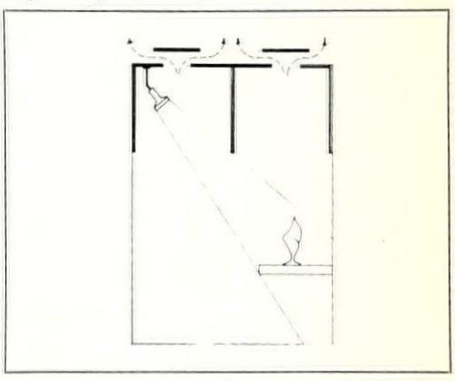
We cannot always arrange that there is a display object in every direction of view, and sometimes we may find it necessary to create interest in certain areas which the display itself does not provide. In such cases lighting fittings can be used



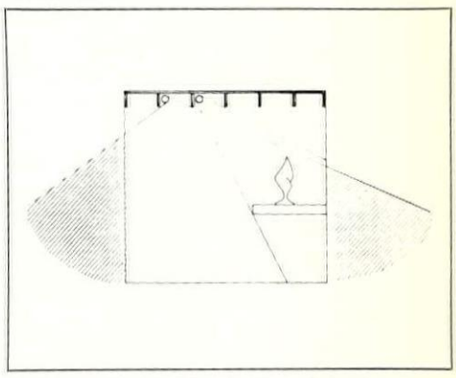
1, *steep gradients of illumination.*



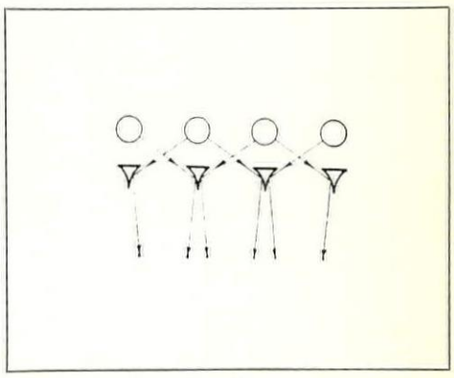
2, *gentle gradient of illumination.*



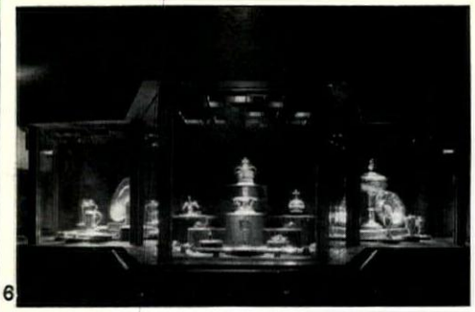
3, *spotlights require deep louvres and ventilation.*



4, *fluorescent tubes take less height but spill light.*



5, *optically shaped, polished louvres can direct all light downwards.*



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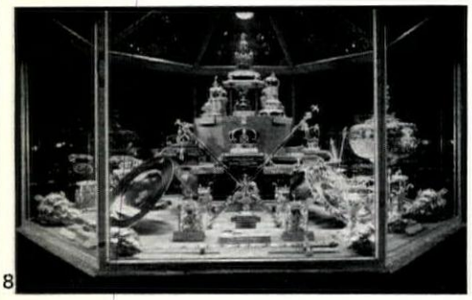

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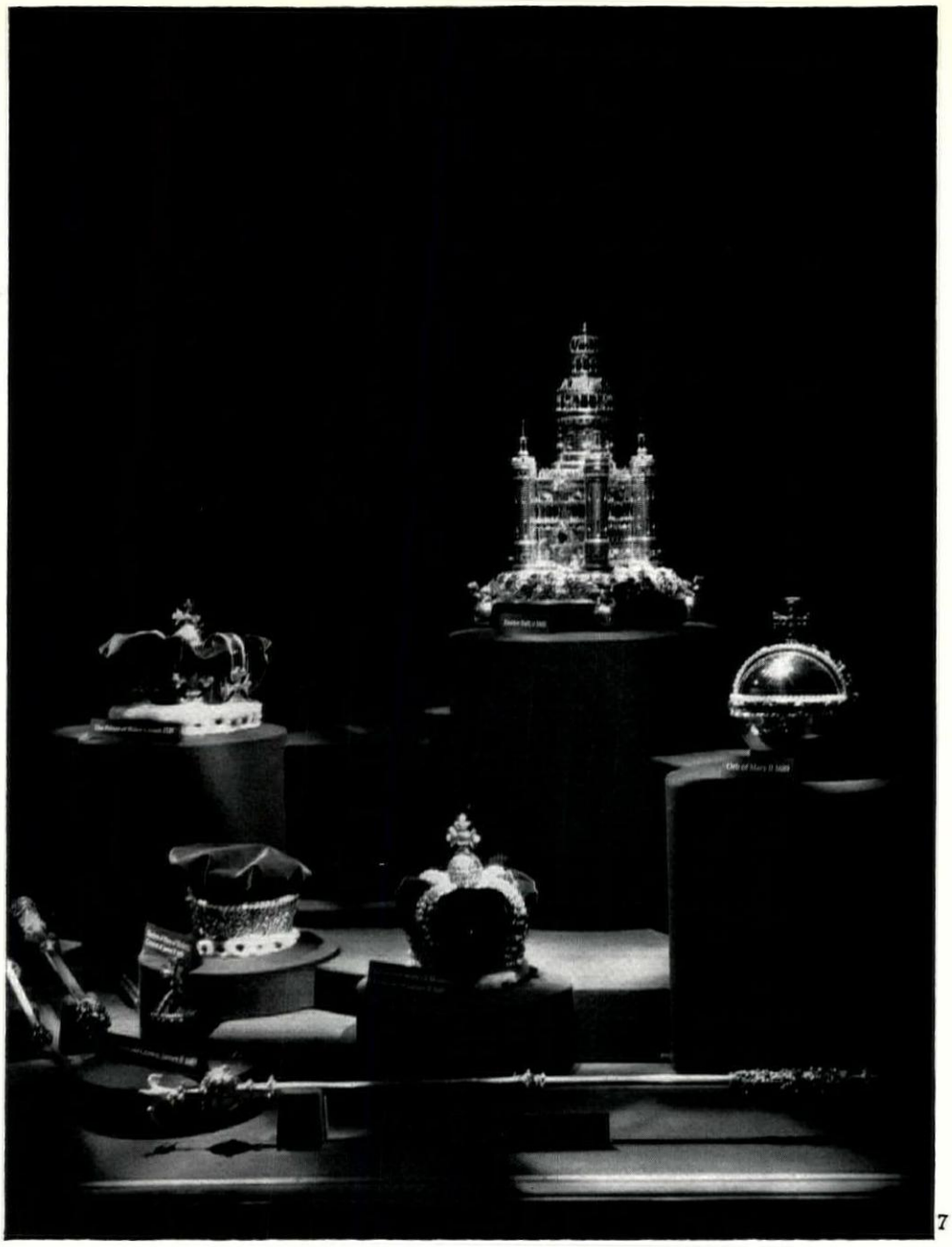
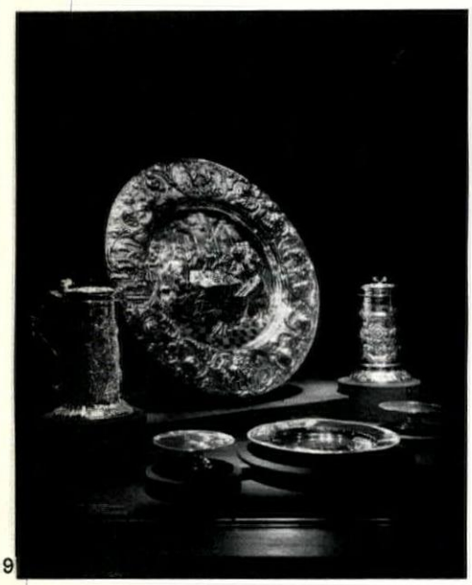


7

6, 7, 9, Crown Jewels display, Tower of London (see also page 281). For effective display objects should be well separated and individually lit (compare 6 with 8, the old display of the Crown Jewels in the Wakefield Tower). But in these circumstances the dividing line between drama and gloom is a very fine one (compare 6 with 7). With strongly modelled objects the directional qualities of lighting should emphasize the modelling, but not cast so much shadow that some aspects cannot be seen. The flagon on the right in 9 is strongly modelled and yet all the detail can be seen from this direction. The altar dish is more strongly modelled, with some loss of detail in the shade. One side of the flagon on the left is almost wholly unlit. In each individual case the requirements of good modelling must be balanced with the need for visibility.

10, John Donald shop, Cheapside, London (see also page 282). For effective display, the light should be confined as far as possible to the objects of particular interest.



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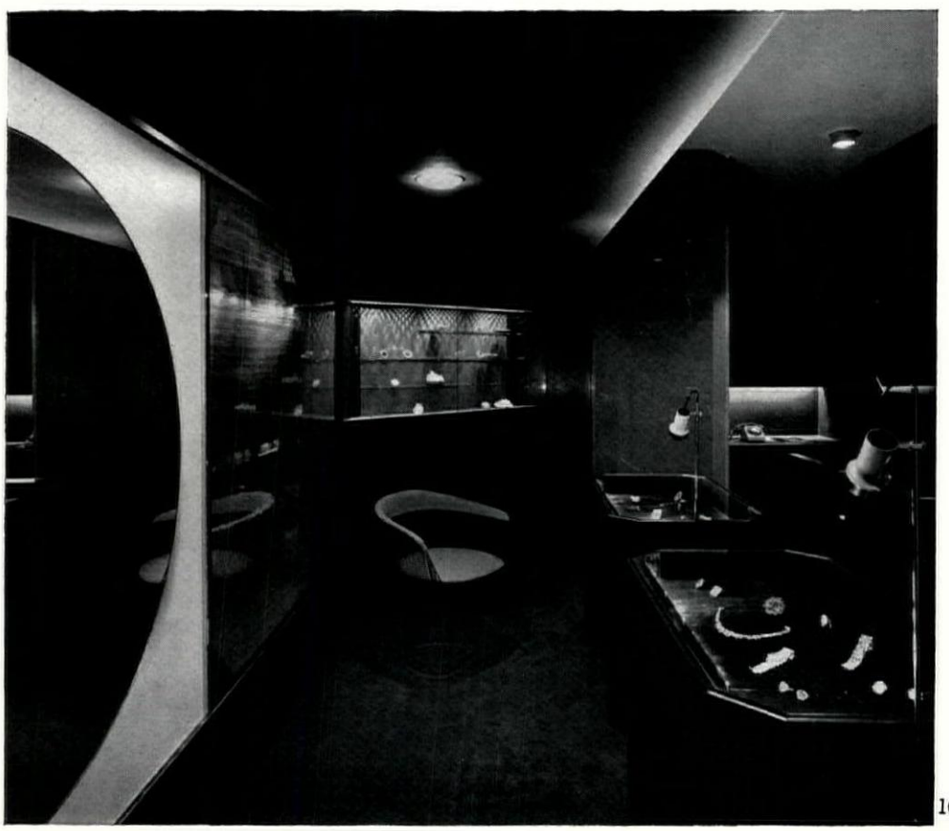


10

in the same way, but if they are not to glare their lighting function will be very small. During the last few years quite a number of fittings have been produced with this object in mind. However, in display areas it is essential that the sources which really do give the light shall not glare at all, otherwise they will compete with the display objects themselves.

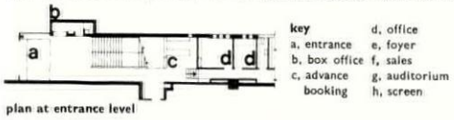
Cinema, St Martins Lane, London

Architects: Casson, Conder and Partners

In the best designs simple themes usually stand out clearly. The new Odeon cinema in St. Martin's Lane, inside an office block by another architect, is designed around a staircase and a screen. Two 12ft. floors demanded a staircase of some importance to carry people down to the auditorium in the sub-basement, and it is a pity that its ample character could not have been fully realized by omitting the statutory central handrail. The staircase is a progression from light to dark spaces and from hard to soft surfaces. The ground floor foyer starts all white and hard, and brightly lit from a suspended ceiling of aluminium plates. The only discordant note in this uncluttered entrance is a large display board, supplied by the distributors of the film and positioned arbitrarily on the wall opposite the front booking office. The narrow frontage leaves inadequate access to the advance booking area, and the offices at the back are now too small, the amount of advance booking having been miscalculated at the beginning.

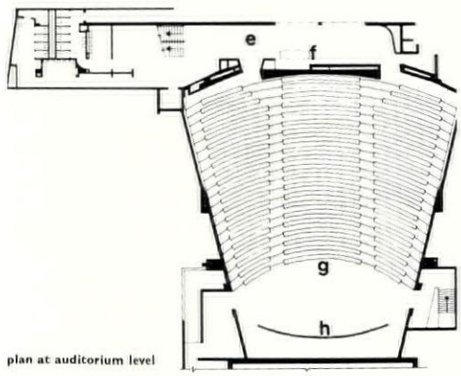
The staircase begins the progression into a darker world, and the purpose of the visit is anticipated in the kinetic effects projected on to the staircase wall. More could be made of this, and the architects did indeed visualize an enthusiastic management using shapes and colours appropriate to the current programme. The blue carpet bathed in violet light, which softens the tread at mezzanine level, is not yet wall to wall. The white wall surface merges into a strip of floor by means of a cove, and forms a hard surround to the carpet. This and the cloakroom area, also in white terrazzo, remind one that this is a transitional area, looking back as well as forward. The open well in front of the cloakroom comes as a surprise, and is too small to be effective.

At the lower foyer level, and anticipating the finishes in the auditorium, floors and walls are carpeted in a continuous surface.



key
a, entrance
b, box office
c, advance booking
d, office
e, foyer
f, sales
g, auditorium
h, screen

plan at entrance level

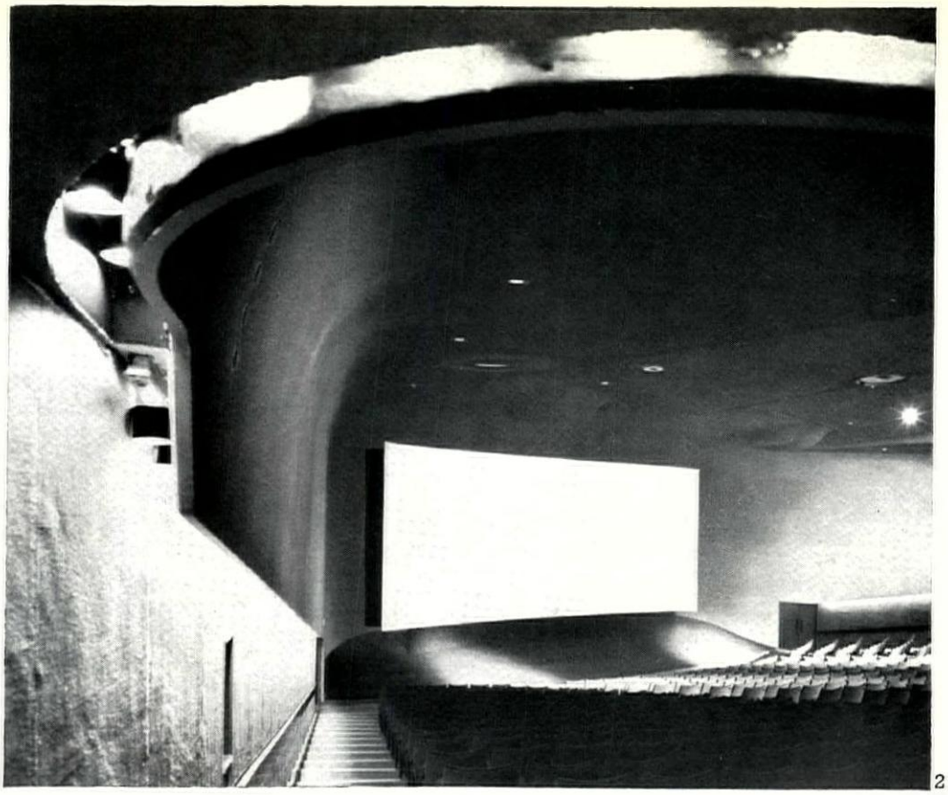


plan at auditorium level

1

1, *the back of the auditorium. The upholstery is green and blue moquette, partly cut and partly uncut to give two tones in each colour. It was designed by a student at the Royal College of Art.*

In the subdued blue lighting (blue because it was found that white lighting killed the blue in the carpet) the staircase treads, each with a masked strip light, float airily and contrast with the solid black handrails. (The lights under the bottom treads should, however, be removed, as the additional thickness of carpet cuts out all but a few chinks.)
The screen is made the focus of the fan-shaped auditorium, and this is not just a truism. The screen is large for the auditorium (see Academy 2 cinema, ID in AR September 1965, for comparison), there are no curtains and it appears to float in darkness, though the lights installed by the management behind it have now wrecked this dramatic effect. The original intention was to make the screen a focus even before the performance began, by the projection of slow-moving pattern but, as a result of unsatisfactory experiments, only single colours are now used. Masking for smaller picture ratios was achieved at the sides by means of hinged panels which swing back behind the screen when not required. At the top overspill disappears out of sight behind the screen, and at the bottom it is absorbed by the turned-up carpet. There are only two projectors instead of the usual three, and this is the first cinema, according to Rank, to have a centralized automated control system designed to look after most of the routine functions normally carried out by staff. The simplicity of this interior is largely due to the consistent use of continuous



2

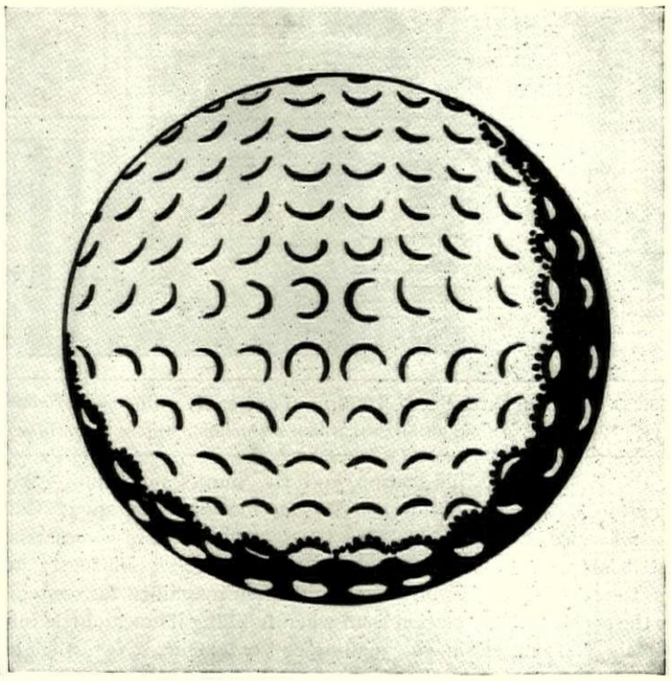
4

Cinema, St. Martin's Lane : 2, the auditorium showing the screen before the management installed lights behind it. The ceiling is a single moulded shell cast on to a metal frame. 3, telephone booth finished in white terrazzo. 4, the staircase from the cloakroom. The ceiling and walls are plaster, the floor is carpeted and the cloakroom is of white terrazzo.

and plain surfaces. There is the overall white terrazzo treatment of the front booking office, cloakroom and telephone booth in conjunction with white plaster walls on the one hand, and the use of two plain colours—white and blue—on the other. But this simplicity has been achieved only at a sacrifice. The white terrazzo surfaces are already dirty, but could easily be washed. More serious is the state of the carpet, especially in the auditorium, where the great number of stains, all showing up clearly on the plain surface, are damaging to the design.

I KNOW HOW YOU MUST FEEL, ROY

Robert Melville



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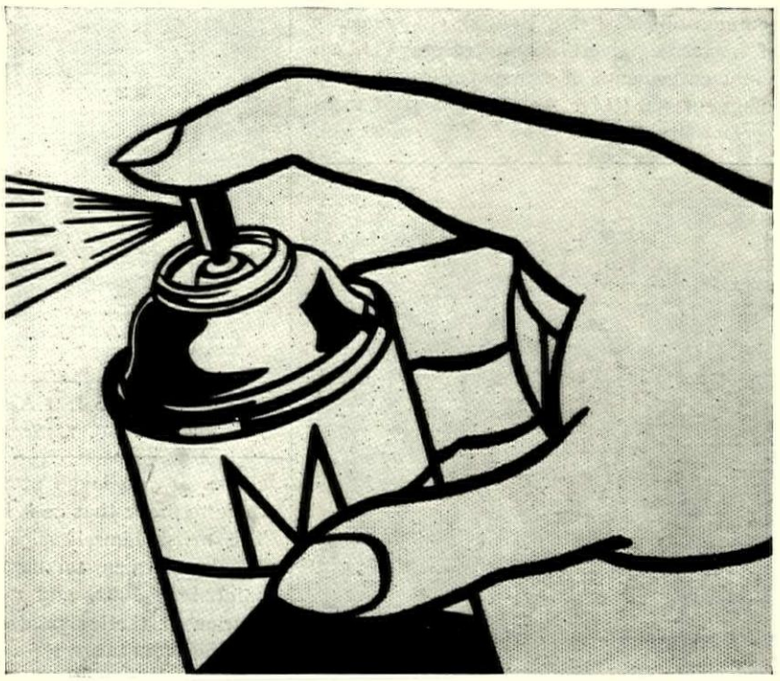


2

Roy Lichtenstein: 1, '*Golf Ball*,' 1962. 2, '*Spray* II,' 1963. 3, '*Live Ammo*,' 1962.

3

The eight paintings by Roy Lichtenstein reproduced here were in the travelling exhibition of his work which came to the Tate Gallery in January. I attended the press view and didn't see the show again, but I understand that attendance figures were very high, and I think they can be taken as evidence of public approval of the Tate's enterprise in acquiring the big 1963 diptych called 'Whaam!' (reproduced AR April 1967). Lichtenstein is not only Pop, he's popular.

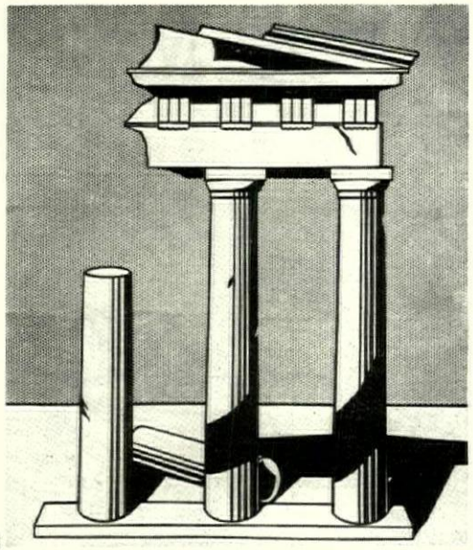
'Whaam!' looked much better in the Lichtenstein show than in the Pop bay at the end of Gallery 17, probably because it's an entirely different kind of painting from all the other examples of American and English Pop in the Tate collection. It's one of the best of his comic strip battlepieces, and I would like to see it hanging in an isolated position, or at least removed from the irrelevant context of works by aesthetes like Dine and Johns.

The catalogue included two interviews with the painter, and it's clear from his clever double-talk that, like all the other avant-garde painters, he wants to be marvelled at rather than understood. There was also an interesting essay by Richard Morphet, a member of the Tate staff, who undertook the task of supporting Lichtenstein's view of himself as a serious abstract painter. Institutions are gluttons for undiluted praise of

anything they buy or sponsor, but Morphet writes well, and it's to be hoped that he will not be expected to write too many yes pieces. A page of the catalogue was devoted to a fascinating chronology of Lichtenstein's imagery. Between 1961 and 1964 he painted enlargements of small printed images of common objects ('Golf Ball,'1); enlargements of magazine advertisements ('Spray II,' 2); and enlargements of newspaper comic strip images of war ('Live Ammo,' 3) and of teen-age love situations ('I know how you must feel,

4

Brad,' 4). In 1964–65 he was painting cartoon-style classical ruins ('Temple II,' 5) and in 1965–66 the brilliant blow-ups of copies of dripping brushstrokes, 8. These were followed by a series of old-fashioned abstract compositions containing the sort of machine-like bric-à-brac that some European painters were using in the 'twenties. He calls them, 'Modern Paintings,' 6, and, according to the catalogue, this titling is intended 'ironically.' They are parodies of a style rather than copies of extant works. They are not amusing, and I suspect that the painter would like them to be accepted as great formal enterprises. They are painted in deadly earnest—I mean, *deadly*—and the facetious titling is merely a sort of escape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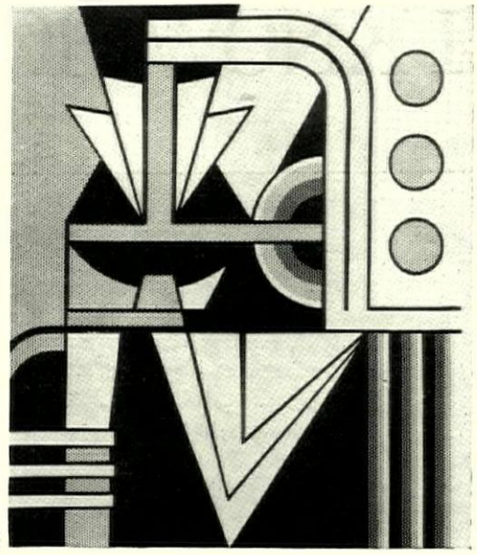
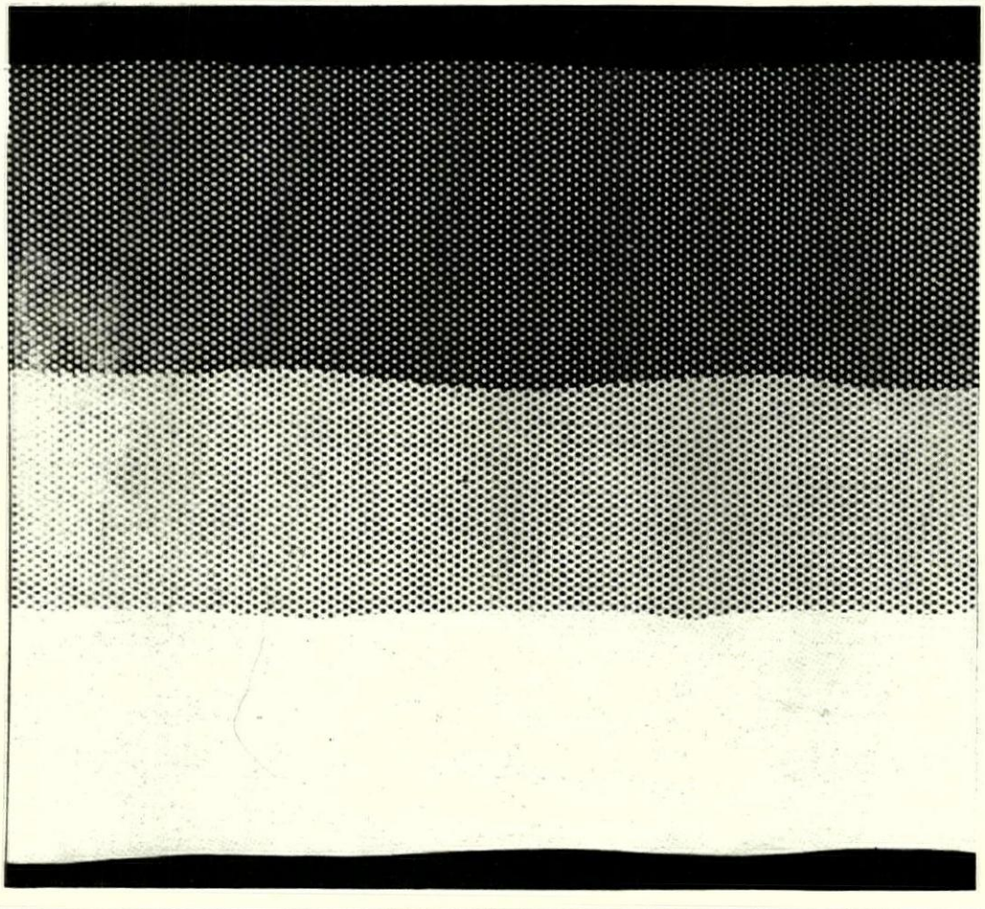

6

Roy Lichtenstein: 4, '*I Know How You Must Feel, Brad*,' 1963. 5, *Temple* II,' 1964. 6, '*Modern Painting* I,' 1966. 7, '*Seascape* II,' 1964 (*red, yellow on brown, brown on yellow, yellow, grey, blue*).

clause. If you laugh at them, the titles are there to prove that he is laughing too.

The artist himself slips in a reference to Mondrian when talking about 'Golf Ball,' painted in 1962, and appears to attach a spurious aesthetic significance to the accidental association between the marks in the golf-ball illustration and the marks in certain early Mondrians. The fascinating thing about 'Golf Ball' is that the sign language of commercial expediency operates no less efficiently to signify 'golf ball' when magnified for contemplation than when fulfilling its mean little role in a mail-order catalogue. Nevertheless,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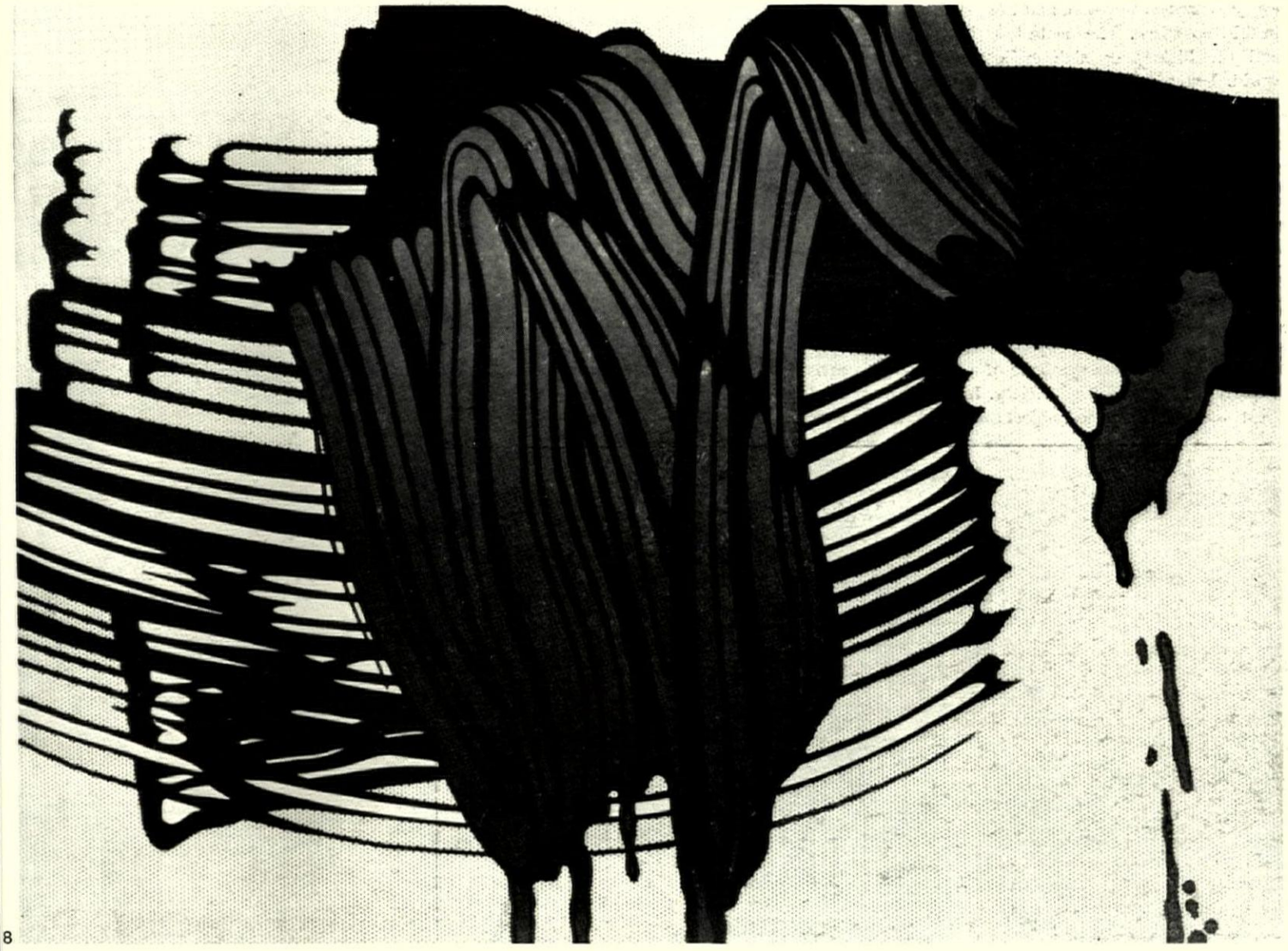
Lichtenstein's mention of Mondrian is a bit of wish-fulfilment. He wants to be considered on the same abstract level as 'real' abstractionists like Stella and Poons. So it's not altogether surprising that he gave an abstract demonstration of his famous comic-strip technique towards the end of his comic-strip period. He calls it 'Seascape,' 7, and since any painting arranged in horizontal bands can at a pinch be thought of as a landscape or seascape, the title vaguely serves. But the signs are not there for the sake of what they pretend to signify; they are there for their own precious sake, and very pretty they look too, in a vacant sort of way. (The photograph is very bad; but no doubt the Tate will soon get used to putting on shows without the help of the Arts Council's efficient team.)

It looks as if he is not going to paint any more comic-strip pictures. This is a pity. They are a unique contribution to contemporary art and are certainly at the core of the general interest in his work. He has always been equivocal about them, and insists on the primary importance of their compositional qualities because he is half-ashamed of their content. Of the images he chose for his war and 'teen romance pictures he says: 'I don't think I'd be capable of making them up. I try to take messages which are kind of universal, or, in a way, either completely meaningless or so involved that they become ludicrous.' I don't think anyone would expect him to be capable of making them up, and I don't think the remark was made in a spirit of humility. He is saying in effect that as a painter he is incapable of sinking so low and at the same time he is saying that it's a language of visual symbols that's been perfected for universal communication, however crass the message may be, and can't therefore be radically tampered with. Yet there is a, wholly admirable, sense in which he has achieved a further perfecting. In the act of choosing, combined with the technical means by which he supports the amplification of the image chosen, he produces an ideal version. If the comic strip can be immortalized, Lichtenstein has done it. His art inherits meaningless and ludicrous details from the original; 'Live Ammo' is really incoherent, but no one could question its overall meaning or the immediacy of its impact. And the girls are all involved in the same lovers' quarrel and the same reconciliation. One can even make one's own sequences as if they were elements in a do-it-yourself set. The girl who knows how Brad feels is drowning in another painting, and says to herself: 'I don't care! I'd rather sink than call Brad for help.' And, as one might expect, there is a painting in which Brad has nevertheless come to her aid and—'We rose up slowly, as if we didn't belong to the outside world any longer . . . like swimmers in a shadowy dream who didn't need to breathe.'

In a sense, it's a new kind of genre painting, and Lichtenstein is the greatest painter of the

Roy Lichtenstein: 8, '*Big Painting*,' 1965.



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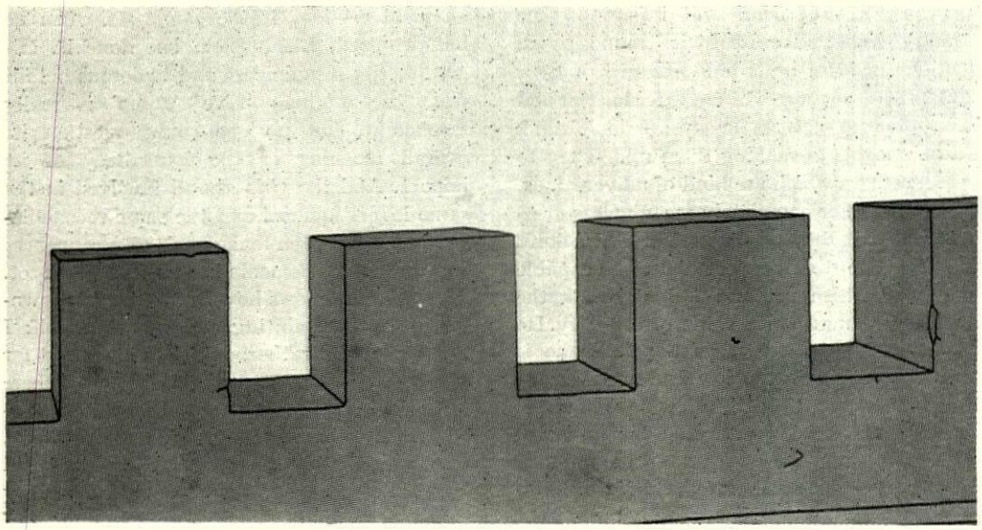
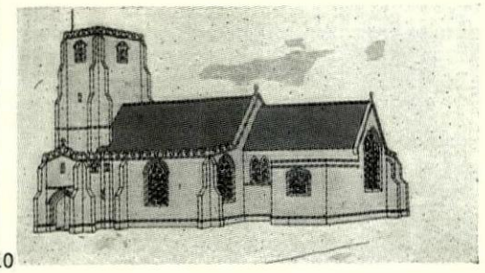


9

American scene since Edward Hopper. He has caught the spirit of the American dream, and half the world wants to be in on that dream. The war scenes would make ideal posters for every American war film, and the girls all live in Peyton Place. The neatest, cleanest girls and the highest of high explosives in the world. I find it intensely real.

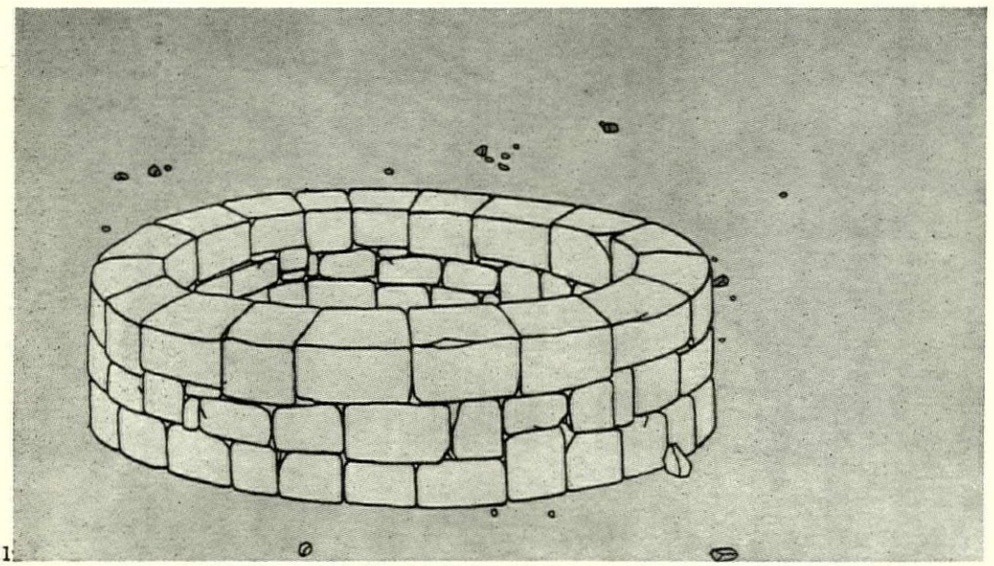
Lichtenstein's paintings of Classical Ruins and his early paintings of common objects bring to mind the art of Patrick Caulfield, who recently showed some new paintings at the Robert Fraser Gallery. He has a totally different colour sense and obtains some superbly overbearing effects from the use of large flat areas of dreadnought grey. He has the same ability as Lichtenstein to get maximum visual impact from the isolation of an object, but his choice of objects is less impersonal and in no sense symbolic of a commercialized and industrialized society. Instead, he creates a world in which objects are back to

Patrick Caulfield: 9, '*Battlements.*' 10, '*Parish Church.*' 11, '*The Well*'.



10

square one, as if he were making a monumental children's alphabet. B is for Battlements, 9; C is for Church, 10; W is for Well, 11. He lacks Lichtenstein's sense of the universal symbol, but he is stripping the object of artistic camouflage and giving out brand-new cards of identity which should rejoice all children and extreme sceptics.



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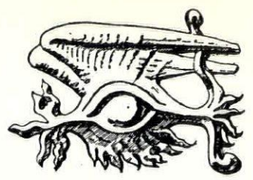


the exploring eye

The Moroccan village of Zaouia Ahansel was founded about six centuries ago by a marabout or holy man, Sidi Said u Amer, who managed to settle tribal differences in the area. It was formerly an independent maraboutic principality, with the holy man exercising both spiritual and temporal power—rather like a miniature Moslem version of the Vatican State. Pilgrims still bring tributes to the marabout's descendants after the autumn harvest. The village is enfolded by some of the highest mountains along the spine of the High Atlas range. It is still difficult of approach, and is cut off by snow in the winter.

1, *the village in its mountain setting.* 2, *one of the four main chateau-forts.* 3 (*overleaf*), *looking along a street to one of the chateaux.* 4, *courtyard of the marabouts's chateau.*

1

2

5

5, *one of the principal buildings of the village of Zaouia Ahansel, with the High Atlas mountains beyond.*

photographs by David Hicks | **Zaouia Ahansel**

21

contemporary draughtsmen

Zdenek Sindlar

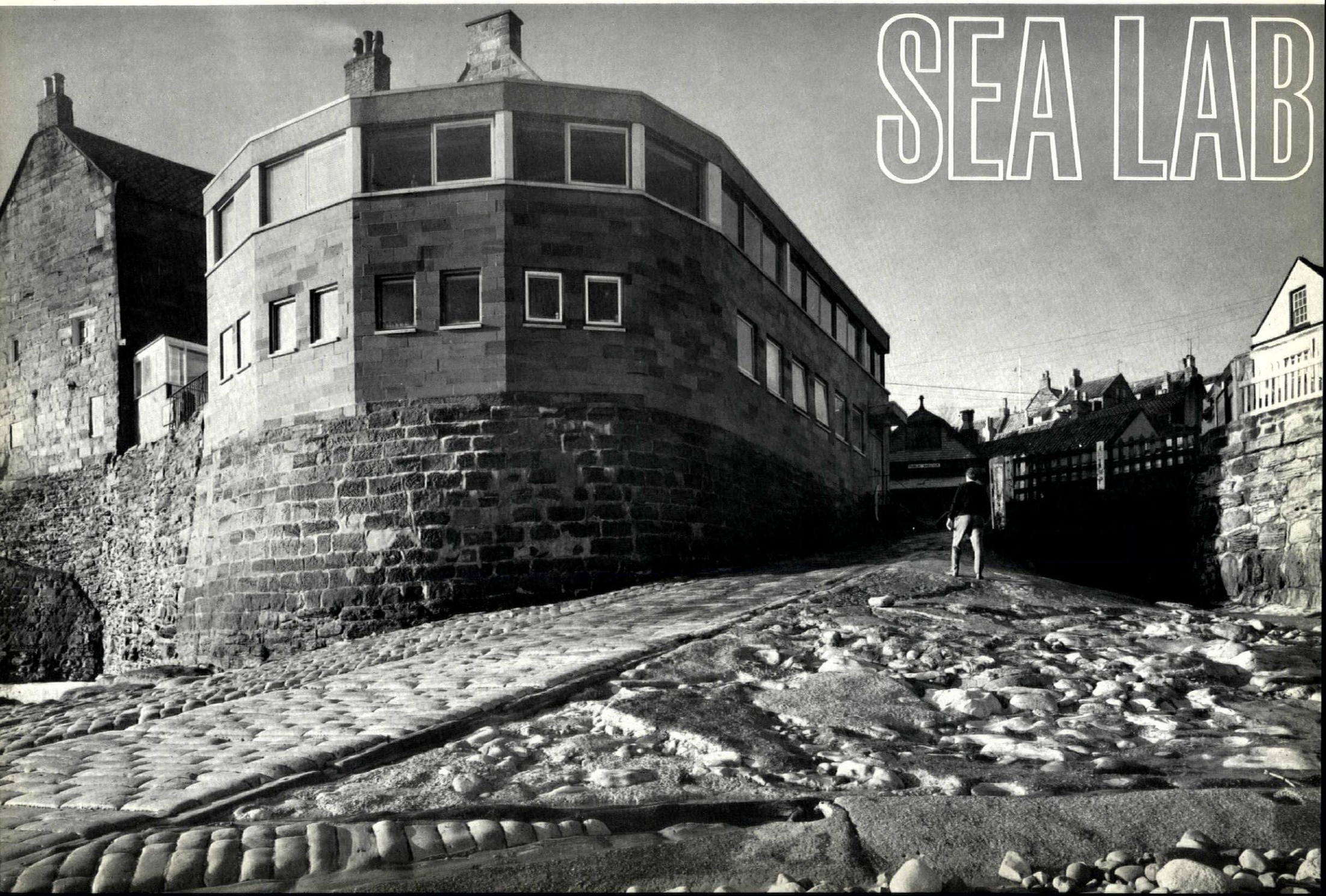
Zdenek Sindlar, born in 1939, studied at the Technical College at Prague for six years, making his living meanwhile by drawings, posters, illustrations and cartoons. In 1964, after qualifying as an architect, he was also admitted to the Association of Czech Creative Artists. In 1965-66 he worked in the Architect's Department of the Greater London Council, being the first 'exchange' architect from Czechoslovakia for many years. He has exhibited his work twice in Czechoslovakia and twice in London. The selection of his London drawings published here show the city through the eyes of someone steeped in the Baroque culture of Bohemia.

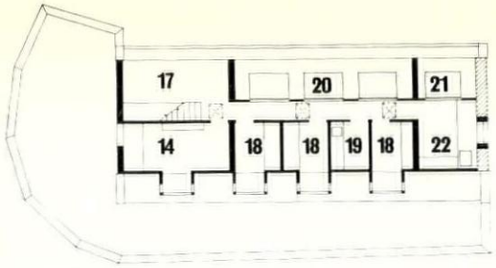

BEDFORD
TO BE

MARINE LABORATORY, ROBIN HOOD'S BAY, YORKS | *architects* **BRIERLEY, LECKENBY AND KEIGHLEY** | *photographs by Keith Gibson*

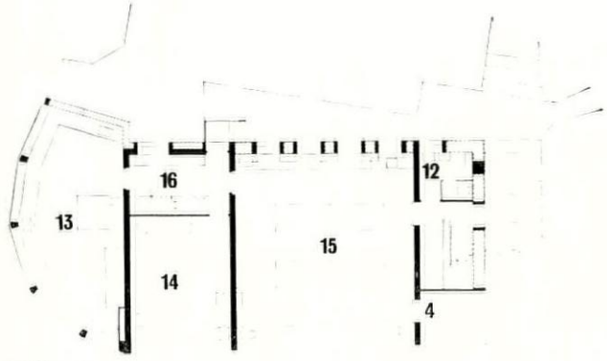
1

SEA LAB

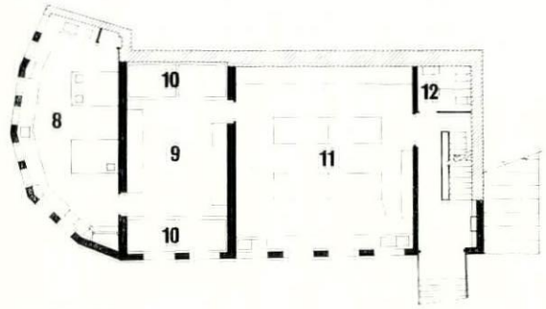




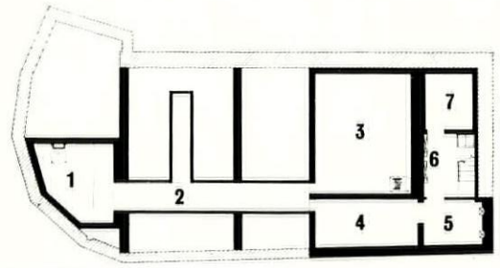
second floor plan



first floor plan



ground floor plan



basement plan

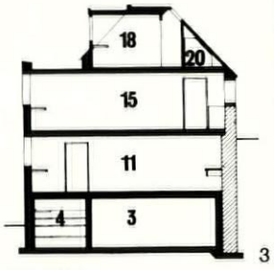
The Wellcome Marine Laboratory of the University of Leeds is an extension of an earlier laboratory converted from an old cottage and coastguard station. The laboratory will be used by research workers from other universities besides Leeds, and an old school in Robin Hood's Bay has been rebuilt as a hostel for them.

The site was very restricted, being bounded by the seawall on two sides and by a narrow passage at first floor level leading to the ground floor of the existing cottage. On the ground and first floors are two teaching laboratories, a physiology and a biochemistry laboratory, a director's room and an aquarium. The last has built-in tanks for fairly large fish and racks for smaller tanks for other fish, sea-animals and sea-plants. In the roofspace are four small study-laboratories, a darkroom and 700-gallon header-tanks for a seawater circulation system. A cellar that existed behind the seawall has been enlarged to house a 4,000-gallon seawater storage tank, a refrigerated constant-temperature room and the ventilation and compressed air pumping plant.

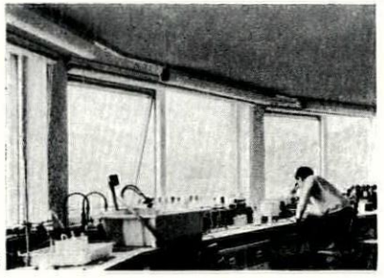
Floor-slabs are reinforced concrete and walls are stone. After an extensive search a source of Cleveland stone almost identical to that used in the old buildings of the village was found, and although the traditional herring-bone boasted finish was too costly, a similar effect was obtained by using coarse steel shot in the frame saw.

A problem was to construct the sea-water suction pipes that have to reach down almost to low-tide mark without disfiguring the foreshore. There were, however, some convenient faults in the shale scar which forms the shore, and by using these and some camouflage the line of the pipes was made hardly detectable.

Designed in association with the resident architect to Leeds University. Quantity surveyors, Turner and Holman. For contractors see page 324.



cross section



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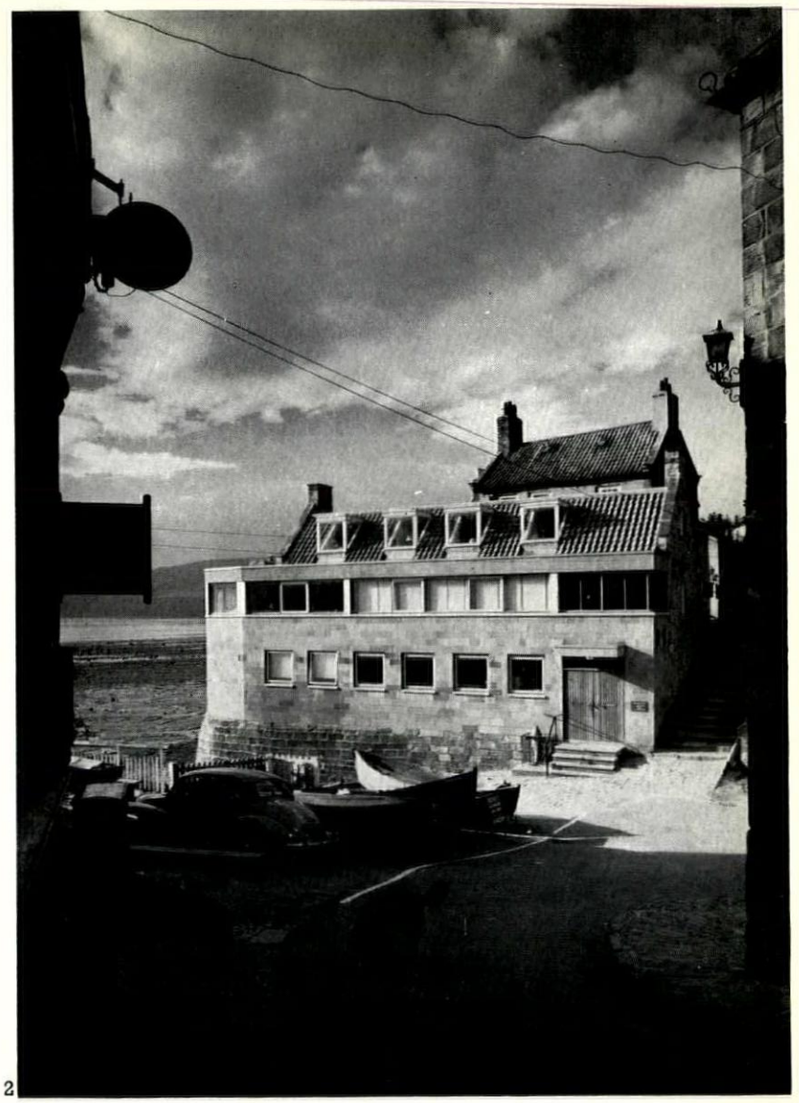


2

1 (preceding page), the laboratory seen from the foreshore. 2, the entrance side. 3, the physiology laboratory; ground and first floor windows facing the sea have armour-plate glass to withstand waves that break over the building.

MARINE LABORATORY, ROBIN HOOD'S BAY, YORKS

key

1. pump chamber
2. service ducts
3. sea water tank
4. store
5. plant
6. control panels
7. constant temperature room
8. biochemistry laboratory
9. tank room
10. fish tanks
11. teaching laboratory
12. w.c.
13. physiology laboratory
14. staff laboratory
15. teaching laboratory
16. gallery
17. storage
18. study laboratory
19. radioactive equipment
20. sea water header-tanks
21. mains water header-tank
22. darkroom

Rowland J Mainstone

STRUCTURAL THEORY AND DESIGN BEFORE 1742

The date 1742 marks the first recorded structural analysis of a building which is recognizably modern. This article enquires into the structural theory that existed to guide designers before that date and into the approach to design of the men responsible for such outstanding achievements as St. Sophia, Istanbul, the great Gothic cathedrals, the dome of the cathedral in Florence, St. Peter's in Rome and St. Paul's in London. Though the roots of modern statical theory can be traced back to classical Greece, its direct role in design before 1742 is shown to have been minimal. The theory actually used took more than one form but was almost wholly geometrical, thus reflecting a close relationship, in terms of the means of construction, between structure and form, and a frequent lack, in designers' minds, of any clear distinction between the two. The structural and aesthetic consequences of this and of the symbolic overtones of some of the theory are discussed for the insights which they can offer both into the surviving structures themselves and into a common part of the professional cultures of the architect and structural engineer of today.

'*Ars sine scientia nihil est: Scientia sine arte nihil est.*' This assertion by Jean Mignot, a French consultant, and counter-assertion by the Milanese masters were recorded in Milan in 1400 during one of the long succession of formal discussions or debates on the design of the new cathedral.[1] Though stated with unusual force in the heat of argument, the dependence of sound design on both theory and practical experience which each emphasized from a different point of view was not, even then, either new or previously unrecognized. Mignot's championship of theory under the provocation of Milanese intransigence, for instance, merely echoed an earlier emphasis on its importance which can be traced back through Islamic, Byzantine and late Hellenistic writers to the first surviving architectural treatise, that of Vitruvius, written in the first century B.C.[2] The changes that have taken place since Vitruvius have been changes in the theory itself, in the ways in which it has been used and supplemented by practical experience, and in the types of structure to which it has been applied.

Hitherto structural historians have largely confined their attention to the development of the present theories of equilibrium, deformation and strength. The first recorded application of these theories in structural practice in 1742–43[3] may be said to mark the birth of the present art of structural design. This art has, however, grown out of what preceded it and still in some ways reflects its origins. Our understanding of it will be deepened by a better knowledge of these origins, and some knowledge of the manner in which the surviving structures of the past were conceived seems essential if they are to be studied with profit today as part of the wider education of the young architect or engineer.

There are difficulties, of course, in any attempt to establish the working methods of designers more than 200 years ago. It is difficult enough to describe adequately the methods adopted today. As the enquiry is pressed further back the evidence becomes, in general, increasingly fragmentary. Different facets of the total changing picture are illuminated at different times, and through them its main outlines must be reconstructed and the significant underlying continuities discerned. The surviving structures themselves are a primary source of information, but they alone can tell us nothing of theory and may easily mislead us into projecting too much of our own approach to design into the past. Supporting evidence must be sought, particularly in treatises, in contemporary drawings and in other contemporary records.

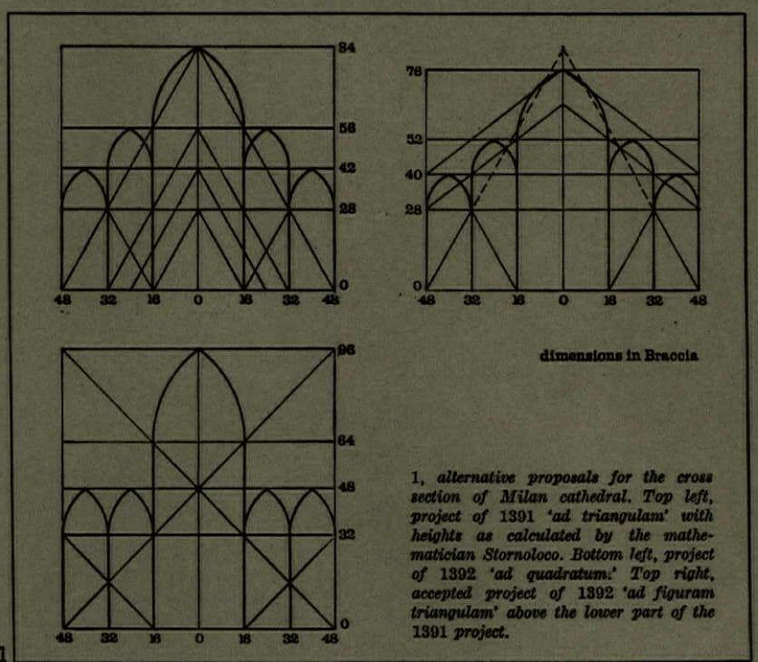
Attention will be concentrated on the design of those structures which presented a real structural challenge on account of their form or scale or the adoption of new methods of construction. Whereas today such structures might be long-span bridges, they were in the past mostly large churches—large essentially unicellular structures which presented as the principal structural problem the need to span a high wide space with some kind of permanent vault.

THEORY (1)

The theory invoked at Milan will be considered first.

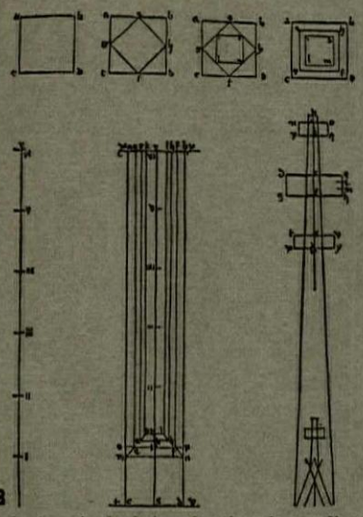
Mignot was quite explicit. The theory of which he spoke in the exchange quoted above was '*scientia geometriae*'.[4] Essentially this required the main lines and forms of a structure—such as the heights of vaults and the proportions of piers and buttresses—to conform to a certain predetermined geometric grid. In the earlier discussions between visiting experts and the local master more than one such grid had been proposed, 1, but the need for some control of this kind on the design was generally accepted and was strikingly acknowledged by the calling in of a professional mathematician in 1391 to compute the irrational height of the equilateral triangle then favoured as the control on the cross section.[5]

This geometric theory can be traced in considerable detail from the birth of Gothic to the early Renaissance and something closely analogous can be seen already in Vitruvius.[6] Evidence of it is found in surviving contemporary drawings of buildings,[7] in precise measurements of the buildings themselves,[8] in the records of other discussions like those at Milan (notably in Siena in 1321[9] and in Bologna in the late sixteenth century[10]) and in the architectural treatises of Filarete,[11] Francesco di Giorgio,[12] Serlio[13] and Philibert de l'Orme.[14] Most explicitly it appears in a number of short treatises from the end of the Gothic period, such as that by Roriczer published in 1486.[15] Roriczer demonstrates the theory by means of a simple example of its application to the design of a small pinnacle, 2. Starting from one dimension in the ground plan he derives all others by means of the simple geometric construction for doubling or halving the square. This construction, repeated often enough, provides all the dimensions needed for both plan and elevation. Variations in the method arise largely from the substitution of other basic figures for



1, *alternative proposals for the cross section of Milan cathedral. Top left, project of* 1391 *'ad triangulam' with heights as calculated by the mathematician Stornoloco. Bottom left, project of* 1392 *'ad quadratum.' Top right, accepted project of* 1392 *'ad figuram triangulam' above the lower part of the* 1391 *project.*

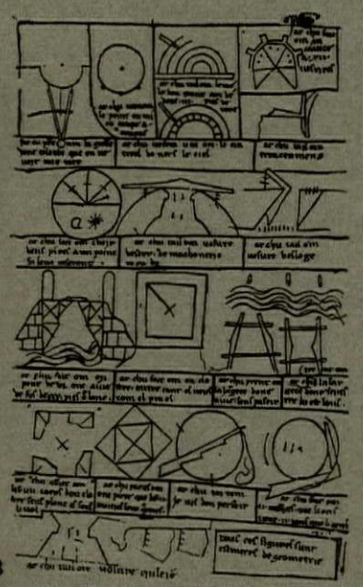
1



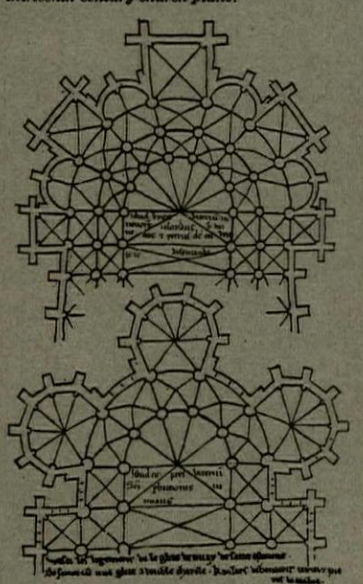
2, *stages in the design of a pinnacle according to Roriczer.*

the square. During the Gothic period the equilateral triangle and probably the regular pentagon (which leads to the 'golden section') were also used,[16] while in the early Renaissance there was an increasing use of the circle and rejection of constructions which led to irrational ratios between dimensions.[17]

Nowhere, however, are the basic



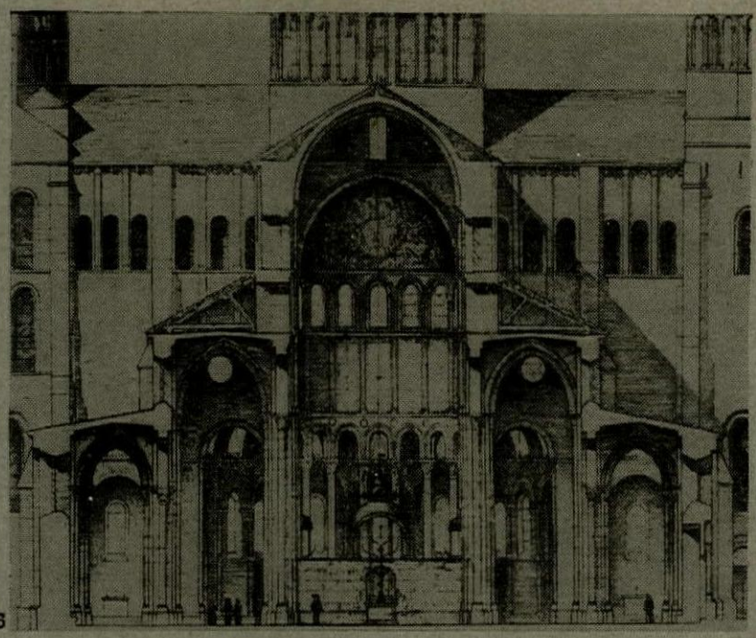
3, *thirteenth-century practical geometry in the pattern book of Villard de Honnecourt.* 4, *two thirteenth-century church plans.*



premises of the theory stated in surviving documents, and it is unlikely that they were ever precisely formulated. It was not solely, and it is unlikely that at first it was even primarily, a structural theory. Initially the immediate practical value of a simple definition of the form of any large structure and of the resultant simplification of the process of setting it out on the site would have been paramount. The preoccupation of designers with the practical problems of setting out is clearly illustrated in the group of small diagrams taken from a text in the Roman agrimensorial—or land surveying—tradition and inserted by a second hand in the mid-thirteenth century pattern book of Villard de Honnecourt,[18] 3. Surviving medieval architectural drawings, other than details and large presentation copies of elevations with more emphasis on the decoration of the facade than on the structure behind, are mostly plans, which are neither dimensioned nor drawn accurately to scale,[19] 4. Dimensions, in both plan and elevation, must, therefore, have been determined largely on the site in terms of the predetermined geometric system and by means of the simple constructions with square and compass or lengths of cord shown in the pattern book;[20] and this procedure alone would have placed a premium on the use of those simple regular geometric figures which readily form repetitive or expanding grids.

The structural connotations were more likely gradual and, in the circumstances of the times, almost inevitable accretions to the theory, which slowly transformed it. Practice in any lodge would tend to crystallize around a particular geometric system, and this system, in the absence of an adequate structural theory in the modern sense, would provide a ready framework for the assimilation of that kind of structural experience which teaches that certain forms are adequate and others are not. That a transformation of this kind had already occurred before the decision was taken, in the fourteenth century, to rebuild Milan Cathedral on an unprecedented scale, is shown time and again in the records of the discussions there of successive structural difficulties. For Mignot and his colleagues the structural relevance of the theory was not only unquestioned: it was their only recorded reason for invoking it.[21] Later similar discussions[22] and the early Italian and French architectural treatises[23] show that the structural connotation survived well into the Renaissance, while, at a much earlier date and in an earlier form, there are hints of it again in Vitruvius.[24]

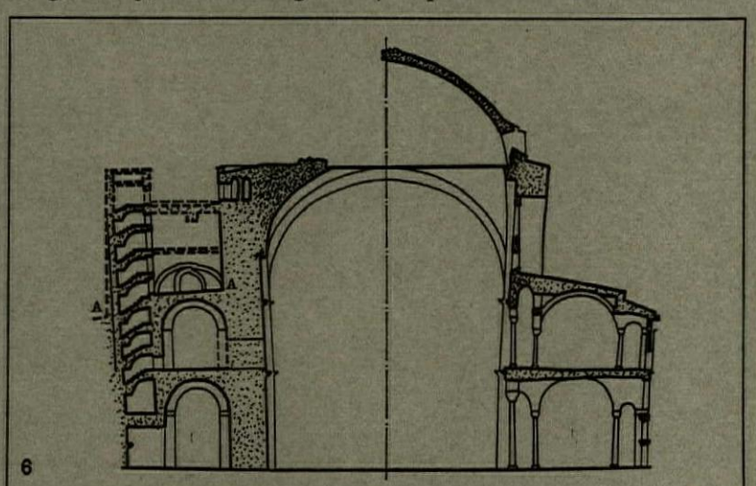
As a structural theory lacking any conceptual distinction between structure and form, the *scientia geometriae* was, in fact, potentially relevant to the extent that there was a close identity of the two in actual construction. To a large extent this identity did exist.[25]



5, *cross section of the nave of the third Abbey Church of Cluny as originally constructed without flying buttresses to the main vault. These were added after the vault collapsed in* 1125.

The wide choice of materials and almost unlimited freedom in using them in combination which are enjoyed today were unknown in the past. Even structures which took generations to complete show a remarkable homogeneity of construction. Almost invariably, with the exception of ties inserted to control the spreading of arches, vaults and domes, their primary structural action is solely that of masonry in compression under its own weight. Mean stress levels due to this dead weight are low[26] and such other stresses and overturning moments as are present are chiefly those due to wind or earthquake and are also, therefore, direct functions of the form. The chief structural problem of design was to ensure the stability of this masonry, and it could indeed be solved largely by appropriate geometric rules.

This potential relevance was, nevertheless, limited in practice by the impossibility, without loss of generality, of removing the inherent ambiguities of the basic geometric symbolism for the conditions of structural integrity. In its basic form the theory called merely for conformity to one of several geometric disciplines. One could choose the discipline of the equilateral triangle, or the square, or one of the other ideal figures; and one could then conform to it in a virtually unlimited number of ways. To remove this ambiguity called for a number of written or unwritten operational rules. With these rules the adequacy and practical validity of the theory turned largely on their adequacy and validity and, in turn, on the extent to which past experience could be validly interpolated or extrapolated in terms of direct geometric proportionality. The theory was, in fact, proved wanting chiefly when, as at Milan, attempts were made to apply it, as developed in one tradition of construction, to structures in a radically different tradition or of unprecedented form or scale.

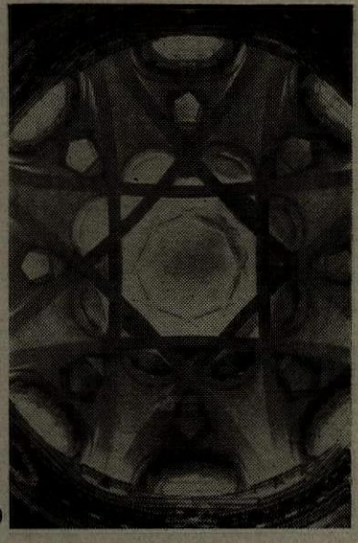


6, *composite transverse cross section of St. Sophia, Istanbul, cut, at the left, on the centreline of the eastern piers and buttresses and, on the right, on the transverse centreline of the church. The buttressing masses above the level AA appear to have been added during the initial construction, but only when the action of the thrusts from the main arches had become apparent. They nevertheless proved inadequate and the dome and other parts of the structure indicated by the heavy stippling had to be rebuilt after a partial collapse about twenty years later. All inclinations from the vertical are exaggerated two times and broken lines signify later additions to the sixth-century structure or later rectifications of the facings.*

7

7, *St. Sophia, Istanbul.* 8, *Florence cathedral dome.* 9, *the vault of San Lorenzo, Turin.*

8



9

DESIGN (1)

At Milan the cathedral had been started with great confidence on the pattern of much smaller brick-built Lombard Gothic churches like the Carmine in Pavia; but for the previous two hundred years Lombardy had been a backwater, and the provincial *ars* of the local masters—which went little beyond a knowledge of local materials and constructional techniques—soon proved unequal to the structural problems which faced them. Possessing little or no *scientia* of their own, they had to call on that developed in the different traditions of Northern Gothic. This, however, presupposed the different *ars* of these northern traditions as well as other characteristics, like the greater heights of northern cathedrals, which the Milanese had no desire to emulate. The essential partnership of northern theory and northern practice could not be broken, and the Milanese were thus thrown back on a highly empirical approach based largely on their own judgments and practical experience.

Radical innovation on this scale was always rare: in the past, even more than today, the norm was a much more gradual evolution which taxed any theory far less. When it was attempted elsewhere it usually called again, ideally, for a synthesis of earlier achievements in different traditions. But, as at Milan, an empirical approach was usually inescapable.

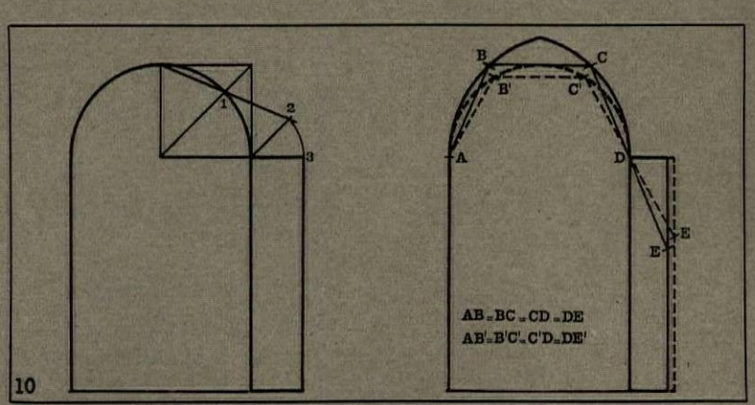
Empiricism betrays itself in various ways. Most commonly it is seen in continual changes in the design as construction proceeds, coupled with an apparent reluctance to face, or inability to make, decisions until they are inescapable. In no great building of the past for which adequate records remain was the form of the superstructure finally determined until its supports were complete or nearly so; and this is equally true whether the final choice was made by the original designer (as in the case of St. Paul's)[27] or left to his successors (as in most other cases).[28] Almost as frequently it is seen in the need to undertake remedial works or even partial reconstructions to forestall or make good the damage caused by partial collapses. All flying buttresses in the great northern churches prior to the second half of the twelfth century seem, for instance, to have been added as casual expedients only after weaknesses had become apparent[29] or, as at Cluny III, 5, the vaults had already pushed the walls aside and collapsed.[30] At both St. Peter's[31] and St. Paul's[32] extensive consolidation or other remedial work on the main piers was necessary before the domes could be safely constructed, and at the former additional chains were necessary at a later date to contain the dome thrusts.[33] Most instructively, it is possible to read, in the distortions and lacks of bond of the brickwork of the great lateral buttresses of St. Sophia, 6, a whole sequence of modifications in their design in an attempt to halt the lateral spread of the dome base.[34] The attempt was only partly successful, and not much later the dome collapsed and had to be entirely reconstructed to a different design.

Occasionally, as in the development of Brunelleschi's design for the dome over the crossing of the cathedral at Florence, new structural ideas were deliberately tried out first on a smaller scale.[35] It is possible also that the oak chain which circles the base of the dome was intended to serve in part as a measuring device to give an early warning of any bursting tendency as construction proceeded.[36] But controlled experiments of this kind seem to have been very rare and their value will always have been limited by the available interpretive framework.

Was that framework merely the *scientia geometriae* and its underlying geometric symbolism? Despite the evident empiricism and the failures that marked its course, this seems unlikely. Most of the failures can, in fact, be attributed largely to errors in detailed proportioning or to faults in construction, particularly to undue haste in the latter and insufficient care over materials and workmanship,[37] rather than to basic errors in the structural concept. Structures like St. Sophia, 7, the great Gothic cathedrals, Brunelleschi's dome in Florence, 8, the dome of St. Paul's and even the more modest churches of Guarini, 9, have suggested to many that their designers possessed a 'superb statical intuition.' Is there any truth in this and, if so, what was this intuition and whence did it come? Did the early statical theory from which modern theory has sprung, or something akin to this, bridge the gap between the *scientia* and *ars* already discussed where these alone were inadequate?

THEORY (2)

Most in evidence in surviving records alongside the *scientia geometriae* proper, and not always sharply distinguished from its operational rules, are numerous purely empirical rules for determining the correct dimensions of foundations, walls, piers, buttresses, arches and vaults. Some are expressed geometrically; some arithmetically. They are found already in Vitruvius and in all subsequent architectural treatises,[38] and they are not unknown even in modern codes of practice. Sometimes, as in the case of the



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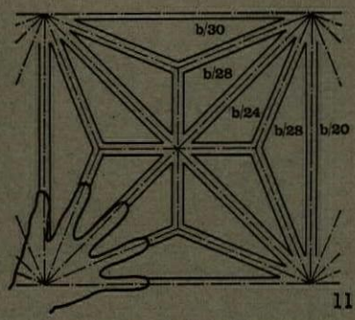
10, *two geometric constructions to determine the size of buttress needed by a given vault; that on the left according to Rodrigo Gil de Hontanon, and that on the right Blondel's rule.*

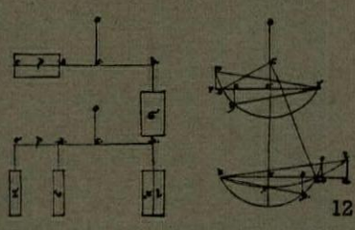


11

11, *Rodrigo Gil de Hontanon's rule for the section depths of the ribs of a late Gothic vault in terms of the mean bay width 'b', these depths being notionally scaled in proportion to the outstretched thumb and fingers of the hand.*

later rules for determining sizes of buttresses from the profiles of the vaults they support,[39] 10, the rules have considerably more generality than the *scientia geometriae*. More commonly though, as in the case of a late Spanish rule for the sizes of vault ribs,[40] 11, they do no more than codify established practice within a closely confined tradition. They might then be useful as simple definitions of the starting points for innovation, but they would be of no further use.

The much more general theory of statics can be traced back at least to the Greeks. Two Greek roots can be distinguished; Aristotelian and Archimedean.[41] Of the two, the *Mechanics* of Pseudo-Aristotle[42] was essentially dynamic in approach, while Archimedes' *Equilibrium of Planes*[43] was essentially static, and they differed also in other important respects. The first was largely descriptive and non-quantitative and therefore of little direct practical value. But, in its treatment of the movements of weights, it introduced the germ of the



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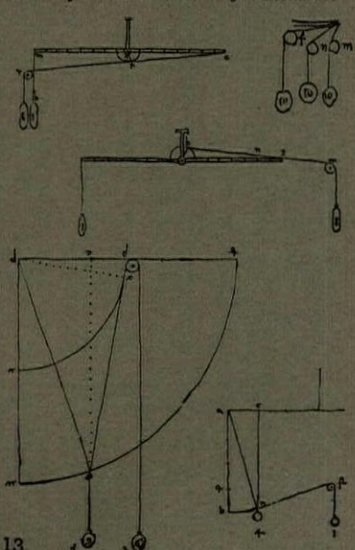
12, *static moments and the law of the balance according to Jordanus.* 13, *static moments and the law of the balance according to Leonardo.*



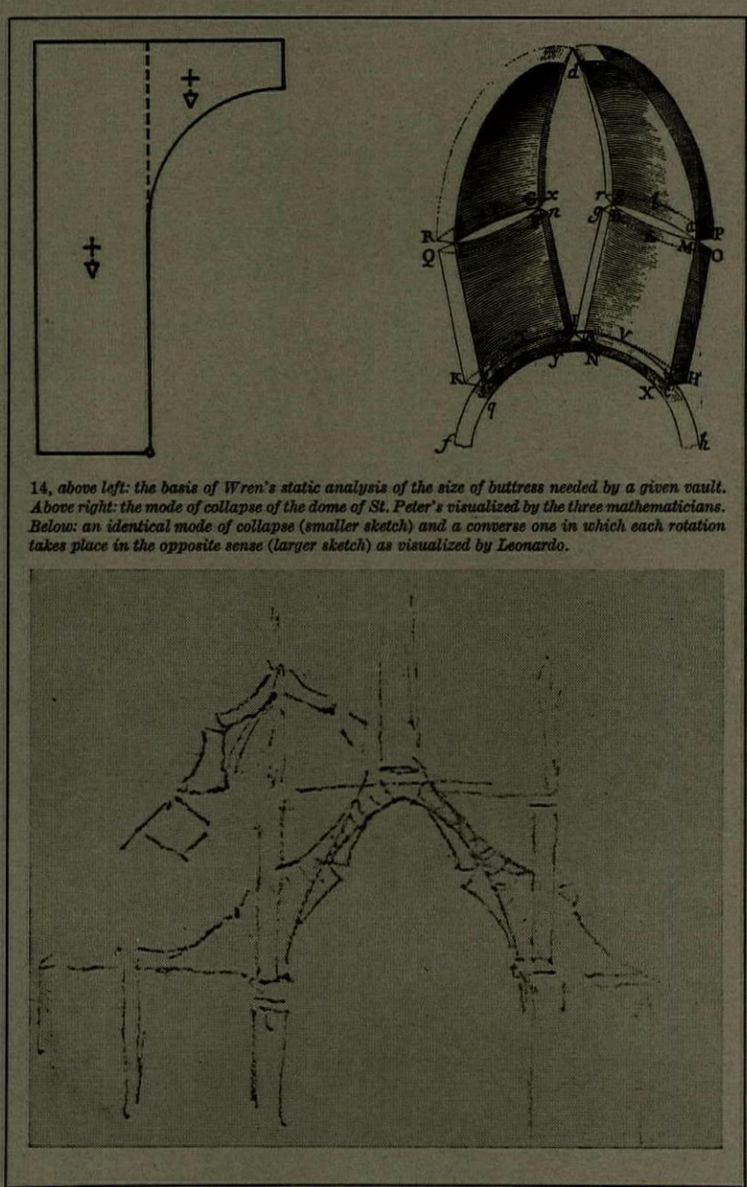
13

modern principle of virtual work and opened the way to a quantitative study of simple machines and their mechanical advantages. The second, with its Euclidean basis and tight Euclidean logical structure, was rigorously quantitative throughout and first introduced the concept of the centre of gravity and furnished the means for calculating its position.

Later Hellenistic writers, notably Hero of Alexandria, developed the work of Archimedes and the Aristotelian school which then passed, with the Islamic conquests, into Arabic scientific thought and and, in turn, became known in the West through Sicily and Spain in the twelfth and thirteenth centuries.[44] In the medieval statics of the enigmatic Jordanus, 12, and his followers, the two roots further interacted, and precise concepts of static moment, of the resolution of a vertical force along an inclined plane and of virtual work were arrived at.[45] Yet, despite the contributions of people like Simon Stevin[46] and Galileo[47] and a keen interest on the part of Leonardo,[48] 13, it was not until the late seventeenth century that a fully generalized concept of a force acting in any direction was reached and the general conditions of equilibrium stated and applied to problems such as the stability of the voussoirs of an arch. Similarly it was not until then that the earlier speculations of Leonardo and Galileo on problems of strength and deformation bore fruit in a manner that permitted quantitative calculations on the basis of tests on materials.[49]

Vitruvius was well aware of early Greek statics and mechanics. He implies, though, that in the first century B.C. a work like Archimedes' *Equilibrium of Planes* was of interest chiefly to mathematicians and used little, if at all, in design.[50] By the early fourth century A.D., however, as Pappus of Alexandria indicates in the preface to the eighth book of his *Collection*, the mechanician—one highly skilled in geometry, statics and mechanics—had assumed a role superior to that of the architect in the design of important structures.[51] In sixth-century Constantinople, for example, the leading designers of St. Sophia, Anthemius and Isidorus, are both described by Procopius as mechanicians;[52] and it is probable that both were professors of geometry or mechanics[53] though less clear to what extent their knowledge of statics, as distinct from that of geometry, was used in structural design. For almost a millennium after this—until the fifteenth century—there is, on the other hand, no clear evidence that theoretical statics played any significant part in design in the West. In the crucial early stages of the development of the Gothic structural system in the twelfth century the theories were, indeed, virtually unknown there and, for a variety of reasons, it seems much more likely that the practical achievements of the mature style in the thirteenth and fourteenth centuries spurred on the theoretic enquiry than that they were materially assisted by it.[54] No quantitative application of statical theory is recorded before the time of Wren.[55]

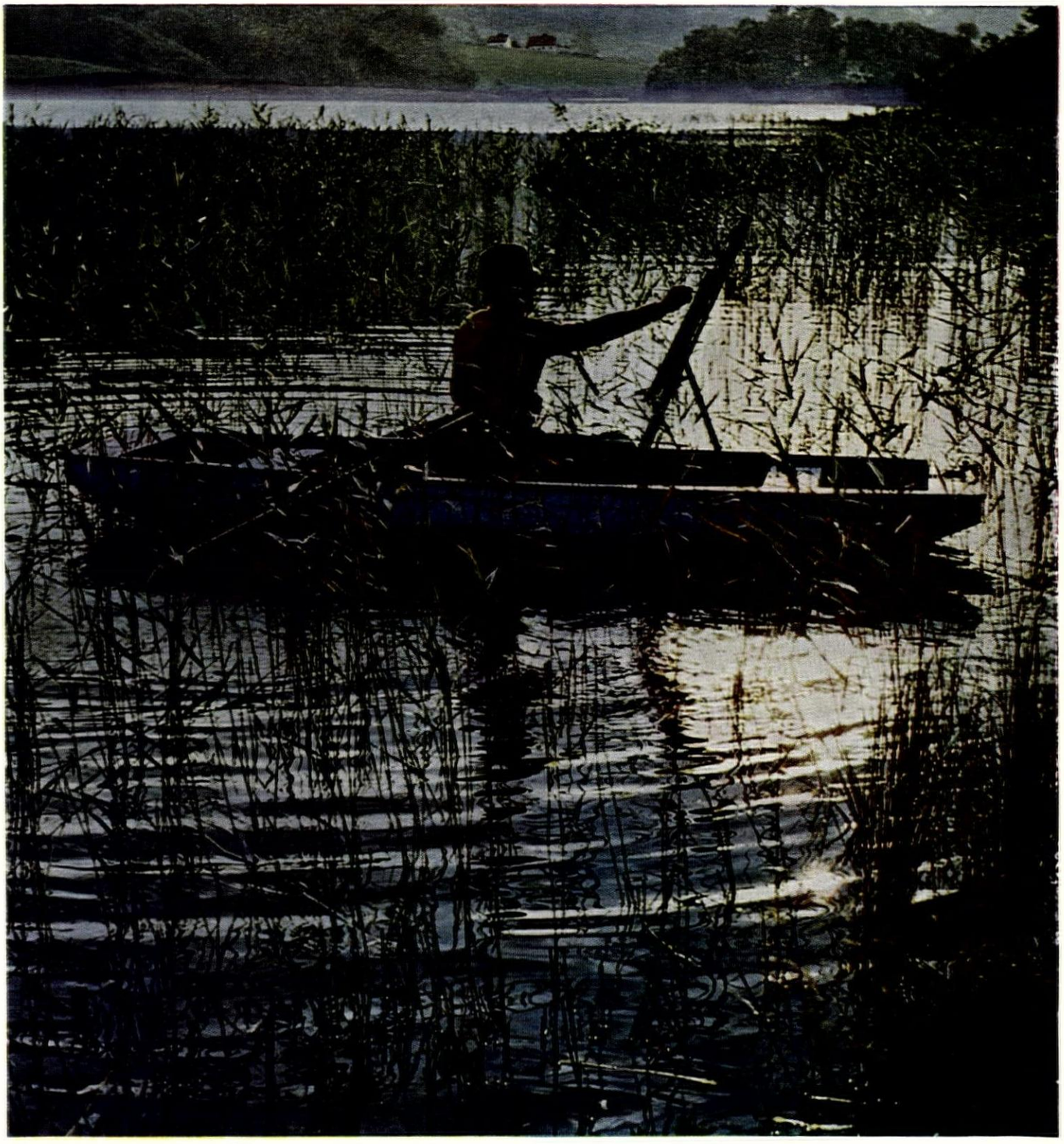
Since, as a quantitative guide to design, the Archimedean theory was, like the *scientiae geometriae*, framed in terms of the structural geometry alone, its validity was equally dependent on the close identity of structure and form in actual construction. Any practical application called, moreover, for a high level of abstraction from the full complexities of behaviour, for which the theory itself provided no guidance. It could be used only to analyze the equilibrium of notionally rigid isolated elements of a structure under the action of their own component weights and other purely vertical applied loads or reactive forces. Whenever it was necessary to isolate such an element, for the purpose of the analysis, by an arbitrary slicing of a more complex continuous structure, the validity of the result would depend also on whether the slicing was done in a manner which truly respected these limitations, and the assurance that this was so could come ultimately only from a wider understanding of the conditions of equilibrium than the theory itself offered. Without that wider understanding the theory could as easily mislead as help. Even Wren was apparently misled, in the analysis of the buttressing required by different types of vault,[56] to such an extent that it would be difficult to believe that he took the analysis seriously were his choice of vault form in St. Paul's not based on his conclusion from it that this form required the least buttressing.[57] He considered a slice of vault up to the crown to constitute, with its supporting pier, an isolated rigid body tending to tip forward about the inner edge of the pier. No account was taken of any horizontal thrust from adjacent slices of the vault, so the abutment was assumed to provide a contrary moment to the inward tipping moment of the weight of the cantilevered vault slice, 14. It was argued that, if this slice was so proportioned as to be in equilibrium, 'the Whole will stand as well as the Halves.' Among the criticisms that could be made of this analysis perhaps the most significant, for the present purpose, is that it implies as the converse of equilibrium (though as



14

14, *above left: the basis of Wren's static analysis of the size of buttress needed by a given vault. Above right: the mode of collapse of the dome of St. Peter's visualized by the three mathematicians. Below: an identical mode of collapse (smaller sketch) and a converse one in which each rotation takes place in the opposite sense (larger sketch) as visualized by Leonardo.*

From canvas



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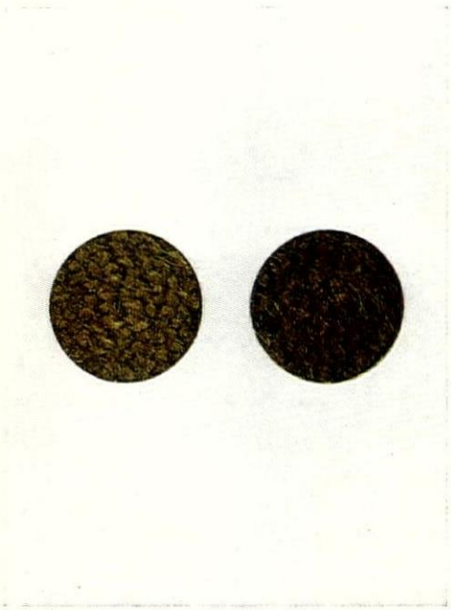

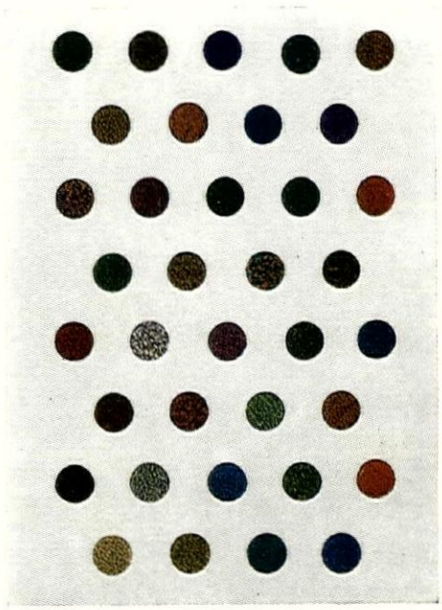

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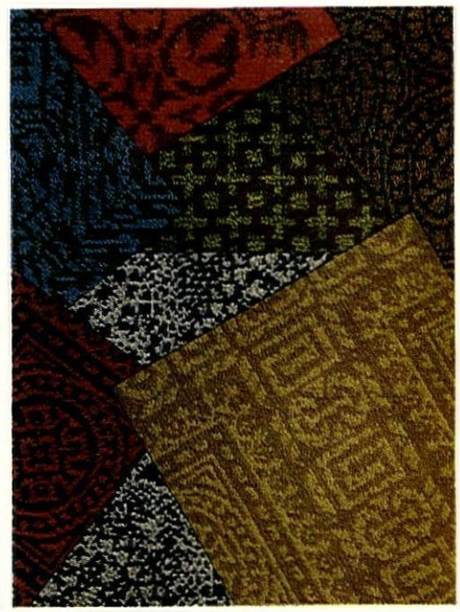

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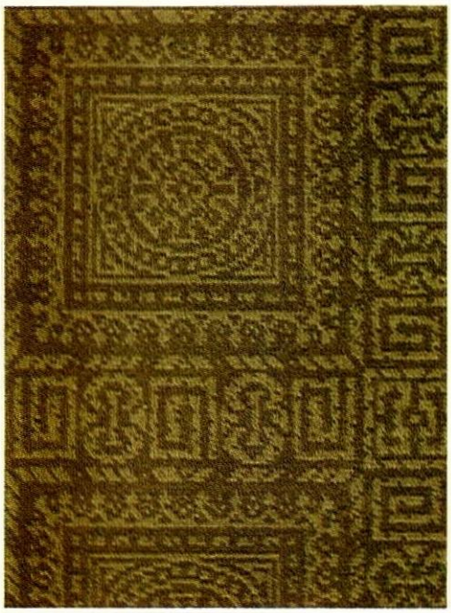

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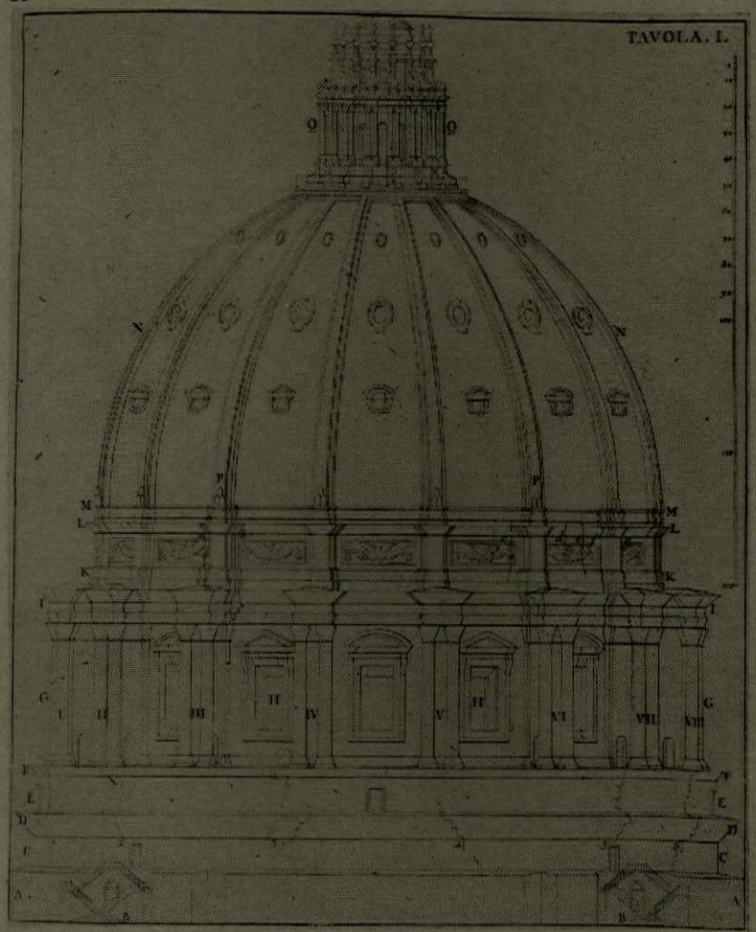


15, *cracking around the base of the dome of St. Peter's in* 1742.

purely statical analysis it does not explicitly assume) a mode of collapse that is impossible.

In contrast, the analysis of the dome of St. Peter's in 1742–43, which has been chosen to terminate the present study, was able to draw on the much wider understanding of the conditions of statical equilibrium reached near the end of the seventeenth century and it brilliantly anticipated a modern collapse analysis. Assisted also by direct observation of the cracks already visible around the base of the dome, which were then giving cause for alarm,[58] 15, the three mathematicians called in to advise on remedial measures visualised a plausible collapse mode,[59] 14. Applying to this the principle of virtual work they then calculated the chain tension required at the level OP, QR to prevent collapse. But they still succeeded only in obtaining a somewhat unrealistic upper bound.

16, *shrine on Mount Cynthium, Delos.*

DESIGN (2)

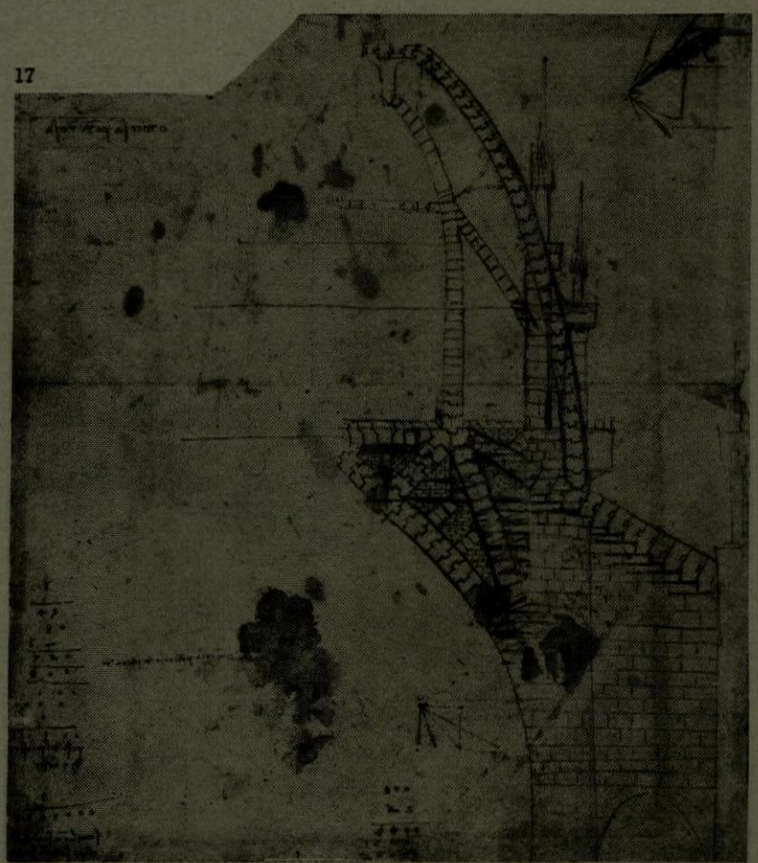
It cannot be concluded that either the 'rules of thumb' that existed alongside the *scientia geometriae* or the early theory of statics played much direct part in guiding structural innovation; but the visualization of a plausible mode of collapse of the dome of St. Peter's hints at another possiblity. That visualization, though guided by observation of the cracks that had already resulted from the structural actions, as Leonardo had been guided earlier by observing the splitting of the skin of a squashed pomegranate or orange,[60] was a purely geometrical one. Concepts of force and resistance entered only into the calculation of the necessary size of chain.

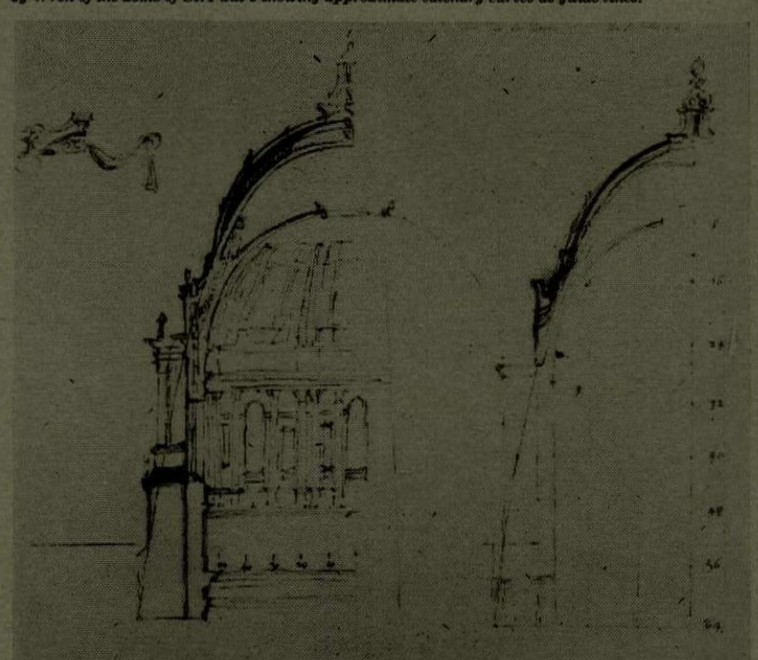
The complementary and equally geometrical or stereometrical visualization of the conditions of structural integrity is possibly the oldest and most fundamental of all insights into structural behaviour;[61] and there is little doubt, on the basis of much circumstantial evidence, that it was, in fact, the chief guide to designers. It clearly lies behind the initial conception of the most primitive of all structures like the simple slab roof of an ancient shrine in a natural rock cleft on the island of Delos, 16, and, at a more sophisticated level, behind the idea of slightly more complex structural forms like the voussoir arch or dome. The great inherent strength and stiffness of the dome and other similar forms with doubly curved surfaces can still be most readily intuited in purely geometric terms by trying, in vain, to imagine modes of deformation that do not involve considerable extensions or contractions of the surface.

Even the dual roles, as both vault and buttress, of the greater and lesser semidomes in St. Sophia, 7, could most readily have been visualized in these terms.

In relation to this more intuitive structural insight, the role of the *scientia geometriae* or the theory of statics was to give quantitative precision where it was otherwise lacking and where it was not a natural outcome of an overriding concern with the practical problems of construction, particularly with the stability of the incomplete structure during construction as in the case of Brunelleschi's dome in Florence,[62] 8. Partial anticipations of the fuller statical understanding of today are seen playing this role in determining arch and vault profiles in some of Leonardo's sketch projects for the tiburio over the crossing of Milan Cathedral,[63] 17, and in two of Wren's sketches for the dome of St. Paul's,[64] 18. More frequently, though, it is the basic geometric

17

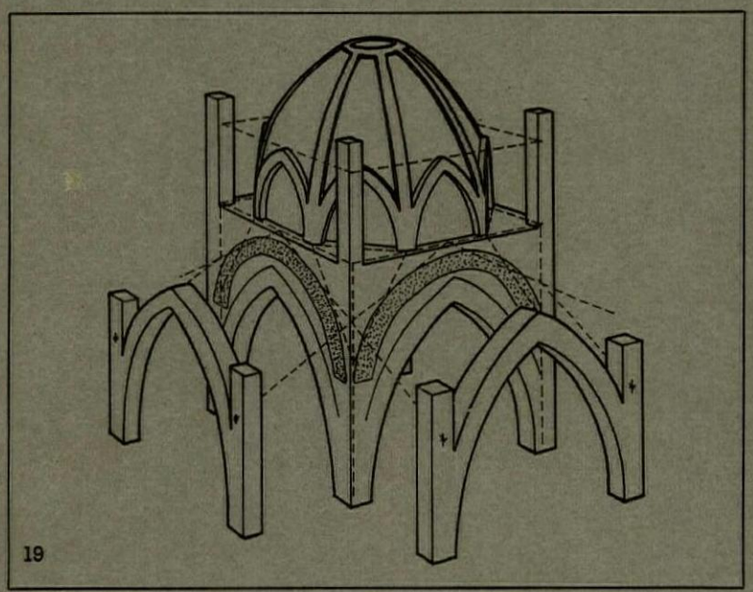




17, *unexecuted project by Leonardo for the tiburio over the crossing of Milan cathedral.* 18, *two sketches by Wren of the dome of St. Paul's showing approximate catenary curves as guide lines.*

18

thinking behind the *scientia geometriae* which is seen in action here, most notably in the widespread preference for the semicircular profile for an arch or dome, which even appears—in the form of semicircular relieving arches over the existing Gothic pointed ones—in the accepted design for the Milan tiburio by Francesco di Giorgio,[65] 19. The geometric reasoning behind this preference is well illustrated by Alberti. Of the full semicircular arch he wrote: 'That the entire arch is strongest of all appears not only from experience but reason; for I do not see how it can possibly disunite of itself unless one wedge shoves out another which they are so far from doing that they assist and support one another.'[66] And, of the 'perfect cupola': '. . . it is composed not only of arches, but also, in a manner, of cornices. . . . And when these cornices or arches are thus built one upon the other, if the work were inclined to ruinate, where should it begin, when the joints of every stone are directed to one centre with equal force and pressure?'[67]



19, *executed project by Francesco di Giorgio for the tiburio of Milan cathedral. Above the existing pointed arches of the crossing the semicircular relieving arches proposed in* 1490 *by Francesco are shown stippled.*

The preoccupation with geometry is thus seen to go much further than the *scientia geometriae*, and there is much to suggest that that theory acquired its structural authority not only in the manner suggested above but also, more directly, through a deep-seated geometric concept of structure akin to that just discussed. The classic statement of that concept, which both antedates Archimedes' *Equilibrium of Planes* and goes far beyond it in offering a rational explanation of the physical world, is to be found in Plato's *Timaeus*.[68] Here both microcosm and macrocosm—the structure of the elements and the form of the universe and the inter-relations that guarantee cohesion and maintain life—are alike visualized in terms of the geometric perfection of the five regular polyhedra and the sphere and the cognate symmetries of the simple 'musical' numerical proportions. Here also, therefore, the equilateral triangle, the square, the regular pentagon and the circle are given a structural significance. The parallel can even be extended. For, just as the perfect geometry of the regular polyhedra is immanent rather than openly manifest in the finished built structure, it defines, for Plato, the unseen reality of 'being' rather than the visible shadow of everyday experience. In his universe only the circle and the sphere are visibly present in the dome of the stars and the circular orbits of the planets, as they are in the constructed dome and the circular arch.

It is an important corollary of this that what would now be called the structural aspect of design was hardly ever, in the past, clearly distinguished from what would now be called the formal or aesthetic. The *scientia* was equally relevant to both, to such an extent that, when neither the structural nor the aesthetic aspect was (as at Milan) of overriding concern, it is difficult to know to which it was considered to be primarily applicable. Vitruvius' recommendation of certain proportions 'for convenience, beauty and strength (*ad usum et ad speciem et ad firmitatem*)'[79] is echoed time and again in later treatises.

There were inevitably shifts of emphasis over a period of some two thousand years, and some are fairly obvious in the surviving structures themselves. A concern for stability must have been dominant (in the minds of designers if not of their patrons) in the early development of the brick domical structures of the later Roman and early Byzantine periods and of the stone vaulted structures of the Gothic West. But it clearly yielded prior place to a greater interest in pure form at some other times. Almost as significantly, though less obviously to modern eyes, the latter interest in pure form alternated between one not very different from the present concern for appearance and quite different concerns for symbolic meaning which have no counterpart today.

Symbolic meaning was even more directly related to Plato's *Timaeus* and similar cosmologies than was the structural authority of the *scientia geometriae*. Through its absorption into Christian theology as a rational extension and interpretation of the biblical narrative of the creation,[70] the *Timaeus*, for instance, profoundly influenced the ideas of those ecclesiastical patrons, closely associated with the school of Chartres, who provided much of the impetus for the initial development of Gothic construction.[71] It had no less influence, though a rather different one, placing more emphasis on the

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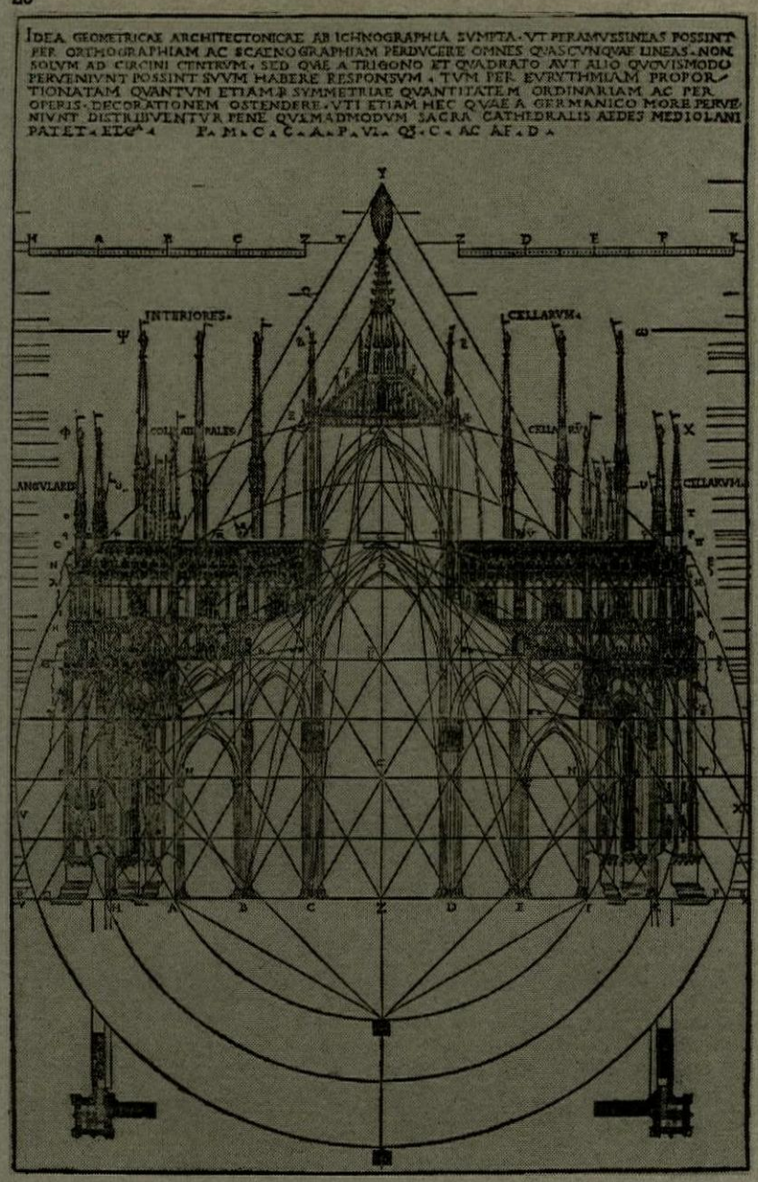

20, *the cross section of Milan cathedral as represented in Cesariano's edition of Vitruvius in* 1521.

21

21, *Christ Pantocrator in the dome of the monastery church at Daphni.*

Fabricators: De Vries Robbé & Co N.V. Gorinchem (Holland)
Architects: H. M. Kraaijvanger, Ir. E. H. Kraaijvanger, R. H. Fledderus

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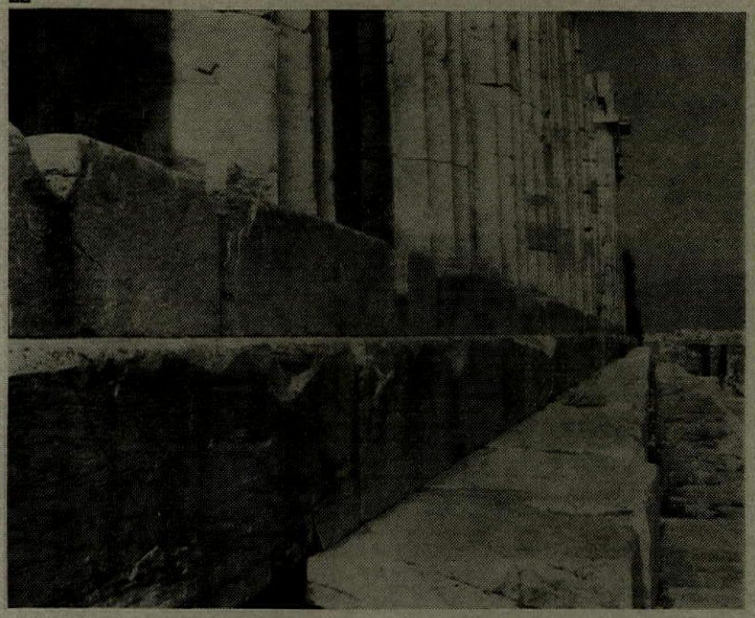


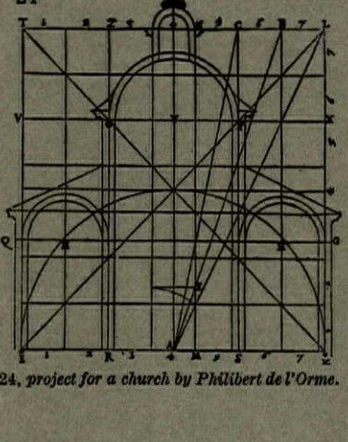
22, *the vertical curve of the stylobate of the Parthenon. Other refinements include similar vertical curves in the superstructure, entasis and inclinations of the columns, slight thickening of the corner columns in relation to the others, and other slight inclinations.*

Pythagorean musical element, on Renaissance architectural theorists and patrons.[72] At both times these men were seeking, in their different ways, an ideal form for the church which would adequately mirror the divine creation, and they found that form in one or another of the perfect symmetries of the Platonic myth, 20. Similarly, throughout the Byzantine period, the dome represented the spherical heaven, and this symbolism was frequently reinforced by gold mosaic and a representation, in the crown, of the ascending Christ or of Christ Pantocrator,[73] 21. The alternative more directly visual interest may be seen in the 'optical refinements' of the Doric temple, 22, and again in the High Renaissance and Baroque and Rococo, 23, when the main architectural commissions (including St. Peter's) passed largely to men trained initially as painters or sculptors.[74]

Philibert de l'Orme, in his treatise published in 1567, marks very well the transition from the Gothic and early Renaissance concern for symbolic meaning to the later concern for simple appearance with its associated desire for a more complex geometry. In seeking an ideal form for the church he aligns himself squarely with his predecessors and appears, in his design for a church facade, 24, to have copied an earlier design in Francesco di Giorgio's treatise of about 1482.[75] But in his major emphasis on complex stereometry he returns, knowingly or unknowingly, to an earlier precedent—that of Hero's *Stereometrica*[76] and his lost treatise on vaulting—and heralds the Baroque and Rococo interest in the mathematics of complex vault surfaces and their warped intersections illustrated in 23 and best exemplified in some of Guarini's lost churches and his *Architettura Civile*.[77] The excitements of the fifteenth-century Italian interest in perspective, again marking a return to a much earlier past, were portents of the change but had initially too many Pythagorean-Platonic overtones to accomplish it.[78]

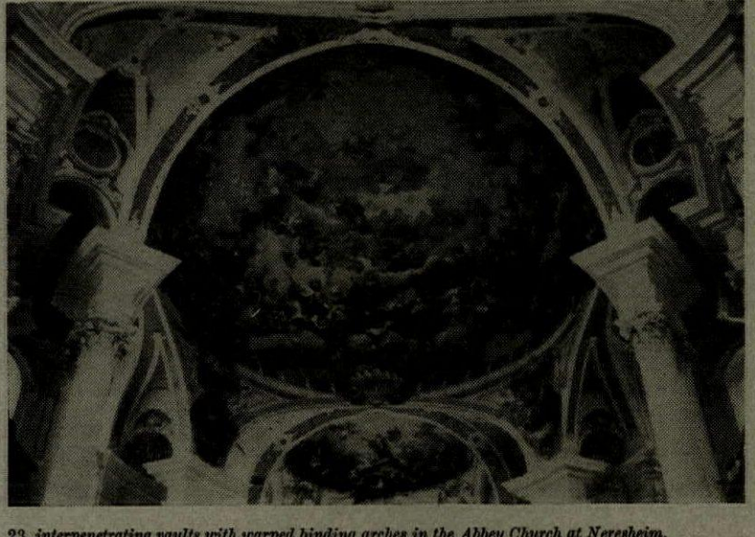
In analysing and attempting to understand the structural achievements of the past, either structurally or aesthetically, all these shifts of emphasis must be borne in mind. At the same time it is necessary to remember the underlying constancy of the close interrelation between structure and form, both in initial conception and in the realized structure. This interrelation, coupled with an inescapable but, in retrospect, wholly beneficial restriction of choice of materials and other technical means, and the sort of care for detail seen in the Doric temple, imparted much of the unity and 'style' which are now so highly prized. But it should also be remembered that the major works were not achieved in the isolation which may now seem to characterize many of them, and that they represented, in terms of the total resources of the times, almost unbelievable concentrations of sustained effort. They were, in this sense at least, *tours de force* which we, with our different senses of values, can never hope to equal. Nor should we, without the religious and other convictions of their builders, necessarily try to emulate qualities which stemmed from those convictions. The structures themselves remain to awaken interest on many levels, to challenge and even inspire, and to help us, through an attempt to learn something of the way in which they were conceived; to come a little closer to the elusive but essentially unchanging marriage of art and science in the process of creative design.

24



24, *project for a church by Philibert de l'Orme.*

23



23, *interpenetrating vaults with warped binding arches in the Abbey Church at Neresheim.*

NOTES

[1] *Annali della fabbrica del Duomo di Milano dall'origine fino al presente*, I, Milan 1877, p. 209.

[2] Vitruvius, I, i, 15: 'ex duabus rebus singulas artes [sunt] compositas, ex opere et eius ratiocinatione,' etc. For later writers see, for instance, Pappus of Alexandria, Collection, VIII, preface, quoted by G. Downey, 'Byzantine architects, their training and methods,' *Byzantion*, XVIII, 1948, pp. 106–7, and Ibn Khaldun, 'Muqadimmah,' translated F. Rosenthal, Bollingen Series No. 43, New York, 1958, II, p. 363.

[3] T. Le Seur, F. Jacquier and R. G. Boscovich, 'Parere di tre mattematici sopra i danni, che si sono trovati nella cupola di S. Pietro' Rome 1743. See below.

[4] *Annali* (op. cit.) p. 209. The best commentary on these discussions is that of J. S. Ackerman, 'Gothic theory of architecture at the cathedral of Milan,' *Art Bulletin*, XXXI, 1949, pp. 84–111, but see also P. Frankl, 'The secret of the mediaeval masons,' *Art Bulletin*, XXVII, 1945, pp. 46–60 and Idem, 'The Gothic, literary sources and interpretations through eight centuries,' Princeton, 1960, pp. 57–86 (referring also to similar discussions at Chartres and Gerona).

[5] P. Frankl, 'The Secret' (op. cit.) pp. 52–55, E. Panofsky, 'An explanation of Stornaloco's formula,' *Art Bulletin*, XXVII, 1945, pp. 61–64 and J. S. Ackerman (op. cit.) pp. 89–90.

[6] Vitruvius, VI, iii, 3 and IX, preface, 4, 5. There is no comprehensive detailed account of the development of the theory from a structural point of view, but R. J. Mainstone, 'Structural theory and design,' *Architecture and Building*, XXXIV, 1959, pp. 106–13, 186–95, 214–21 gives an earlier general account with the emphasis on the contrast with modern theory.

[7] There is no published corpus of early drawings, but some of the most interesting, those of Villard de Honnecourt and from the Reims palimpsest, are reproduced and discussed in H. Hahnloser, *Villard de Honnecourt*, Vienna, 1935, T. Bowie, *The sketchbook of Villard de Honnecourt*, New York, 1959, and R. Branner, 'Drawings from a thirteenth-century architect's shop: the Reims palimpsest,' *Journal of the Society of Architectural Historians*, XVII, 4, 1958, pp. 9–21. Among publications of later Gothic drawings may be noted particularly O. Kletzl, *Planfragmente aus der Dombauhütte von Prag*, Stuttgart, 1939. The Villard drawings are the most valuable for the present purpose and include three sheets of masons' geometry (Hahnloser XXXIX–XLI, Bowie 55–7) and several (though mostly non-architectural) of controlling geometric grids. The danger of inferring such grids from finished drawings (where they are not discernable as scribed lines on the drawing itself) is illustrated, however, by the conflicting interpretations of Villard's plan of the tower of Laon cathedral (Hahnloser XVIII, Bowie 39) by W. Ueberwasser, 'Nach rechtem Mass,' *Jahrbuch der preussischen Kunstsammlungen*, LVI, 1935, pp. 250–72 and M. Velte, 'Die Anwendung der Quadratur und Triangulatur bei der Grund- und Aufrissgestaltung der gotischen Kirchen,' Basle, 1951.

[8] Measurements of buildings are even less reliable guides to the theory behind their design, unless the measurements are very precise, and there is evidence of a similar precision in construction and of unusual consistency in the practical application of the theory. (There is no *a priori* reason why designers in the past should have followed the indications of their theory any more slavishly than designers do today, but this in no way necessarily belittles the importance of the theory.) The most convincing recent measurements are possibly those reported in K. J. Conant, 'New results in the study of Cluny monastery,' *Journal of the Society of Architectural Historians*, XVI, 3, pp. 3–11 and in M. Detoni and T. Kurent, 'The modular reconstruction of Emona, Situla No. 1,' Ljubljana, 1963. See also O. Von Simson, 'The Gothic cathedral,' New York, 1956, pp. 207–10 and E. Levy, 'On the proportions of the south tower of Chartres cathedral,' ibid, pp. 235–65, but the comments on these latter analyses by S. McK. Crosby in *Art Bulletin*, XLII, 1960, pp. 149–60 are very pertinent.

[9] G. Milanesi, *Documenti per la storia dell'arte Senese*, I, Siena, 1854, pp. 144–253 passim.

[10] G. Gaye, *Carteggio inedito d'artisti dei secoli* XIV, XV, XVI, III, Florence, 1840, pp. 487–510. Discussed by P. Booz, *Der Baumeister der Gotik*, Munich, 1956, pp. 54–61.

[11] 'Trattato di architettura,' written in Milan 1461–4, MS reproduced with English translation in J. R. Spencer, *Filarete's treatise on architecture*, New Haven, 1965. Discussed in H. Saalman, 'Early Renaissance architectural theory and practice in Antonio Filarete's Trattato di architettura,' *Art Bulletin*, XLI, 1959, pp. 89–106; and P. Tigler, *Die Architekturtheorie des Filarete*, Berlin, 1963, pp. 46–68 and 141–77.

[12] *Trattato di architettura civile e militare*, written about 1482–92, printed by C. Promis and C. Saluzzo, Turin, 1841. Discussed in R. Papini, *Francesco di Giorgio architetto*, Florence, 1946, pp. 49–67 and 193–6; and H. Millon, 'The architectural theory of Francesco di Giorgio,' *Art Bulletin*, XL, 1958, 257–61.

[13] *Regole generali di architettura*, Venice, 1537; *Il primo libro d'architettura* and *Il secondo libro di perspettiva*, Paris, 1545, etc. Serlio's work is less explicitly concerned with theory than the others referred to but he demonstrates the Vitruvian and mediaeval quadrature; for instance, on p. 3b of Book I, shows it as the *proportione diagonea* on p. 15a, and uses it frequently both in the perspective demonstrations of Book II and in deriving the proportions of the orders in Book IV (Regole generali).

[14] *Le premier tome de l'architecture*, Paris, 1567. Discussed in A. Blunt, *Philibert de l'Orme*, London, 1958, pp. 124–33 but with the emphasis very largely on de l'Orme's later theory of divine proportion.

[15] Reproduced in R. K. Heideloff, *Die Bauhütte des Mittelalters in Deutschland*, Nürnberg, 1844, pp. 101–16. Discussed in W. Ueberwasser (op. cit.); P. Frankl, 'The secret' (op. cit.); M. Velte (op. cit.), pp. 17–28; and (mentioning also several similar late Gothic treatises) P. Booz (op. cit.), pp. 41–7.

[16] The use of the equilateral triangle at Milan has already been noted. That of the regular pentagon is hinted at by Villard de Honnecourt (Hahnloser XXXVI, XXXVII, Bowie 36, 37) and again, at the end of the period, by the 'Geometria deutsch' of 1472 (also reproduced in R. K. Heideloff (op. cit.), pp. 95–9), but it is nowhere so conclusively demonstrated. See also, in this connection, W. Ueberwasser, 'Spätgotische Baugeometrie,' *Jahresbericht der öffentlichen Kunstsammlung Basel*, 1928–30, pp. 79–122; O. von Simson

and E. Levy (op. cit.); B. G. Morgan, *Canonic design in English mediaeval architecture*, Liverpool, 1961; P. Frankl, *Gothic architecture*, Harmondsworth, 1962, pp. 37, 156; a forthcoming paper by K. J. Conant, 'The afterlife, Vitruvius in the middle ages'; and relating to much earlier periods, J. Hambidge, 'The Parthenon and other Greek temples: their dynamic symmetry,' New Haven, 1924; and N. Detoni and T. Kurent (op. cit.).

[17] Philibert de l'Orme's theory of divine proportion referred to in note 14 is one example of the change, but primarily numerical systems of commensurate proportions can also be traced back much earlier as shown, for example, by K. J. Conant (op. cit.). See especially R. Wittkower, *Architectural Principles in the Age of Humanism*, 3rd ed., London, 1962; Idem, 'Systems of proportion,' *Architects' Yearbook* v, 1953, 9–18; and P. H. Scholfield, *The theory of Proportion in Architecture*, Cambridge, 1958.

[18] H. Hahnloser (op. cit.); R. Branner, 'A note on Gothic architects and scholars,' *Burlington Magazine*, XCIX, 1957, 372–3; and B. L. Ullman, 'Geometry in the mediaeval quadrivium,' *Studi di Bibliografia e di storia*, IV, 1964, pp. 263–85.

[19] O. Kletzl (op. cit.), pp. 16–18; P. du Colombier, *Les chantiers des cathedrales*, Paris, 1953, pp. 64–5; and P. Booz (op. cit.), pp. 74–79.

[20] D. Knoop and G. P. Jones, 'The decline of the mason-architect in England,' *Journal of the Royal Institute of British Architects*, XLIV, 1937, pp. 1004–7; P. Frankl, 'The secret' (op. cit.), pp. 48–50; L. F. Salzman, *Building in England down to* 1540, Oxford, 1952, pp. 16–17; P. du Colombier (op. cit.), pp. 65–6; and P. Tigler (op. cit.), pp. 141–171.

[21] *Annali* (op. cit.), pp. 209–10.

[22] e.g. the discussions at Bologna referred to above.

[23] e.g. D. Barbaro, *I dieci libra dell'architettura di M. Vitruvio*, Venice, 1556, p. 24 (commentary on Vitruvius I, ii, 4) 'ne si puo lodare abastanza l'effetto della proportione, nella quale e posta la gloria dell'Architetto, la fermezza dell'opera e la maraviglia dell artificio'; and Philibert de l'Orme, "Le premier tome" (op. cit.), p. 234a, referring to the purely geometrical basis of the design for a church illustrated in 24, 'Quant à la pente et sa couverture ayant une poussée et boutée suffisante contre la grande voute . . . vous les prenez sur la ligne horizontale qui fait la quatrieme partie de la hauteur . . .'

[24] See below and note [65].

[25] The literature on methods of construction is very extensive, the most useful sources being: E. E. Viollet-le-Duc, *Dictionnaire raisonné de l'architecture française*, Paris 1858–68 especially the article on construction IV, pp. 1–279; A. Choisy, *L'art de bâtir chez les Romains*, Paris, 1872; Idem, *L'art de bâtir chez les Byzantins*, Paris, 1883; M. E. Blake, *Ancient Roman construction in Italy from the prehistoric period to Augustus*, Washington, 1947; Idem, *Roman construction in Italy from Tiberius through the Flavians*, Washington, 1959; G. Lugli, *La tecnica edilizia Romana*, Rome, 1957; J. B. Ward-Perkins, 'Notes on the structure and building methods of early Byzantine architecture,' *Second report on excavations in the Great Palace of the Byzantine Emperors at Constantinople*, Edinburgh, 1958, pp. 52–104; W. MacDonald, 'Some implications of later Roman construction,' *Journal of the Society of Architectural Historians*, XVII, 4, 1958, pp. 2–8; J. Fitchen, *The construction of Gothic cathedrals*,' Oxford, 1961; and N. Davey, *A history of building materials*,' London, 1961.

[26] This point is well made in J. Heyman, 'The stone skeleton, *International Journal of Solids and Structures*, II, 1966, pp. 249–79, and in a forthcoming paper, 'On the rubble vaults of the middle ages and other matters,' *Gazette des Beaux-Arts*. Heyman proceeds to analyze the stability of masonry arches and vaults in very largely geometric terms, and the analysis can be criticized only on the grounds that it does not go far enough. In taking the stability of the vertical supports for granted he ignores the main problem of the designers of the structures considered here—that of ensuring that the horizontal thrusts generated by the superstructure would not push aside the supports sufficiently to permit collapse—and in assuming that voussoirs never slide on one another he also ignores an important contributory factor to most of the near-collapses that have come to the writer's notice.

[27] Wren's many reconsiderations of the design, especially of that of the dome, while construction proceeded, are well illustrated by the surviving drawings. See *Wren Society*, I–III and XIII–XVI, 1924–6 and 1936–9; E. Sekler, *Wren and his place in European architecture*, London, 1956, pp. 110–45; V. Furst, *Sir Christopher Wren*, London, 1956.

[28] The cathedrals of Milan and Bologna have already been mentioned. Florence Cathedral and St. Peter's in Rome are other outstanding examples. For an excellent discussion of the earlier phases in Florence see H. Saalman, Santa Maria del Fiore: 1294–1418,' *Art Bulletin*, XLVI, 1964, pp. 471–500. The design and construction of the dome are discussed by P. Sanpaolesi, *La cupola di Santa Maria del Fiore*, Rome, 1941; F. D. Prager, Brunelleschi's inventions and the 'Renewal of Roman masonry work.' *Osiris*, IX, 1950, pp. 457–554; and H. Saalman, 'Giovanni di Gherardo da Prato's designs concerning the cupola of Santa Maria del Fiore in Florence,' *Journal of the Society of Architectural Historians*, XVIII, 1, 1959, pp. 11–20. The literature on St. Peter's is very extensive. See, for the present purpose, J. S. Ackerman, *The architecture of Michelangelo*, London, 1961, I, pp. 89–102 and II, pp. 83–112.

[29] M. Aubert, *Notre-Dame de Paris*, Paris, 1920, pp. 86–107; Idem, 'Les plus anciennes croisées d'ogives, leur rôle dans la construction,' *Bulletin monumental*, XCIII, 1934, 5–67 and 137–237; M. E. Lefevre-Pontalis, 'L'origine des arcs-boutants,' *Congrès archéologique de France*, LXXXII (Paris 1919), 1920, pp. 367–96. The cathedral of Orvieto provides a well documented, though slightly different later example outside France. See R. Bonelli, *Il duomo di Orvieto e l'architettura italiana del duecento trecento*, Città di Castello, 1952, pp. 80–2. The more usual Italian expedient, seen for instance in Florence Cathedral, was the addition of internal tie rods. The scissor arches in the crossing at Wells illustrate yet another analogous expedient.

[30] K. J. Conant, 'Observations on the vaulting problems of the period 1088–1211,' *Gazette des Beaux-Arts*, 6th ser. XXVI, 1944, pp. 127–34.

[31] G. Vasari, *Le vite de piu eccelenti architetti, pittori et scultori . . .* Part III, 1, Florence, 1550, p. 880 and Part III, 2, Florence, 1568, p. 751.

[32] *The Wren Society*, XIV, 1937 (Building Accounts), pp. 85, 89 and 98.

[33] Added, as suggested by the three mathematicians and Poleni, by Vanvitelli in 1743–4. G. Poleni, *Memorie istoriche della gran cupola del Tempio Vaticano*, Padua, 1748, pp. 410–423. See also note [9] and below.

[34] R. J. Mainstone, 'The structure of the church of St. Sophia, Istanbul,' to be published in *Transactions of the Newcomen Society*, XXXVIII, 1965–6. The study of the structural history of the church by Mr. R. L. Van Nice and the writer is still proceeding and will be reported more fully in the text volume accompanying the Dumbarton Oaks publication of Mr. Van Nice's survey drawings.

[35] In addition to models of the dome itself, one of which appears to have been a substantial structure of brick and stone (C. Guasti, *La cupola di Santa Maria del Fiore illustrata con i documenti dell'Archivio dell'Opera secolare*, Florence, 1857, docs. 17, 18, 19, pp. 17–18 and 68, 69, pp. 34–35), Brunelleschi built two smaller but similar cupolas before starting work on the dome (Manetti, *Vita di Ser Brunellesco* (c. 1485), ed. E. Berti-Toesca, Florence, 1927, p. 37 and G. Vasari (op. cit.), Part II, p. 310).

[36] F. D. Prager (op. cit.), pp. 495–6.

[37] Much of the trouble at St. Peter's and St. Paul's necessitating the remedial works referred to above while construction was still in progress may probably be attributed to undue haste or insufficient care in the choice of materials. G. Vasari (op. cit.), Part II, p. 597, for instance, suggests haste on the part of Bramante—'et era tanta la furia di lui che faceva, et del Papa, che aveva voglia, che tali fabriche non si murassero, ma nascessero . . .'—and C. S. Peach and W. G. Allen, 'The preservation of St. Paul's cathedral,' *Journal of the Royal Institute of British Architects*, XXXVII, 1930, pp. 656–76, comment on the excessive use of uncoursed rubble fillings to the walls and piers of St. Paul's. Procopius, *Buildings*, I, i, 77, hints similarly at haste in construction at St. Sophia.

[38] Vitruvius, III, iv, 1; v, i, 3, 5; VI, viii, 5–7; L. B. Alberti, *de re aedificatoria*, Florence, 1485, III, 3, IV, 6, VII, 5, 10, 14, 15; A. Palladio, *Quattro libri dell'architettura*, Venice, 1570, I, 11, 13; and Philibert de l'Orme (op. cit.), II, 7.

[39] E.g. both the popular 'Blondel's rule' illustrated here (F. Derand, *L'architecture des voûtes*, Paris, 1643, pp. 16–17, and F. Blondel, *Cours d'architecture*, Paris, 1698 (2nd ed.), p. 419, and those recorded by Rodrigo Gil de Hontañon (c. 1500–1577) and incorporated in S. Garcia, 'Compendio de arquitectura,' 1681–5 (published in *Arte en Espana*, VII, 1868, and discussed in G. Kubler, 'A late Gothic computation of rib vault thrusts,' *Gazette des Beaux-Arts*, 6th ser. XXVI, 1944, pp. 135–48).

[40] From the same source as the rules for buttresses referred to above. See also Philibert de l'Orme (op. cit.), IV, 8.

[41] The extensive literature on Greek statics and mechanics and their subsequent Islamic and later western developments is best summarized for the present purpose (with a representative selection of source material) in M. Clagett, *The science of mechanics in the middle ages*, Madison, 1959.

[42] Published with English translation in *Aristotle, minor works*, W. S. Hett ed., London, 1936, pp. 330–411. Discussed in M. Clagett (op cit.), pp. 4–9.

[43] English translation in *The works of Archimedes*, T. L. Heath ed., Cambridge, 1897, reprinted New York, 1950, pp. 189–220. Discussed in M. Clagett (op. cit.), pp. 9–13.

[44] A. C. Crombie, *Augustine to Galileo*, London, 1952, and M. Clagett, op. cit., pp. 14–23, 38–51 and 56–72.

[45] E. A. Moody and M. Clagett, *The medieval science of weights*, Madison, 1952, pp. 182–90, and M. Clagett, op. cit., pp. 72–84 and 104–8.

[46] *Hypomnemata mathematika*, IV, *Mathematicorum hypomnematum de statica*, Leiden 1605, pp. 3–51 and 79–108.

[47] Chiefly in *Discorsi e dimostraziomi matematiche intorno a due nuove scienze*, Leiden, 1638. English translation by H. Crew and A. de Salvio, New York, 1914.

[48] *I libri di meccanica*, A. Ucelli ed., Milan, 1940, collects together all the notes on statics and mechanics and includes a bibliography of facsimile editions of the manuscripts. English translations in *The literary works of Leonardo da Vinci*, J. P. Richter and I. A. Richter ed., 2nd ed., Oxford, 1939. There is, as yet, no adequate critical study, paying proper attention to the sequence of the MSS, of the development of Leonardo's ideas and their dependence on and advance beyond those of his predecessors.

[49] It is beyond the scope of the present paper to review these later developments, since they first found practical application only at the end of the period under review. S. B. Hamilton, 'Charles Augustin de Coulomb,' *Transactions of the Newcomen Society*, XVII, 1936–7, pp. 27–49 and Idem 'The historical development of structural theory,' *Proceedings of the Institution of Civil Engineers*, I, Part II, 1952, 374–402 cite the principal sources.

[50] Vitruvius, I, i, 17. The *Equilibrium of planes* is not mentioned explicitly here but Archimedes is named. In X, iii, Vitruvius shows that he was familiar with the less mathematical Aristotelian *Mechanics* (note [42]).

[51] G. Downey (op. cit.); H. A. Meek, The architect and his profession in Byzantium,' *Journal of the Royal Institute of British Architects*, LIX, 1952, pp. 216–20.

[52] *Buildings*, I, i, 24, 50 and 76.

[53] T. L. Heath, *A manual of Greek mathematics*, Oxford, 1931, reprinted New York, 1963, pp. 518–9, G. L. Huxley, *Anthemius of Tralles, a study in later Greek geometry*, Cambridge, Mass., 1959.

[54] Perhaps the only leading figure in medieval science who was closely connected with an important structure and in a position to influence its design was Robert Grosseteste, Bishop of Lincoln; but his scientific interest was primarily in optics and there is no evidence that he brought any knowledge of statics to bear on the reconstruction of the Lincoln choir vaults after the collapse of 1237 or 1239 or on the construction of the chapter house. F. Nordström, 'Peterborough, Lincoln and the science of Robert Grosseteste,' *Art Bulletin*, XXXVII, 1955, pp. 24–72, sees, on the contrary, evidence in the choir vaults of Grosseteste's interest in perspective illusion and in the chapter house of the Pythagorean-Platonic overtones of his theory of light (C. C. Riedl, *Robert Grosseteste on light*, Milwaukee, 1942, p. 17).

[55] C. Wren, 'Second tract on architecture,' in S. Wren, *Parentalia of the Wren family*, London, 1750, pp. 356–8, in which it is argued that 'the Design, where there are Arcades, must be regulated by the Art of Staticks, or the Invention of the Centres of Gravity, and the duly poising all Parts to equiponderate; without which, a fine Design will fail and prove abortive.'

[56] C. Wren (op. cit.), pp. 357–8.

[57] C. Wren (op. cit.), p. 358.

[58] Reproduced here from one of a series of plates in G. Poleni op. cit. Poleni was also called in to advise, at about the same time as the three mathematicians. He presented his report in 1743 and it is reproduced in the volume cited. The three mathematicians (T. Le Seur, . . . op. cit.) reproduce a single composite external, internal and sectional elevation of the dome and drum showing the same crack patterns.

[59] The present illustration is taken again from Poleni (op. cit.) since it represents the assumed collapse mode more fully than the corresponding sketches in the report of the three mathematicians, which show only the rotations of a single radial cross section such as dRLQK about d, L and K. The two small sketches reproduced in fig. 14c suggest that Leonardo may, some 250 years earlier, already have been thinking, qualitatively at least, along very similar lines. In 1732 Danisy had made tests on the collapse of model arches and these were published in A. F. Frezier, *La théorie et la pratique de la coupe des pierres*, III, Strasbourg, 1739, p. 389.

[60] Arundel MS, 141v, with sketches of a pomegranate and a cracked semidome.

[61] R. J. Mainstone, 'The springs of structural invention,' *Journal of the Royal Institute of British Architects*, LXX, 1963, pp. 57–71.

[62] The need to ensure the stability of the incomplete structure at all stages of construction may be expected always to have had a predominant influence on the form when temporary supports were dispensed with or reduced to a bare minimum. See, for instance, P. Sanpaolesi (op. cit.), A. Godard, 'Voûtes Iraniennes,' *Athar-é-Irán*, IV, 2, 1949, pp. 187–360; and J. Fitchen (op. cit.). Beyond this the search for practical convenience and economy in construction will have had its influence in the past as much as today.

[63] Leonardo's projects are discussed in L. Beltrami, *Leonardo da Vinci negli studi per il tiburio della cattedrale di Milano*, Milan, 1903, in which a selection of the many sketches in the MSS is reproduced. Apart from the intrinsic evidence of sketches such as that reproduced here (Codice Atlantico 310Br) and the many which explore more generally the stability of the arch (including those mentioned in note [48]), there is further evidence of Leonardo's approach in the draft of a letter of submission of his proposals for, presumably, the tiburio. He writes here that the sick cathedral has need of 'uno medico architetto, che 'ntenda bene che cosa è edifizio, e da che regole il retto edificare diriva; e donde dette regole sono tratte e 'n quante parti sieno divise, e quale sieno le cagioni, che tengono lo edifizio insieme, e che lo fanno permanente, e che natura sia quella del peso, e quale sia il desiderio de la forza, e in che modo si debbono contessere e collegare insieme, e, congiunte che effetto partoriscino . . .' (*Codice Atlantico* 270A, printed in J. P. Richter and I. A. Richter (op. cit.), II, pp. 330–1). In this connection some reference must also be made to Guarini who, apart from his architectural work, wrote inter alia on celestial mechanics. Unfortunately, however, his 'Architettura civile' (see below and note [77]) hardly mentions the domes which play so large a part in his major works and gives no clue to the structural bases of his designs which can only be inferred from the confident daring of, for instance, San Lorenzo, in Turin, 9. Though the dome of San Lorenzo and others like it may owe something to Borromini and have precedents in hispanomoresque and other Islamic vaults and in a few Romanesque and Gothic vaults inspired by these, the writer strongly suspects a more direct influence of Leonardo's Milan projects and his closely related projects for centralized churches, and, perhaps through these, of German High-Gothic rib-vaults, towers and baldacchinos. The only reference to Guarini in a purely structural context known to the writer is a report on the stability of the dome of Florence Cathedral in 1695, to which he was one of the signatories (C. Guasti (op. cit.), doc. 391, pp. 177–183). It was recommended that four iron chains should be placed round the dome, but the quantitative analysis which supported a similar recommendation at St. Peter's is lacking here.

[64] In these sketches the approximate catenary curves superimposed on cross sections of the dome recall the entry in Robert Hooke's diary for September 26, 1675: 'riddle of arch, ut pendet continuum flexile, sic stabit (inversum) rigidum.' The same (very conservative) approach to the choice of a stable profile for a dome is illustrated more explicitly in G. Poleni op. cit. (pp. 42–50 and fig. XIV, the latter reproduced in R. J. Mainstone, 'Structural theory' op. cit., p. 188) and is discussed mathematically in a forthcoming paper by J. Heyman, 'On shell solutions for masonry domes.'

[65] G. Milanesi (op. cit.), II, pp. 431–5; L. Beltrami (op. cit.), pp. 57–61; R. Papini (op. cit.), pp. 180–5 and 261–4.

[66] op cit., III, 14 (Leoni translation).

[67] op. cit., III, 13 (Leoni translation).

[68] English translations and commentaries in F. M. Cornford, *Plato's cosmology*, London, 1937; H. D. P. Lee, *Plato Timaeus*, Harmondsworth, 1965.

[69] Vitruvius, III, iii, 6.

[70] R. Klibansky, *The continuity of the Platonic tradition during the middle ages*, London, 1939.

[71] E. Panofsky, *Abbot Suger on the Abbey Church of St. Denis and its art treasures*, Princeton, 1946; O. Von Simson (op. cit.).

[72] R. Wittkower, *Architectural principles* (op. cit.).

[73] K. Lehmann, 'The dome of heaven,' *Art Bulletin*, XXVII, 1945, pp. 1–27; O. Demus, 'Byzantine mosaic decoration,' London, 1948; E. B. Smith, 'The dome: a study in the history of ideas,' Princeton, 1950; C. Mango, 'A twelfth-century description of St. Sophia,' *Dumbarton Oaks Papers*, XIV, 1960, pp. 233–45. For further valuable discussions of this iconographic aspect of design see R. Krautheimer, 'Introduction to an "Iconography of medieval architecture"' *Journal of the Warburg and Courtauld Institutes*, V, 1942, pp. 1–33, and P. Frankl, 'Gothic architecture' (op. cit.), pp. 229–40.

[74] Doric refinements are discussed, with bibliographies, in W. B. Dinsmoor, 'The architecture of ancient Greece, 3rd ed., London, 1950, pp. 164–9, and A. W. Lawrence, 'Greek architecture,' Harmondsworth, 1957, pp. 169–75. Later Renaissance design is discussed in W. Lotz, 'Das Raumbild in der italienischen Architekturzeichnung der Renaissance,' *Mitteilungen des kunsthistorischen Institutes in Florenz*, VII, 1956, pp. 193–226, and J. S. Ackerman, 'Architectural practice in the Italian Renaissance,' *Journal of the Society of Architectural Historians*, XIII, 3, 1954, pp. 3–11. Though a direct visual interest seems to have been unusual in the Gothic period see also F. Nordström (op. cit.).

[75] Le premier tome (op. cit.), pp. 233b–4b. Though introduced as an illustration of the new theory of divine proportion to be set out more fully in a promised subsequent treatise which never appeared, the design undoubtedly reflects the practices seen at Milan and Bologna (see note [28]). Francesco di Giorgio's design is illustrated and discussed in H. Saalman, *Early Renaissance architectural theory* (op. cit.), pp. 92–3 and R. Papini (op. cit.), p. 194.

[76] Published with German translation in *Heronis Alexandrini: opera quae supersunt omnia*, V, 'Heronis quae feruntur stereometrica et de mensuris,' J. L. Heiberg ed., Leipzig, 1914, pp. 1–162.

[77] Published posthumously, Turin, 1737. At the outset (p. 2) Guarini states that l'Architettura come facultà dipende dalla Geometria' and the more theoretical part of the treatise is entirely devoted to it. In this acceptance of the primacy of geometry per se (rather than in its wider but less precisely defined role in the Gothic *scientia geometriae*) Guarini may be considered as the successor to Borromini and the model of Neumann, 23.

[78] R. Wittkower, 'Brunelleschi and "Proportion in perspective"' *Journal of the Warburg and Courtauld Institutes*, XVI, 1953, pp. 275–91. For the later interest in perspective see, in addition to the last two works cited in note [74], A. Pozzo, *Perspectiva pictorum et architectorum*, Rome, 1693, and C. Wren, '*First tract on architecture*, S. Wren (op. cit.), p. 352—'The Architect ought, above all Things, to be skilled in Perpective; for everthing that appears well in Orthography may not be good in the Model, . . . ; and everything that is good in the Model may not be so when built.'

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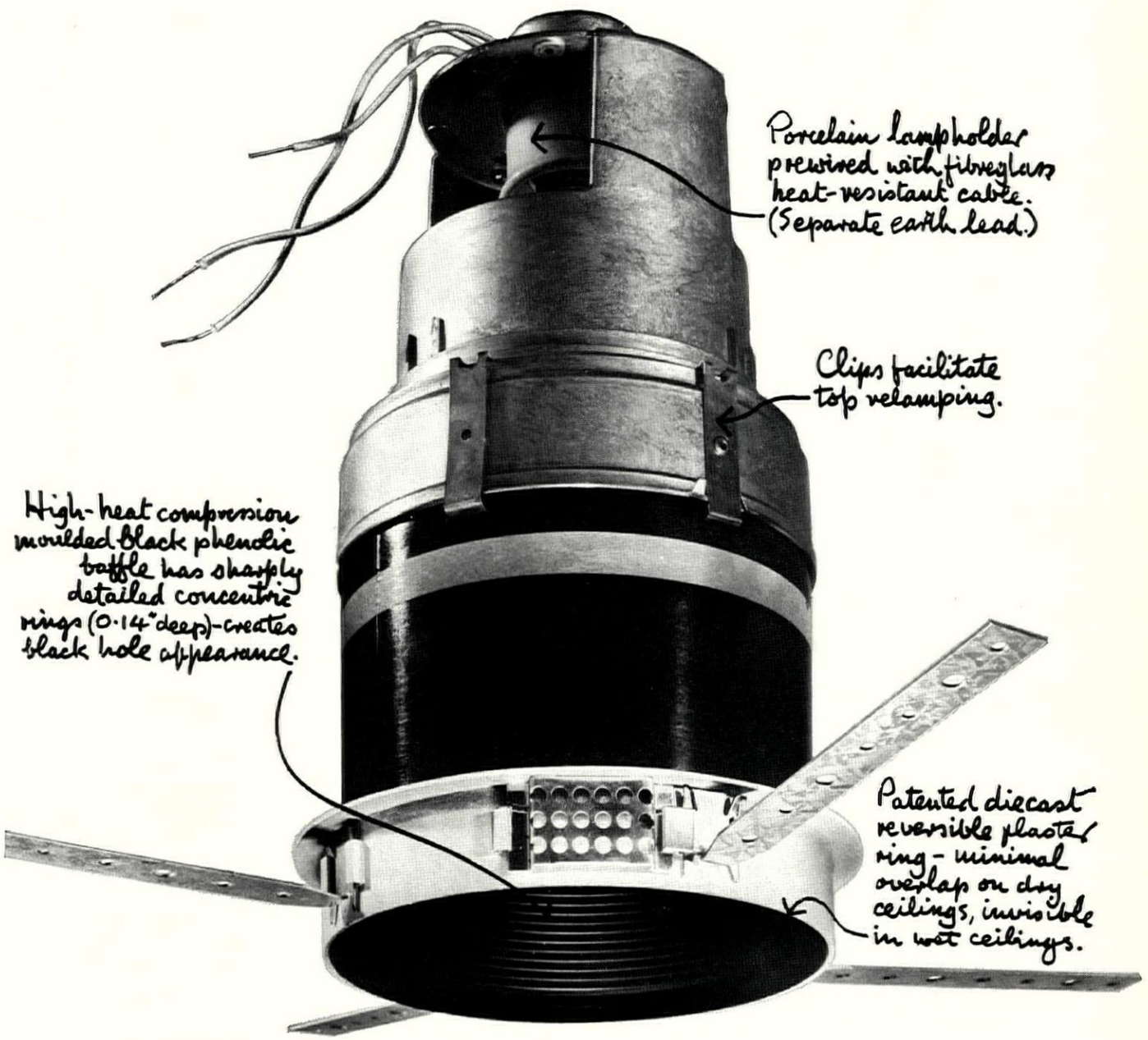

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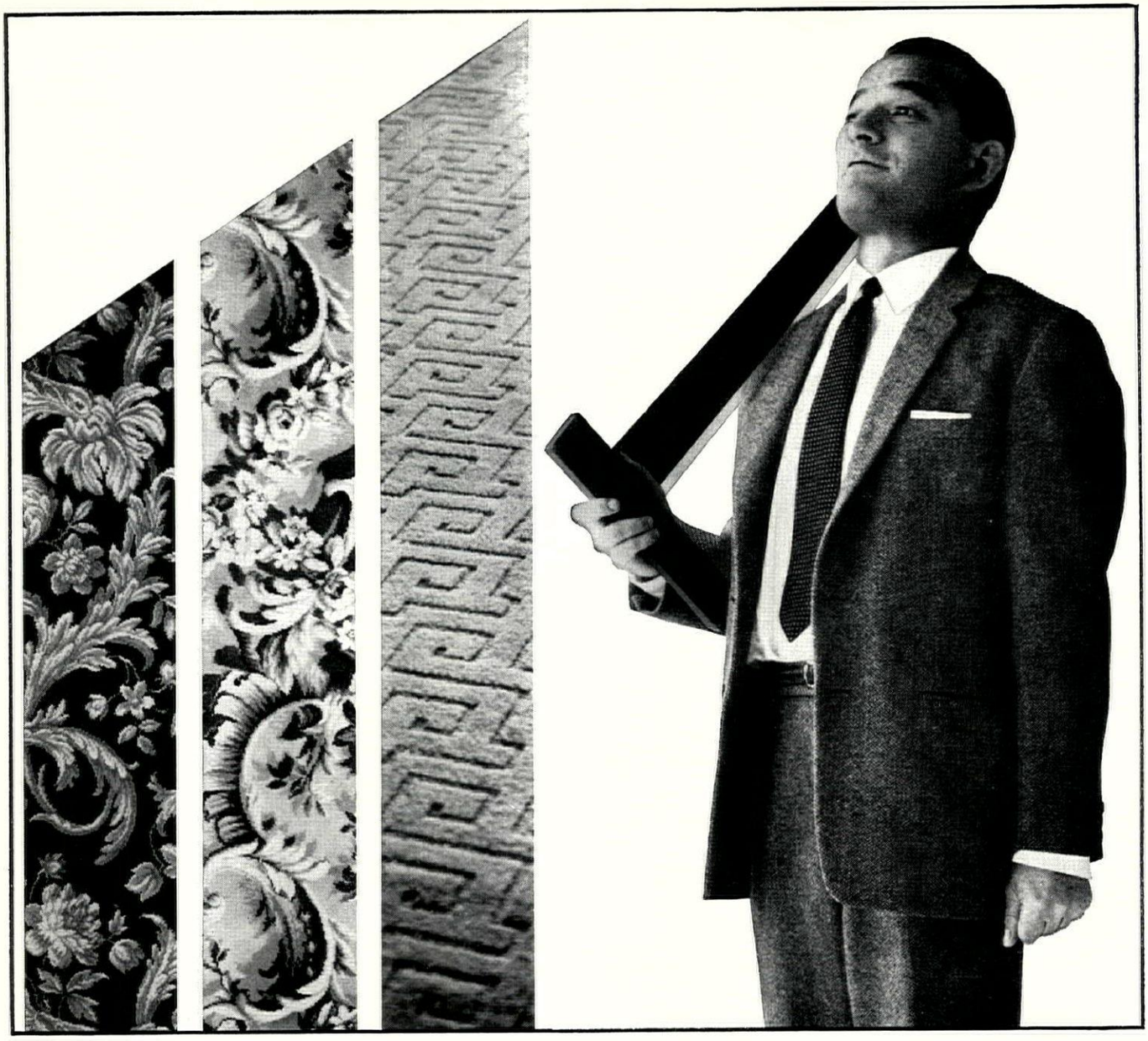

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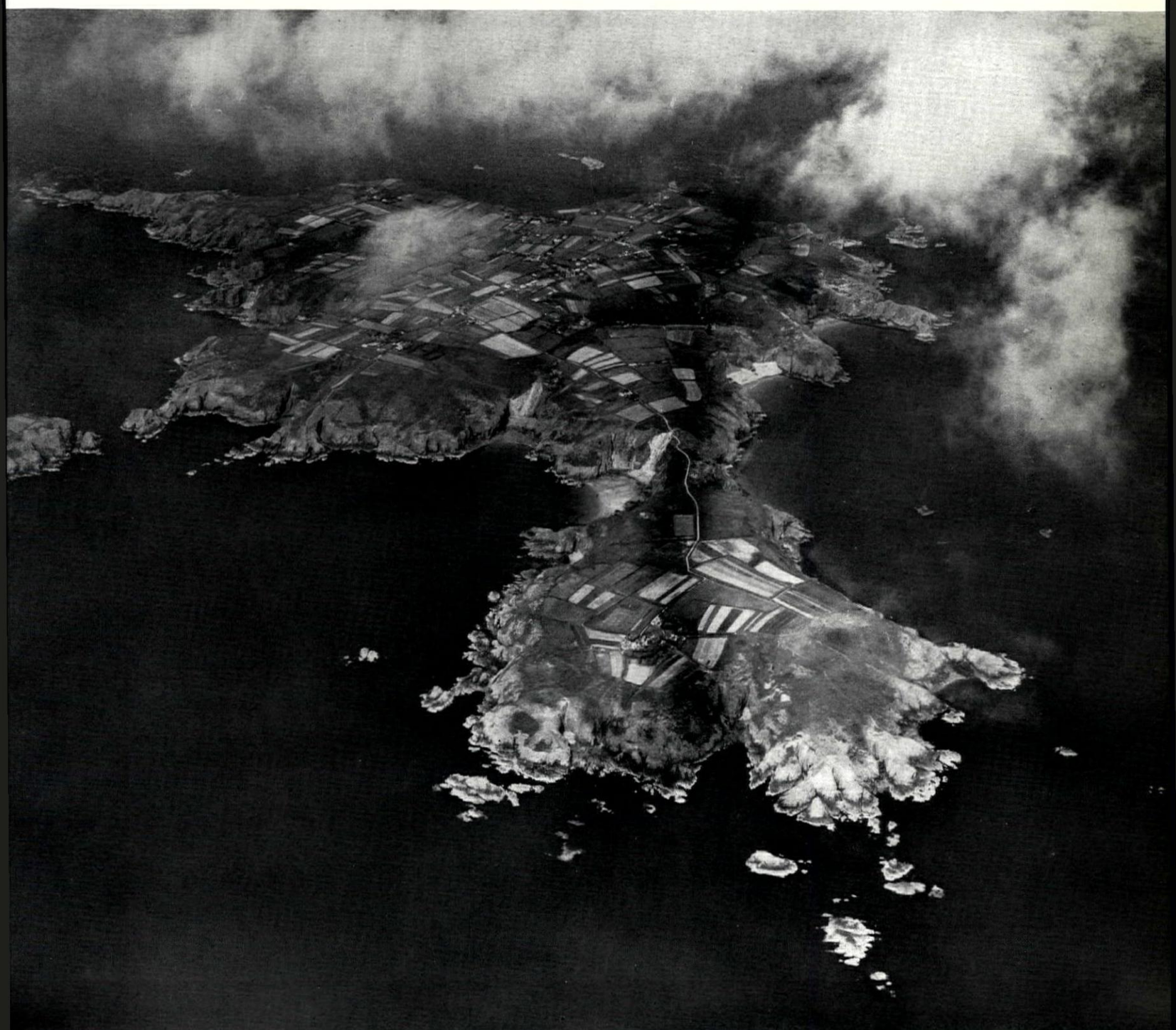
MISCELLANY

a landscape charter for

SARK

The island of Sark, 1, a rockgirt community of 500 inhabitants, is that rare thing, history suspended. The fame of its Dame's determination to keep cars off the island has obscured Sark's enviable freedom from other features of contemporary life on the mainland—no taxes, no civil service, no planning authority and no planning law. Obscured from some, that is, for Sark's problem is that a growing number of people from outside the island are determined to share this freedom. The island is under siege. The native islanders are already heavily outnumbered—of the 236 dwellings on the island, 28 are summer cottages and chalets, 143 belong to outsiders and only 93 to Sarkese.



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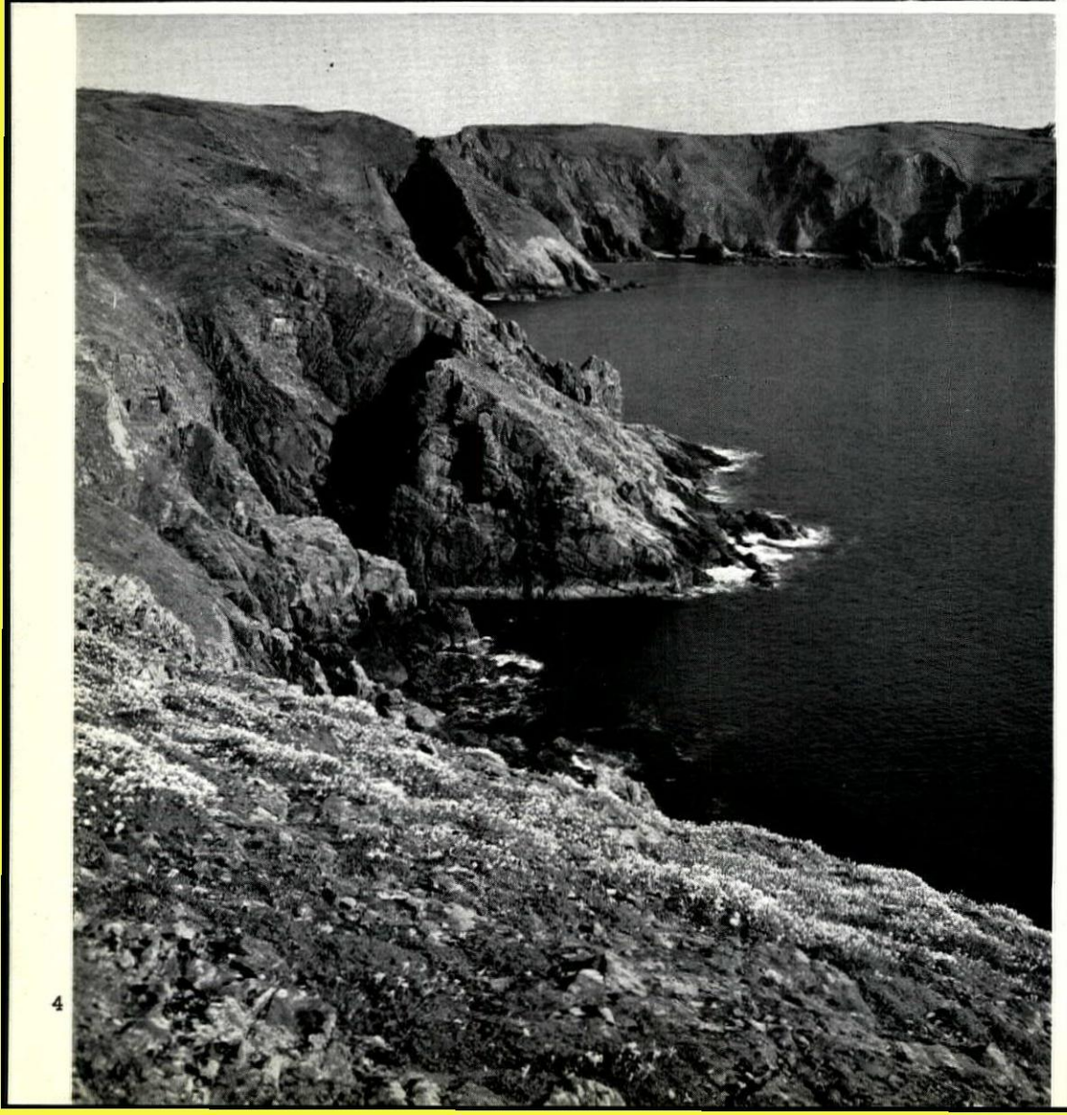

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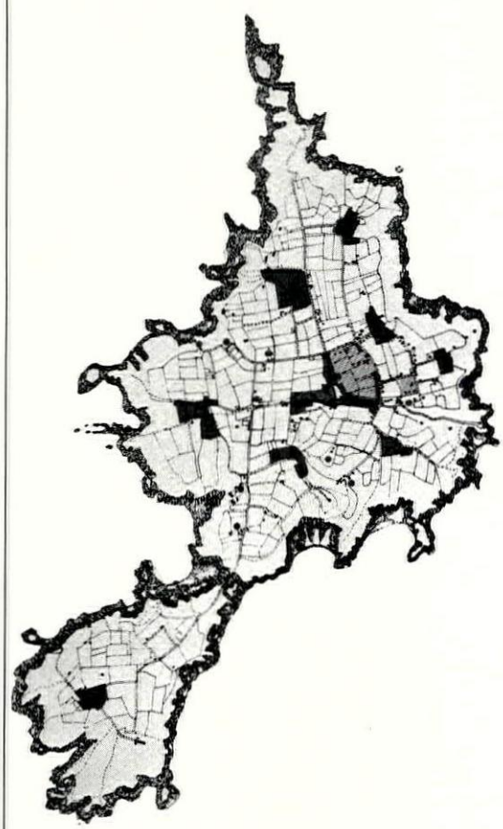
In the early part of 1967 the realization that this tide was barely reversible unless drastic steps were taken, led the Natural Amenities' Committee to make an urgent recommendation to the Chief Pleas, Sark's Government: 'the future policy of this committee concerning new dwellings is clear. There should be fewer houses built in future, of better quality, and almost exclusively for Sark people.' And whereas on the mainland, an influx of newcomers to a village generally 'takes over' the village, soon dominating the parish council and later the district council, in the case of Sark its unique medieval fiefdom allows it to put a stop to growth at will. So firmly is the composition of the Chief Pleas vested in Sark's history, in fact from a charter of Elizabeth I, that representation of outsiders is well-nigh impossible. At one stroke in 1967 the island's amenities' committee was forced to become a planning body and the Chief Pleas readily gave this restrictive policy the force of law.

The committee shortly afterwards engaged Geoffrey Jellicoe to study the existing landscape and to make short and long term proposals. Jellicoe's starting point was his acceptance that, while Sark is and should continue to be for the Sarkese to live on, 40,000 tourists a year cannot be ignored—the economy of the island is now wholly dependent on tourism.

His report, presented at the end of last year, was deceptively simple. Finding that the



map of the main island of Sark showing Jellicoe's proposals—a policy of restriction and infill.

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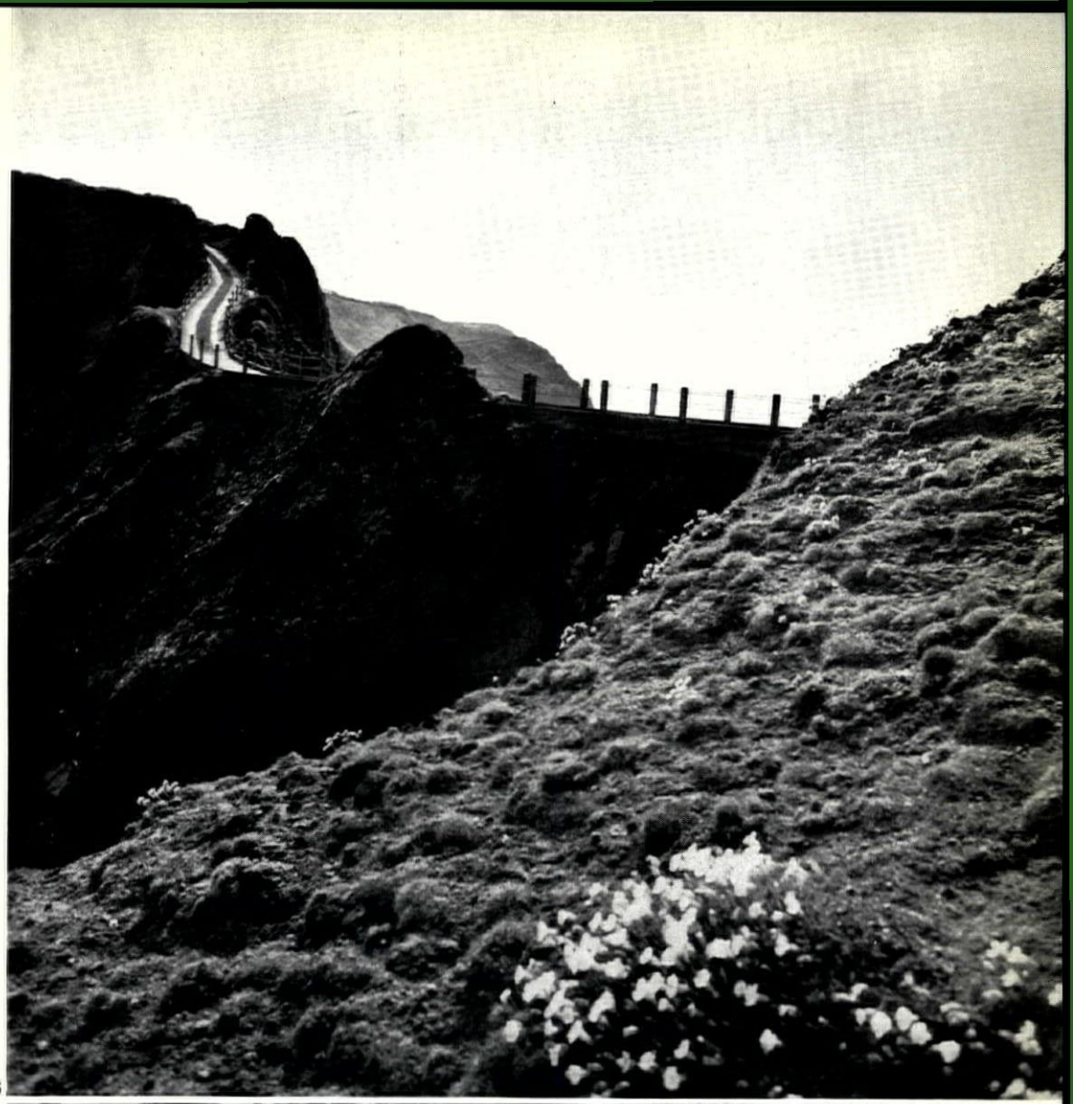

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landscape basically is 'static'—unchanged from Elizabethan times when it was laid out as land for the Seigneur and forty farmers or tenants—Jellicoe proposes to restrict development to these nine original clusters, 3, 7, and the area of the Seigneurie which has now become absorbed into the central area. Tree planting around each of these clusters, along roads, and in the valleys, is proposed as part of a total policy for healing existing scars in the landscape, 2, and for locking new development firmly into it. The suggestions also embrace a phasing out policy on the lines of Lionel Brett's suggestions in *Landscape in Distress* for the most damaging eyesores which cannot be absorbed.

The island is divided into two unequal parts by an isthmus called La Coupée, which was charmingly depicted by Turner, 5. 6 shows the same view today, with a road striding brutally across the gentle contours of the isthmus. Jellicoe argues that this changed character must be accepted, and stresses the need to emphasize the romantic, 8, and dangerous topography, 4, by keeping it free of artificial planting. La Coupee would be joined to a coastal footpath system around the two parts of Sark, Great and Little. His recommendations for meeting the tourist problem are for a

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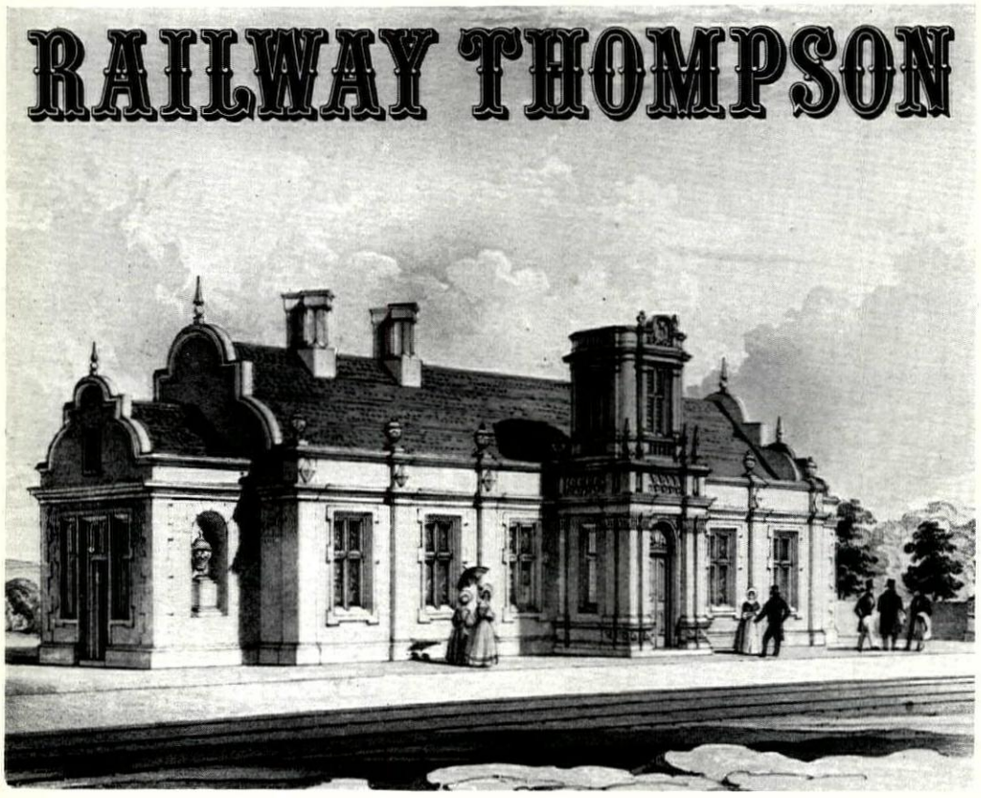
new international hotel and a nine-hole golf course. The report ends by stressing the need for continuing advice on planning and landscape and the appointment of an engineer to go into the question of supplying fresh water to new development.

RAILWAY THOMPSON



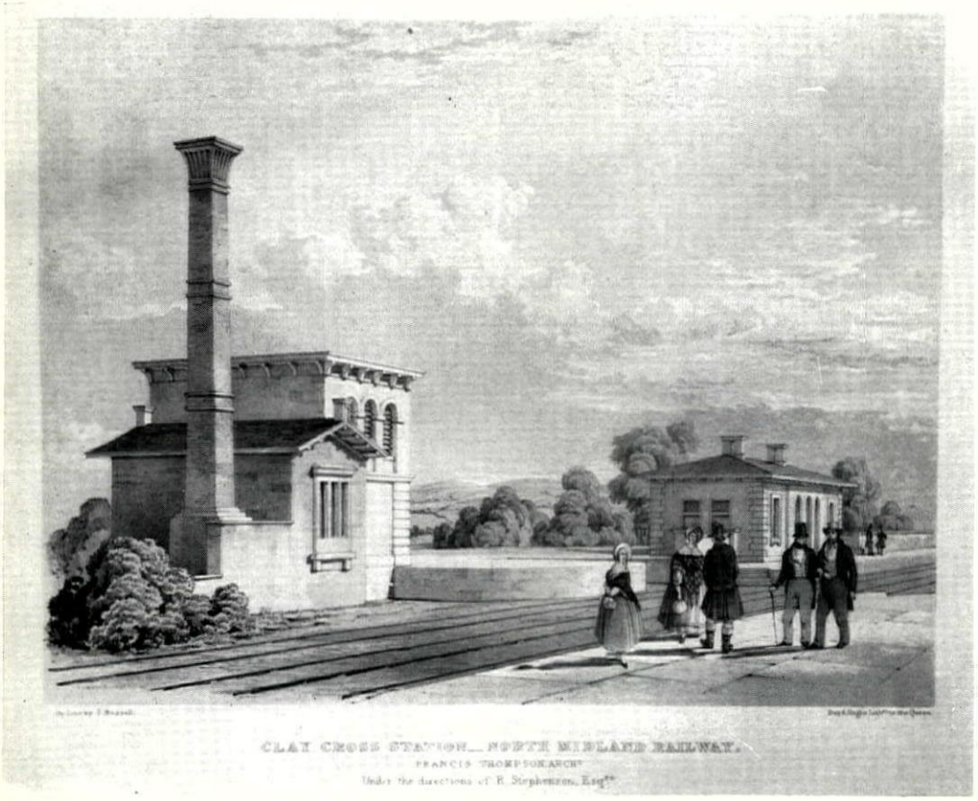
1

It is believed that Francis Thompson was a member of a wealthy London tailoring family who counted among their patrons several railway directors. They were influential in gaining him the appointment of architect to the North Midland Railway in 1835, at a salary of £1,103 12s. per annum. His successful co-operation with Robert Stephenson during the next five years no doubt led to his appointment to the Chester and Holyhead company in 1846, but Thompson's apparent absence from active architecture from 1841-46, and after 1850, might indicate that he was not wholly reliant on his architectural earnings.

As architect to the North Midland Railway, Thompson designed the twenty-six stations between Derby and Leeds, two of the earliest railway hotels—at Derby and Normanton—and two locomotive round-houses. Tunnel entrances, cuttings and bridges also received architectural treatment. From the stations that remain, and from the examples known to have been illustrated by S. Russell, it is apparent that the Derby station set the theme. Here the façade was dominated by a high entrance block, flanked by two-storied office wings and tailing off in an arcaded front, punctuated by subsidiary entrances, in all 1,050 ft. in length. Within, shelter was afforded to passengers and staff by three elegant glazed train-sheds.

Of the intermediate stations, several had a large central block flanked by wings. A variety of styles and features was used; Georgian, Elizabethan and ornate villa. The windows were sometimes circular or square headed, Venetian or French. Low pitched roofs were hidden by parapets in some stations, while the steeply pitched roofs in the Elizabethan examples featured parapets and gables. The villas had low pitched overhanging eaves with ornate brackets. Chimneys were a feature, some square, some octagonal or diamond-shaped and all with decorative copings. Window jambs stood proud and cills had brackets and decorative under-panels. String courses, plinths and angles gave further variety.

The central bay containing the booking hall and waiting area was set forward of the wings on the platform elevation. Platform canopies were completely absent. One building which departed from its neighbours was Ambergate, which adopted an A-shape to serve as a junction. This station, 1, is still largely intact though it was somewhat altered in the 1860s. The Russell lithographs, which were published in 1842 and are now in the Harvard collection, feature an adjoining building which housed a water-storage tank and steam pump. These little buildings displayed the same features as their respective stations and boasted elegant chimneys, as is the case of Clay Cross, 2. Also illustrated here are the stations at Chesterfield, with its pumphouse, 3, built by Leather and Waring, and Belper, 4, which stood at the southern end of the Belper cutting. The station at Masborough was similar but had square headed windows. Both were built by Thomas Jackson of Pimlico. 5 shows the station at Eckington,



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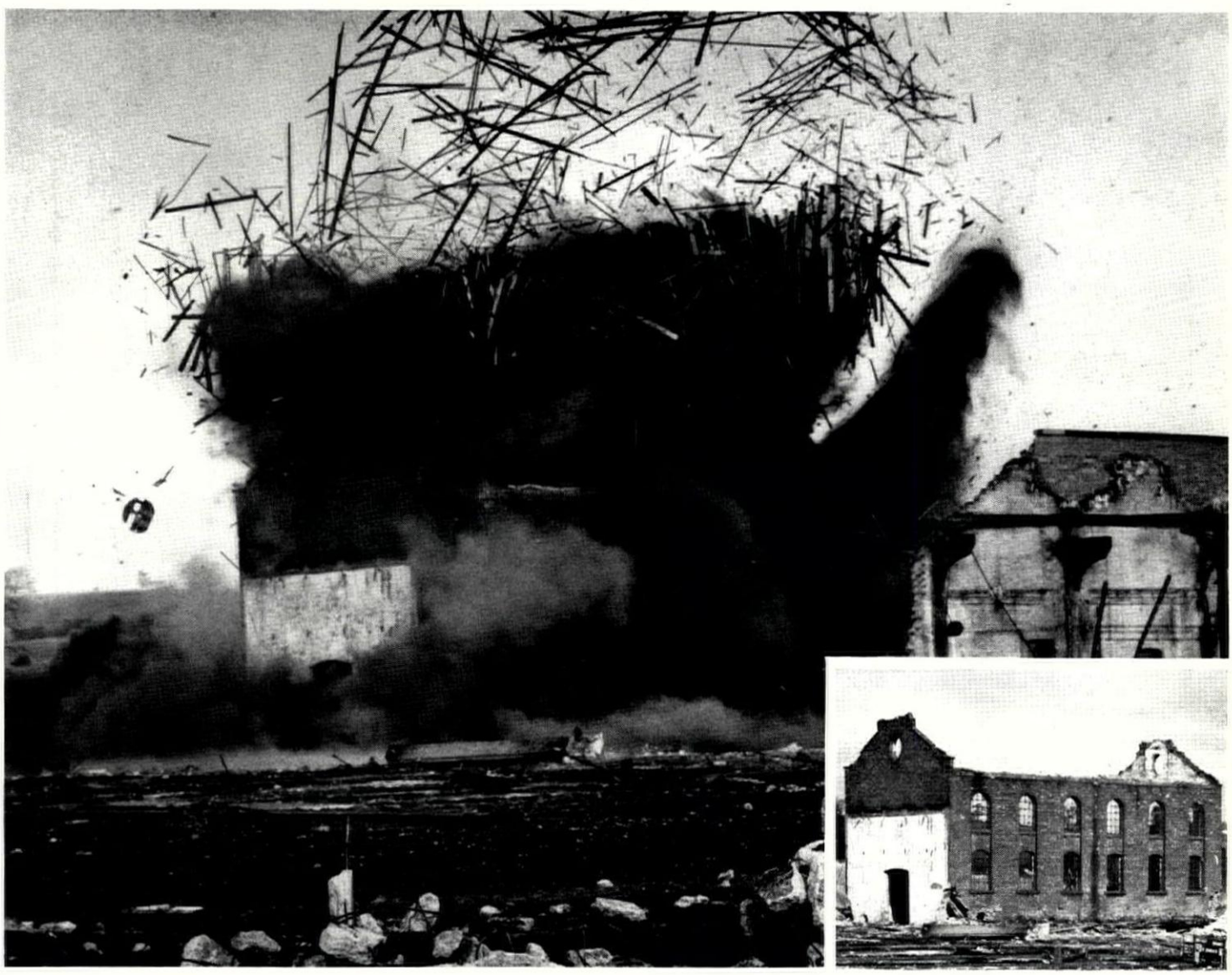

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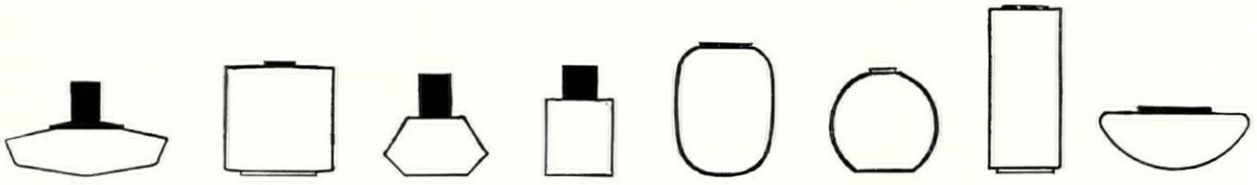

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SEE BARBOUR INDEX

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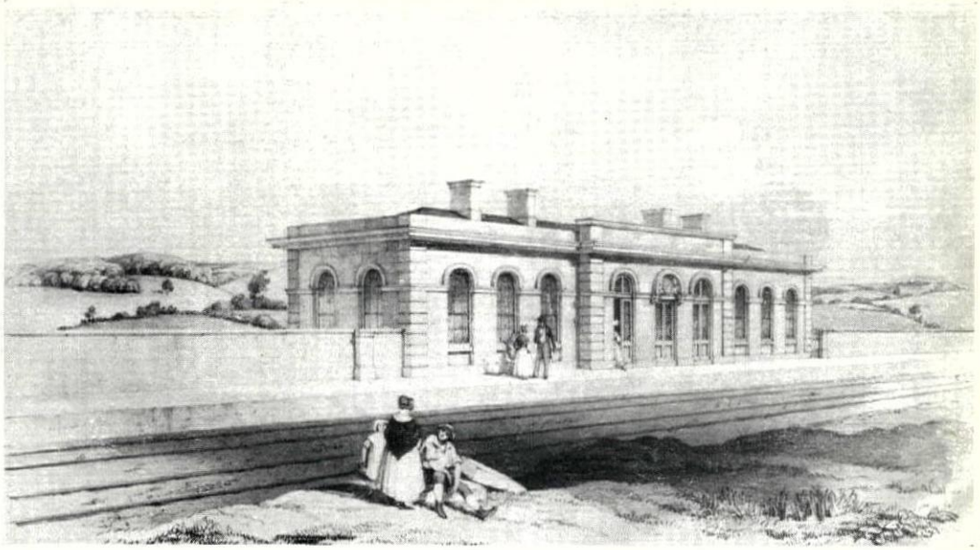
long since demolished, which once served the Sitwell's family seat, Renishaw Park. The circular entrance block was used on a larger scale for the Barnsley station. The average cost of the North Midland stations was from £2,000 to £2,500. The Derby station contract totalled £39,986.

The two railway hotels which Thompson designed for the company, at Derby and Normanton provided overnight accommodation for travellers. The Derby hotel is sited at an angle to the main station façade and is H-shaped and of three-storey construction in brickwork, with stone trim to the windows, plinth, parapet and string courses. The Normanton hotel, 6, is a simple two-storey rectangle with a service wing. Here the roof is low-pitched with projecting eaves. Dominance is given to the stone façade by deep windows, corbelled cills at first floor level and raised underpanels at ground floor level. The central entrance porch gave direct access to the platforms lying below, via a footbridge. The Normanton station, however, is believed to have been designed by G. T. Andrews, the architect to the York and North Midland Railway which here joined forces with North Midland Company.

After a gap of five years Thompson re-appears as architect to the Chester and Holyhead Railway which was opened in 1850. Several of the stations were sketched for the *Illustrated London News* and appeared in the issues of 19 August, 1848, and 23 March, 1850. From these illustrations, and from the remaining examples at Chester, Flint, Holywell, Mostyn, Prestatyn, Conway, Aber, Bangor, Bodorgan and Valley, it is seen that these buildings differed in two respects from their North Midland predecessors. Two-storey construction was adopted, with a booking-hall, waiting-room and staff accommodation below, and living-rooms for the station-master above. Passengers were afforded shelter by a canopy which was fixed to the main house block and terminated against a pair of single-storey flanking blocks which were set forward from the main building. The Chester station, 7, has a large entrance unit flanked by wings of the same height, and set forward to allow an entrance canopy to be neatly incorporated in the façade. As at Derby, the central office block is flanked by an arcaded screen-wall punctuated by subsidiary entrances. The main train shed does not make exclusive use of cast-iron column supports, but relies on a brick supporting wall broken by arches. 8 shows the station at Abergele (also on the Chester-Holyhead line), from the *Illustrated London News* of 19 August, 1848. It is typical of the two-storey house blocks with a platform canopy placed between the flanking pavilions. The elevational treatment of the Chester and Holyhead stations followed a less varied course than their North Midland predecessors, and variety was obtained more by size and shape, than by decoration. Brick replaced stone as the basic material, and stone appeared in plinths, string courses, door and window jambs, parapets and angles. The two most notable features of this route are the Conway and Britannia tubular bridges. Designed by Robert Stephenson, but with Thompson responsible for the masonry, these bridges are among the best examples of the successful co-operation of architect and engineer to be found in the Victorian era. At Conway the portals recall barbicans, and blend with the nearby castle. At the Menai Straits, the abutments and towers, though simple and with little decoration, echo the rectangularity of the tubes, and the white Anglesey granite produces an air of brightness. The bridges were the subject of a book by Stephenson's resident engineer, Edwin Clark, in 1850 and the text was accompanied by a folio of lithographs by S. Russell.

O. F. CARTER



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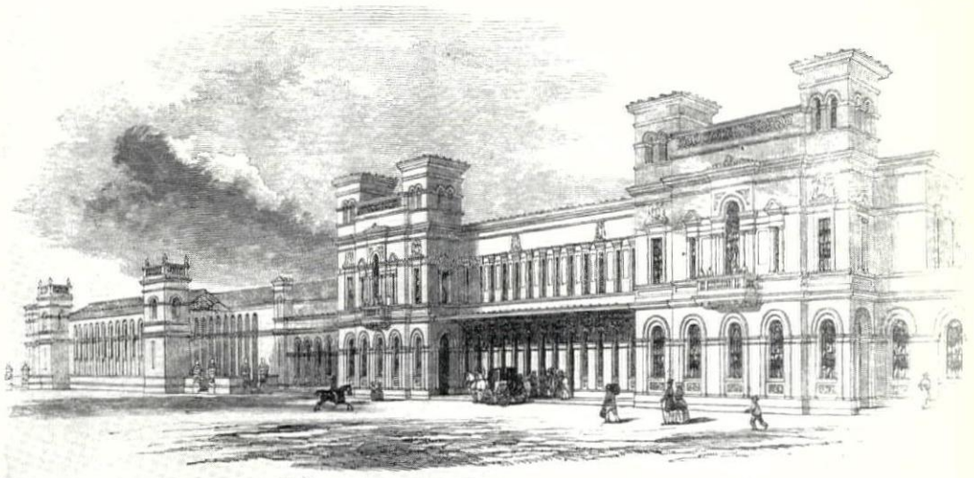

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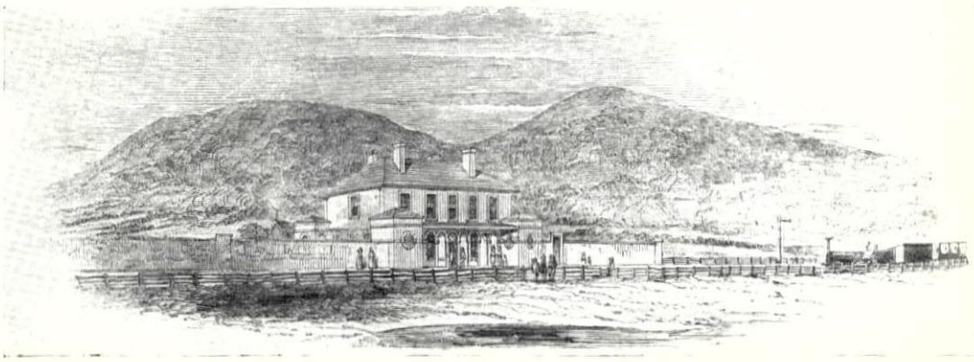
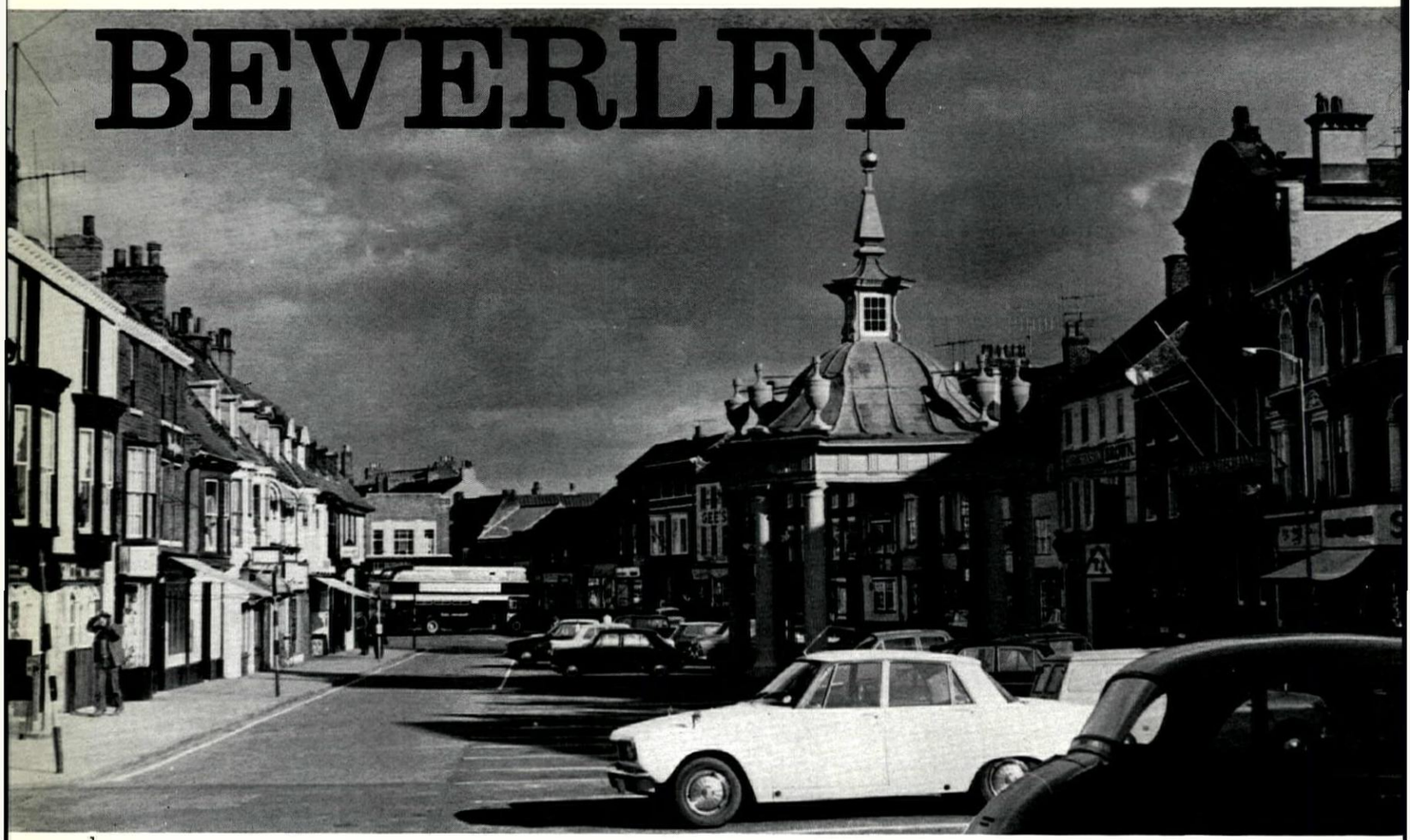


8

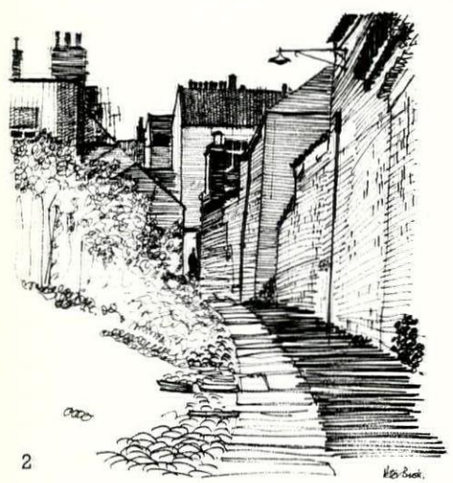
BEVERLEY



1

A non-event of some significance will shortly happen in Beverley, when one side of the Dings area of the Saturday Market is removed, opening up the town's one remaining ancient market place to through-traffic from east to west (at right angles to the town's historic linear pattern). Eventually this will mean the exclusion of the pedestrian from what was once a safe area of the town, and the destruction of an urban space of real quality.

Eleven hundred years ago the town was sacked by the Danes. One hundred and fifty years ago a road linking the town to its new railway station was cut through, destroying the other market place. Ironically history is repeating itself; today a major traffic route is being cut through the traditional commercial centre.



2

1, the Sow Hill link will slash across the market place in the foreground. 2, Silvester Lane—a pedestrian street linking Saturday Market with Walkergate, Beverley's traditional weaving industry area.

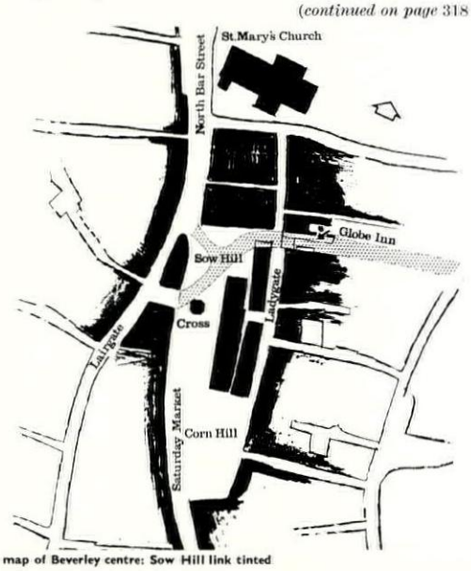
The census figures of 1377 show that Beverley with a population of 5,000 was the eleventh largest town in the country, second only to York in importance in the north of England. In its spaces the town certainly bears the stamp of its historical importance. Known locally as the 'Sow Hill link,' the present proposals for the Market Place were published in February, 1966, along with certain other road plans prepared jointly by the county council and the borough. In May, 1967, the Minister of Transport included Beverley's by-pass scheme in her 'preparation list.' A torrent of dialectic in both council meetings and the local press ranged over the argument that the early promise of a by-pass would make expediency of this kind unjustifiable.

Earlier in the year, *Perspective**, the Journal of the York and East Yorkshire Architectural Society, published an appraisal of the town's development including criticisms of the official plans. This brought the argument to a climax in June, 1967, when the borough council reversed its decision to proceed with the short term scheme, and refused to sell several properties including the 'listed' Globe Inn to the county council.

But, in October 1967, despite all arguments the borough reversed its decision and decided that the county council road works should proceed, and the market place should be opened up to east-west traffic through the town. The civic society having fought determinedly against the proposal, chose this moment to restrict their comments to the road proposals as a whole. At the Society's annual dinner later that same year they decided to say no more on the Sow Hill issue.

Throughout the debate, protagonists on both sides quoted freely from *Traffic in Towns*. Only later will the gap between the message of *Traffic in Towns*, and the county council's lamentable failure to interpret it in practice, become apparent. The implementing of the Sow Hill road scheme will go against all the principles advocated by Buchanan, cut diagonally across the Market Place and for

(*continued on page* 318



map of Beverley centre: Sow Hill link tinted

*Perspective East Yorkshire, March/April.

Have you seen our fifth* report on calculated brickwork?

We have now completed a further study in the area of calculated loadbearing brickwork. There is much in it that has great significance in tall building projects. Redland, as always, are well to the fore in the development and manufacturing of bricks for high rise building. This latest addition to our list of technical publications is of great significance to architects and the building industry in their continuing search for improved design at satisfactory cost. The number of this publication is LB8. Please write for it.

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Telephone: Leeds 75206.

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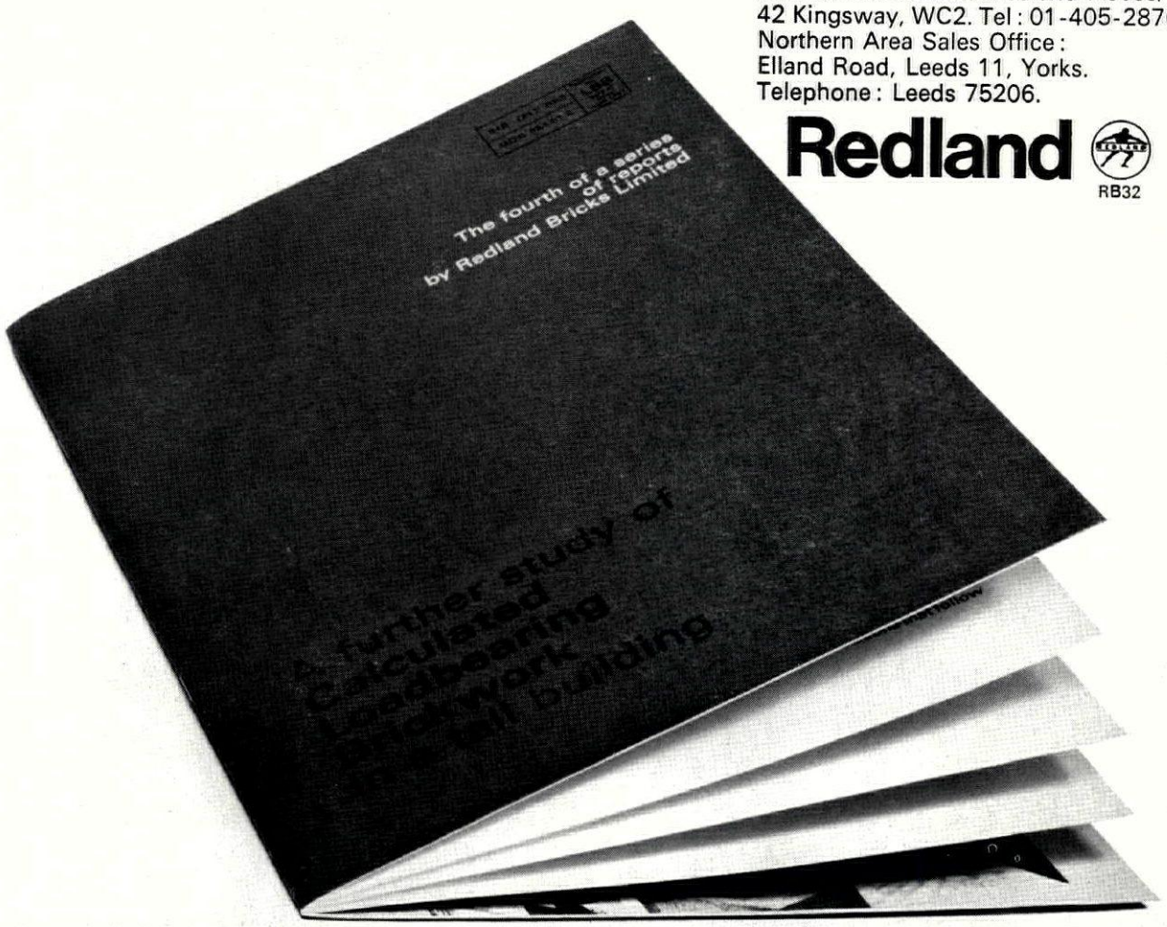

*Five includes the illustrated report on Baylis Road.

3

good measure across the length and breadth of the Civic Amenities Bill as well.

So Beverley, listed in 1964 by the Council for British Archaeology for its 'well preserved medieval market place and street plan,' is to be desecrated. A doctrinaire solution will be carried out where the most sensitive treatment was desperately needed. There is, it seems, no one with the will, the responsibility and the necessary powers to prevent such things happening—no planning Ombudsman to intervene. Because the land was owned by the borough, no public inquiry could be held. Piece-meal road proposals creating environmental havoc slip through the net.

Ironically, the Historic Towns and Cities Conference, 1968, was held at the end of March in York, just twenty-nine miles away from Beverley, where Sow Hill will become just another pig's ear.

PETER BUSH


4


5

3, the market place on a normal day and, 4, on market day. 5, Ladygate Street, which is to be demolished to provide further parking space. 6, the Sow Hill link will cut through the corner of the market place, demolishing the café and other buildings.

6

How in the world can we cut construction time and costs?

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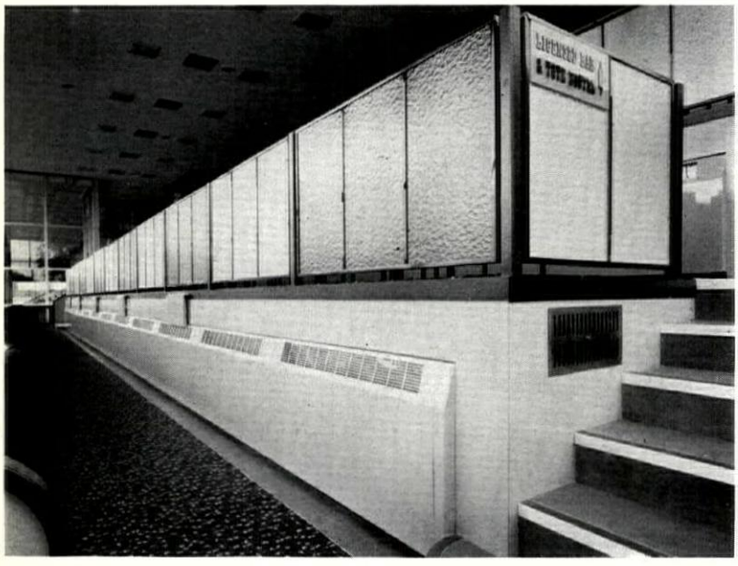
BP plastics

The Industry

Heating units

Copperad have a variety of Sill-Line hot water heating units for installation in continuous runs beneath window sills. All types incorporate one or two heating elements of copper or steel tube with non-ferrous fins for improved heat transfer and dampers can be fitted to control the output of warmed air. The casings are made in various heights up to 28 in., and with outlet louvres in a vertical or sloping front, 1. There is also a new Classic model with a flat front and an aluminium top outlet grille formed from extruded sections. Electrical ducting is made for installation below the heating units. This has a sloping top to allow the free entry of air into the heater and is made with either two or three compartments so that mains supplies, telephones and other circuits can be kept separate. Socket outlets can be arranged in the ducting itself or at high level in the heater units.
Copperad Ltd., Colnbrook, Bucks.



1

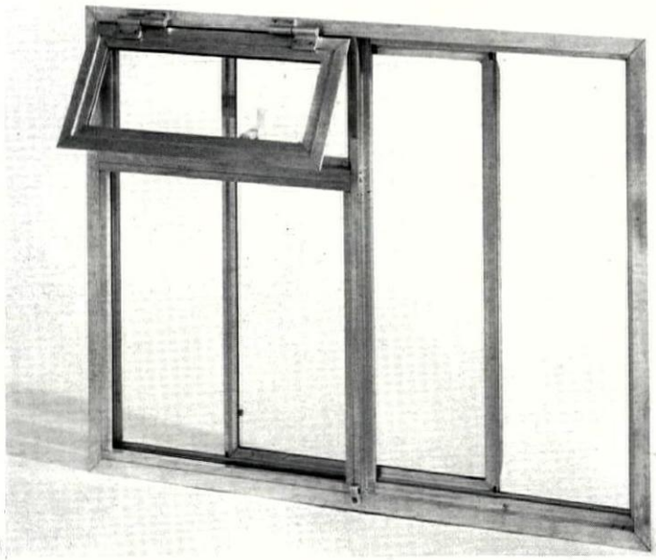
Automatic oven cleaning

Electric cookers in the United States have been available with self-cleaning ovens for several years and have apparently been a great success. The method involves heating the oven to a temperature of about 900 deg. F—about 350 deg. more than the usual maximum cooking temperature—and this converts burnt fat and other mess into vapour, smoke and ash. An eliminator in the oven vent contains an assortment of catalysts which eliminate most of the smells and all the smoke except with an exceptionally dirty oven. The amount of ash left is very small and can easily be blown or swept away. Owing to the high temperatures involved it is necessary to provide extra insulation and also an automatic lock for the oven door. It is also necessary to modify and rearrange the heating elements and use a different type of vitreous enamel. The first British-made cooker with a self cleaning oven is the Creda Autoclean, 2, which should be available about September, though at least two other manufacturers have similar types in course of development. In the Creda model the cleaning switches are set in the control panel at grill level and are housed in a separate box with a hinged door. The cleaning time varies from two to three hours, depending on the dirtiness of the oven, and is controlled by an adjustable time switch. A solenoid-controlled lock prevents the oven door from being opened until the oven interior has dropped below maximum cooking temperature. Demonstrations show that a really filthy oven looks like new after treatment, all grease having disappeared. Spillage trays from the cooker hob can be put in the oven for cleaning, but it is not recommended for saucepans, even if they have metal handles. The price of the cooker will be about £110.
Simplex Electric Co. Ltd., Creda Works, Blythe Bridge, Stoke-on-Trent, Staffs.

2

Sliding windows

A new series of horizontally sliding aluminium windows is now being made in Module 4 sizes by Aygee, 3. The windows are supplied factory glazed and have been developed for low-rise industrialized and for traditional housing. The sliding windows run on Delrin plastic skids and are fitted with guides, stops and an aluminium face bolt, and are fully weatherstripped with wool pile draught seals. Top hung ventilators have aluminium hinges and Delrin stays, or a sliding night flap can be added to the head of the fixed pane instead of the ventilator. Fixing is direct into brickwork with lugs, or stainless steel screws into a timber sub frame. Mill finish is standard for all windows, but they can also be supplied with an anodised finish.
Aygee (Metal Windows) Ltd., Havelock Road, Southall, Middlesex.



3

Grass-concrete surfacing

Mono Concrete have evolved a very ingenious method of soil stabilization for load bearing while still providing an overall effect of grass. This is done with the Mono Bg slab, 4, a cast concrete unit about 4¾ in. thick and about 23 by 15 in. on plan. Each block presents a series of load-bearing rectangles at ground level, to take wheeled traffic, and also contains slots, open at the bottom, which are filled with earth and seeded with grass. The result is a surface giving a visual impression of being about three quarters grass and a quarter concrete, 5. This avoids large and often depressing expanses of metalling and also avoids the drainage problems of hard surfaces as rainwater passes through the grass into the ground. Maintenance is the same as for any other grass surface and mowing can be carried out by cutting diagonally across the slabs. For areas to be used by cars the slabs need a layer of well tamped sand, with a layer of ballast for heavy vehicles. The system can be used for the hard shoulders and edging strips of roads, to allow access by fire engines or lorries on housing estates, and for parking areas in the country as well as for farm roads. A further important use is for the stabilization of slopes and embankments to prevent erosion. When the slabs are laid on slopes up to 45 deg. and anchored at intervals with stakes, the grass roots ultimately lock the slabs together, giving a completely stable surface. Cost is comparatively low. The slabs themselves are 23s. per yard super, and a complete job on a reasonably level site, including a layer of sand, blocks, soil and seeding works out at a little less than £2 per sq. yd.
Mono Concrete (Northern) Ltd., Oxclose Lane, Mansfield Woodhouse, Notts.

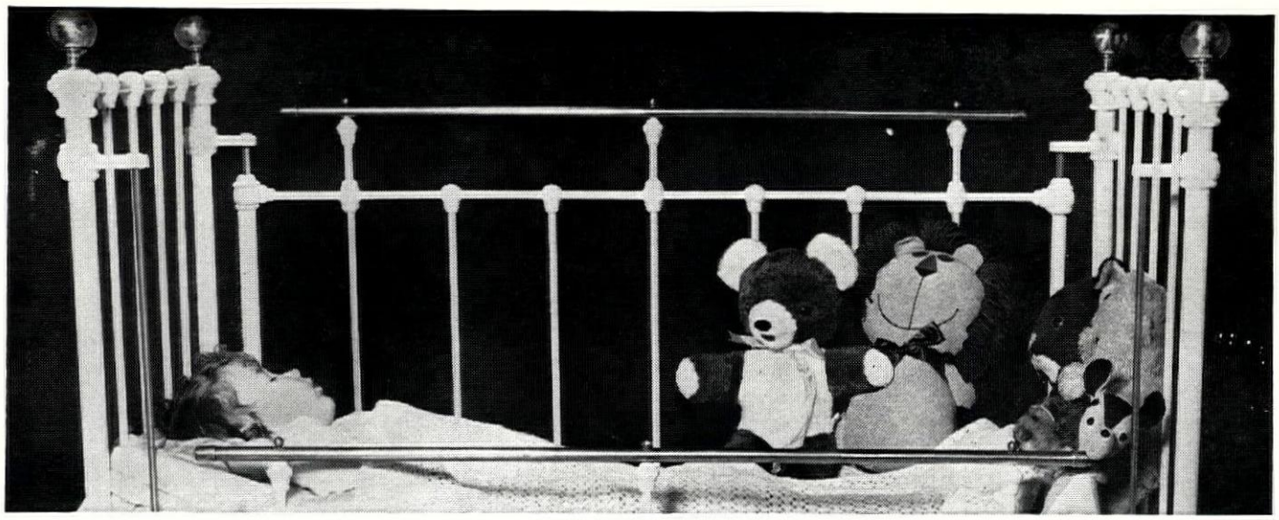
4

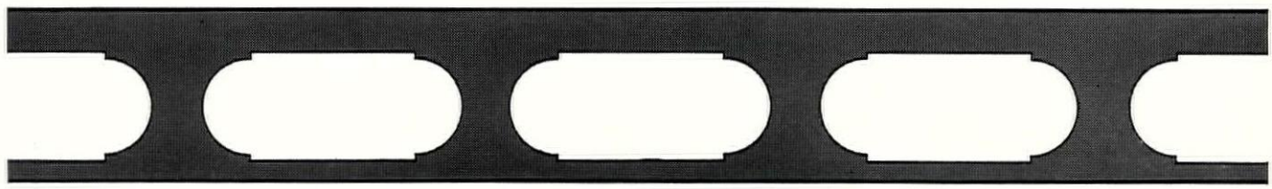
House insulation

Warmalayer insulating foam is a urea formaldehyde resin which is injected into wall cavities and hardened in position. The resin and acid hardener are injected through ¾ in. holes

[continued on page 322

5





Bison meets the sound regulations in seven different ways

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continued from page 320]

drilled in the outer brick leaf in existing houses, or, in new property, in the inner leaf before plastering. Holes in external walls are made good and re-pointed after the injection process is completed. The foam is not affected by water or fungi and is not attacked by vermin: condensation is generally reduced as the temperature of the inner leaf of the wall is maintained above dew point. The foam has very good insulation properties and reduces the U factor of an 11 in. cavity wall from 0.30 to 0.09. If insulation of the roof space is found to be necessary this is carried out with mineral wool pellets.
Warmalayer Insulations Ltd., 27 Kirkstall Road, Leeds 2.

Shower equipment

The Lidomat shower system, 6, has been introduced by Heatrae for use in houses where there is not enough

6

head between the supply tank and the bathroom. The equipment consists of a 3-gallon electric water heater for connection direct to the cold main with a restrictor to limit the rate of flow to 1 gallon a minute. A blending valve is used with the heater and the cold supply and there is thus no need for a thermostat as both hot and cold supplies are at the same pressure and there is no danger of scalding. The shower hand set has two sockets for wall mounting and three angle adjustments.
Heatrae Ltd., Norwich, NOR 29A.

Carpet tiles

Tretford carpet tiles are approximately half an inch thick and have a surface of animal hair and wool strongly bonded to a backing of cork composition. The tiles are made in ½-metre squares, 7, and in a choice of 20 colours: they are simply laid in position and need no adhesive or other fixing, so that they can be easily replaced or changed about to offset heavy wear in corridors or other heavy traffic areas. They can be laid on any floor which is reasonably smooth and flat and the composition backing prevents them from slipping. The tiles have good thermal conductivity and can be used with under-floor heating installations and the fibres are moth-proofed.
Tretford Carpets Ltd., Shenstone, Lichfield, Staffs.

New bath design

The new Orchid Isle bath, 8, by Shires, has been designed with a back having a comfortable slope for people lying in the bath, and has a wide ledge at the tap end which can be sat on when drying. For the elderly there is a full length grab rail along the back and on the front a small handle which can be held from any angle, and the bottom of the bath is flat. Taps are mounted at the corner so that plumbing connections are simplified. The bath is moulded in perspex in white and five colours. Standard length is 5 ft. 6 in. and a 6 ft. model will be produced later.
Shires Ltd., Guiseley, Leeds.

Fire extinguisher points

Although all fire extinguishers should be regularly inspected they are often found to be corroded or damaged when a fire occurs, particularly if they are kept in exposed positions out of doors. The most usual arrangement is to hang the extinguisher in a wooden box, but this hides the extinguisher unless the box has a glass door, which is always liable to damage. The Kersafe weatherproof box, 9, seems to offer a useful answer to this problem. It is made of transparent and shock resistant plastic and contains a hanging bracket adjustable for use with the majority of extinguishers. A similar cover is being developed to house breathing apparatus.
John Kerr & Co. (Manchester) Ltd., Ashcroft Road, Kirkby Industrial Estate, Liverpool.

Footpath signs

Footpath signs to the winning design of the Commons, Open Spaces and Footpath Society are now being made by Redland Bricks at a Bexhill-on-Sea factory. The units are in reinforced precast concrete with a granite aggregate, 10, and can be made with any lettering to include such things as place names and distances. The raised panel for the lettering is 12 in. wide and the whole sign stands 21 in. above ground.
Redland Bricks Ltd., Graylands, Horsham, Sussex.

Non-concussive taps

James Barwell have recently revised the design of a non-concussive tap, 11, in their Fairlight range of fittings. It is intended mainly for use in schools and public buildings where water economy is important and there is a regulating screw which controls the closing speed so that water hammer is prevented. The inlet tails are arranged for direct connection to copper pipe with a compression nut so that the cost of the usual fittings is saved.
James Barwell Ltd., 40 Great Hampton Street, Birmingham 18.

Flexible roofing sheet

Marleydek, 12, is a flexible roofing made from vinyl sheet with a backing of asbestos and can be fixed with cold adhesive to virtually any structural roof material, including roofing grades of compressed straw slab. It is flexible enough to take up normal sub-structure movement and is solvent welded at the seams to provide a jointless roof covering with special flashings, maintaining complete unity of surface. The material needs a minimum fall of 2 in. in 10 ft., and weighs 2¾ lb. per sq. yd.: heavy enough for quite substantial installations. Fire rating is EXT. SAA. Standard sheets are 72 by 38 in., giving a cover width of 36 in. with a 2 in. selvedge. Tapes of the same

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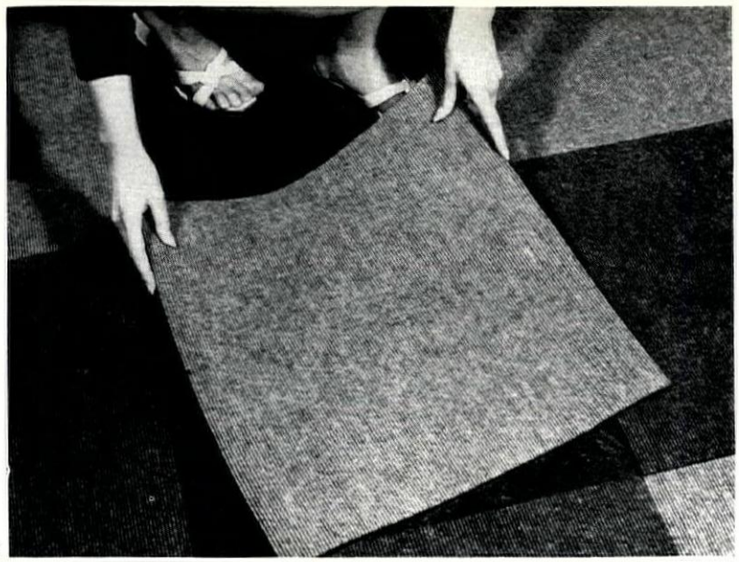

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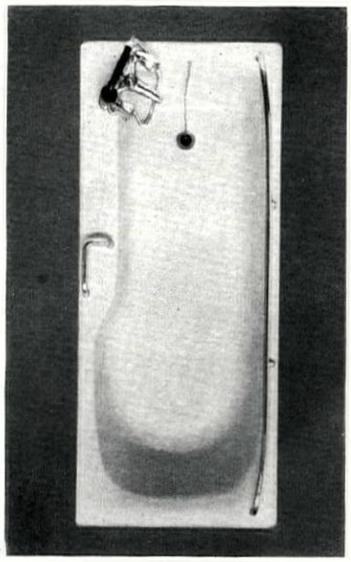

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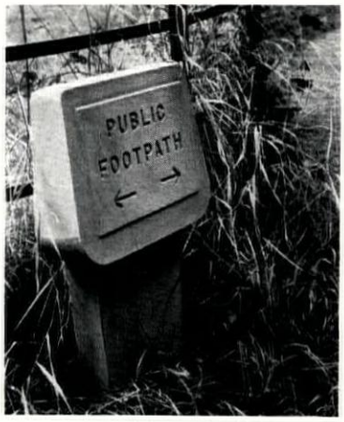

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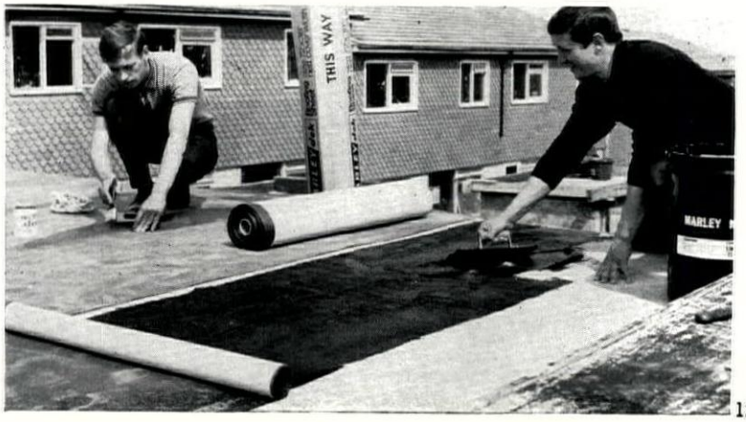

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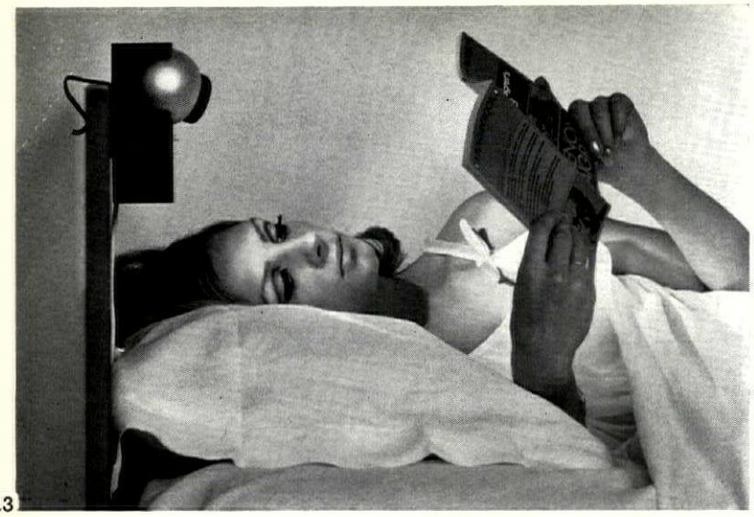


13

continued from page 322]

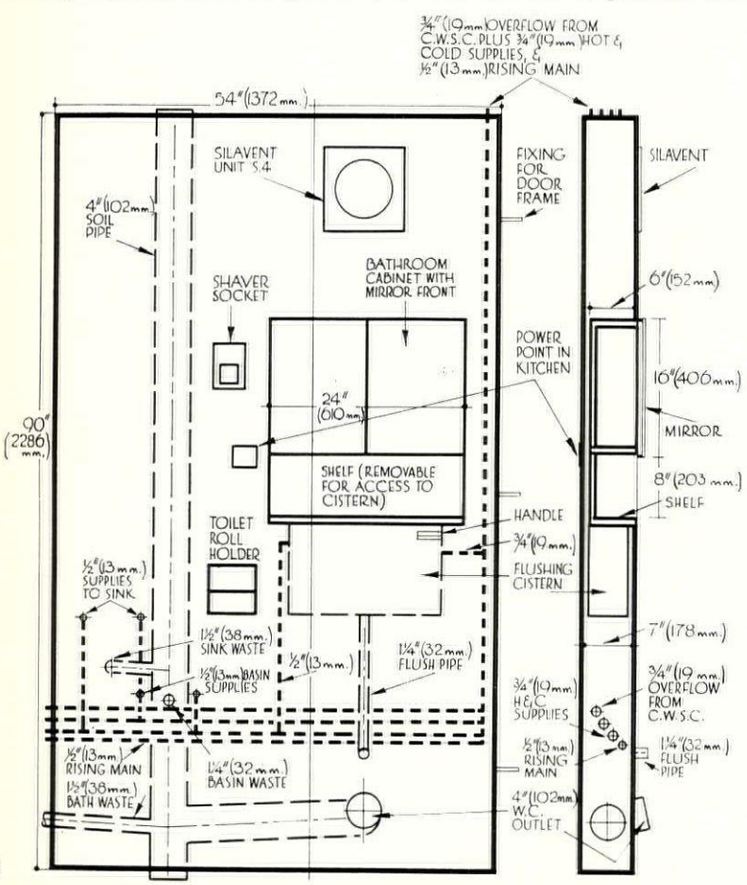
material are made for sealing butt joints.
The Marley Group, Sevenoaks, Kent.

Low voltage spotlight

The new Rotaflex 4448 spotlight uses an 18 watt car type lamp operated from a step down transformer built in to the casing and providing a 12 volt supply. The casing, finished in charcoal grey, is very compact, and provides a ball and socket mounting for the spherical lamp housing. The sphere is in natural anodized aluminium and contains a coiled louvre formed from flat strip to minimize glare. The lamp can be used freestanding, but is supplied with a slide-on bracket so that it can be mounted on a flat surface in any attitude. There is also a spring clip for fixing the lamp to a bedhead, 13. *Rotaflex (Great Britain) Ltd., Rotaflex House, City Road, London, EC1.*

Service wall units

The GD Service wall unit, 14, has already been used on several jobs in this country and is now being sponsored by a Shires company. The unit consists of a frameless panel, generally of floor to ceiling height, incorporating all the necessary pipework and ducting for water, soil gas, electricity, ventilation and any other service required in bathrooms, w.c s. or kitchens. Connections and any necessary brackets are provided at the panel face for the installation of the fittings, which can be built in as required. The units are not standardized but form an open system which can be applied to any type of rationalized traditional or industrialized building and the system has already been used in hospitals, schools and hotels as well as for domestic work. In manufacture all the necessary pipework, conduit, trunking, access panels and fixing brackets are jigged in position and a containing wall of closed cell polyurethane is foamed round them, the thickness being determined by the largest service plus a cover of 1 in. The surface can be pre-finished with tiles or other materials and a fire resistance of up to one hour can be provided. Site installation time is considerably reduced and the system shows a saving with a production run as low as 24 units. The fact that all pipework is embedded in polyurethane means that no insulation is required and that structure-borne noise is reduced. Connections are normally made between floors and any necessary expansion joints can be included. The manufacturers provide a design and advisory service.
GD Wall Units Ltd., Gillroyd Mills, Wide Lane, Morley, Leeds.



14

Stop Press

The page numbers of the Stop Press feature in this issue have been wrongly printed. They should be 325 and 326.

Contractors

Mammal House, London Zoo. *Architects:* Design Research Unit. *General contractor:* G. E. Wallis & Sons Ltd. *Sub-contractors: Electrical:* Troughton & Young Ltd. *Heating and ventilating:* Benham & Sons Ltd. *Patent glazing:* Haywards Ltd. *Cage rooflights:* Faulkner Greene & Co. *Window gear:* Teleflex Products Ltd. *Flat roofs and cage floors:* F. L. Prater Asphalte. *Granolithic floors and stairs:* H. F. Badcock Ltd. *Quarry tile floors:* John Caddick & Son Ltd. *Terrazzo stairs:* Alpha Mosaic & Terrazzo Co. *Metal windows, screens, doors and cage fronts:* Gardiners, Sons & Co. *Cage service doors, grilles, etc.:* Light Steelwork (1925) Ltd. *Lift:* Evans Lifts Ltd. *Painted cage finish:* Brook-Blast Ltd. *Cage fibreglass rockwork (including design):* David Gillespie & Associates Ltd. *Facing bricks:* Sussex & Dorking Brick Co. *Paviors:* Richard Parton Ltd. *Precast concrete (fascia, etc.):* Dean Jesmond & Co. *Door facing:* De La Rue (Plastics Div.), Arborite Ltd. *Door viewing lenses:* Haynor (Optical) Ltd. *Sliding door gear:* P. C. Henderson Ltd. *Ironmongery:* James Gibbons Ltd. *Paint:* Pinchen Johnson & Associates Ltd. *Mosaic:* Milano Mosaics Ltd. *Signs:* P. B. Screen Painting Ltd. *Litter bins:* Harvey Fabrication Ltd. *Plant containers:* The Daines Display Organization, David Gillespie & Associates Ltd.

Crown Jewels' display, Tower of London *Architects:* Stefan Buzas and Alan Irvine. *Contractors: Interiors of show cases:* A. E. Edmonds. *Covering fabric:* Hunt & Winterbotham Ltd. *Labels:* Lettering Centre.

Jewellery shop, Cheapside, London. *Architects:* Stefan Buzas and Alan Irvine. *Contractors: Shopfitters:* A. E. Edmonds. *Light fittings:* BBI Lighting. *Carpets:* Marshall & Brush Ltd. *Furniture:* Form International Ltd. *Protection services:* Elektric Lock Co. *Special mechanical services:* Matthew Hall Mechanical Services Ltd. *Marble:* Frank England & Co.

Jewellery shop, Brompton Arcade, London. *Architects:* Michael Brown Associates. *General contractor:* Anderson Manson Ltd. *Sub-contractors: Display units:* R. Denny & Co. *Antique silvered glass:* J. Preedy & Sons. *Perspex lettering:* Radiant Signs Ltd. *P.V.C. units:* Resistant Equipment Ltd. *Joinery—counter unit desk:* E. L. Westwood (Chelsea) Ltd. *Banquette seating:* Aerofoam Ltd. *Carpet:* Marshall & Brush Co.

Jewellery shop, Sloane Street, London. *Architects:* G. H. & G. P. Grima. *Contractors: Shopfitters:* PM Designs Ltd. *Shopfront glass:* Steels (Contractors) Ltd. *Display case glass:* James Clark and Eaton. *Sliding glass track:* T. Saveker Ltd. *Carpet ground floor showroom:* Peter Jones Ltd. *Carpet basement showroom:* Liberty and Co. *Leather:* Alma (London) Ltd. *Marble:* Marble Products Ltd. *Silk wallpapers:* Toynbee Clarke Interiors Ltd. *Wall tiles:* Wooliscroft. *Air conditioning:* Barnet Refrigeration Ltd. *Cork wall papers:* Edgar Brothers Ltd. *Fabrics:* Sekers Ltd. *Electrical:* The Davenant Electrical Co. *Signwriting:* Richard Kindersley. *Furniture:* Latex Upholstery Ltd. *Light fittings:* Atlas Lighting Ltd., Phillips Electrical. *Display cases:* N. H. Ward Ltd.

Cinema, St. Martin's Lane, London. *Architects:* Casson, Conder & Partners. *General contractor:* Stephen Easten Ltd. *Sub-contractors: Electrical:* Alliance Electrical Ltd. *Terrazzo:* Marriott & Price Ltd. *Stonework* Frank England Ltd. *Metalwork:* G. Johnson Bros. Ltd. *Decorative plaster:* David Esdaile Ltd. *Seating, carpeting:* Rank Audio Visual. *External box signs:* Claudgen Ltd. *Internal box signs:* F. H. Pride Ltd. *Mirrors:* Chelsea Glassworks Ltd. *Internal plumbing:* Richard Costain (Construction) Ltd. *Paint:* Screeton Paintmaker Ltd. *Illuminated ceiling:* F. H. Pride Ltd. *Sanitary fittings:* Adamsez Ltd. *Metal toilet boxes:* Robert Rigby Ltd. *Ironmongery:* G. & S. Allgood Ltd. *Carpet, upholstery:* T. F. Firth & Sons Ltd.

Marine Laboratory, Robin Hood's Bay, Yorks. *Architects:* Brierley, Leckenby & Keighley. *General contractor:* G. Stuart & Sons. *Sub-contractors: Refrigeration:* Southern & Redfern Ltd. *Gas installation, compressed air installation:* Edward Leffek Ltd. *Insulating and acoustic ceilings:* Pyrok Contracts Ltd. *Moveable storage racks:* Acrow (Engineers) Ltd. *Sea water pumping installation:* Rae Arnott & Co. *Air compression equipment:* Broom & Wade Ltd. *Mechanical ventilation installation:* A. Taylor & Son (Leeds) Ltd. *Plastic tanks, trays and tank linings:* Low Cost Automation Ltd. *Laboratory plumbing fittings:* Allied Ironfounders Vulcathene Division. *Metalwork in balustrades, etc.:* J. D. Thompson (Stockton) Ltd. *Lettered signs:* Bond Moulding & Engraving Co. *Special laboratory benches and fittings:* H. Jarvis & Son Ltd. *Fire extinguishers and hose reels:* Dunford Fire Protection Services Ltd. *Venetian blinds:* Kindlite Ltd. *Opening lights and windows:* E. D. Hinchliffe & Sons Ltd. *Design and supply of reinforcement:* GKN (Reinforcements) Ltd. *Stone:* E. Pilling. *Waterproofing:* Chemical Building Products Ltd. *Hand glazed wallsurfacing:* Prodorite Ltd. *Ironmongery:* Edwin Showell & Sons Ltd., Josiah Parkes & Sons Ltd., Armstrong Patents Co., Randalls Ltd., E. Hill Aldam & Co., Charles B. Moody Ltd. *Roofer:* Joseph Hardgrave Ltd. *Tanalized timber:* Hicksons Timber Impregnation Co. (GB) Ltd. *Doors:* F. Hills & Sons. *Paint:* A. Sanderson & Sons Ltd.

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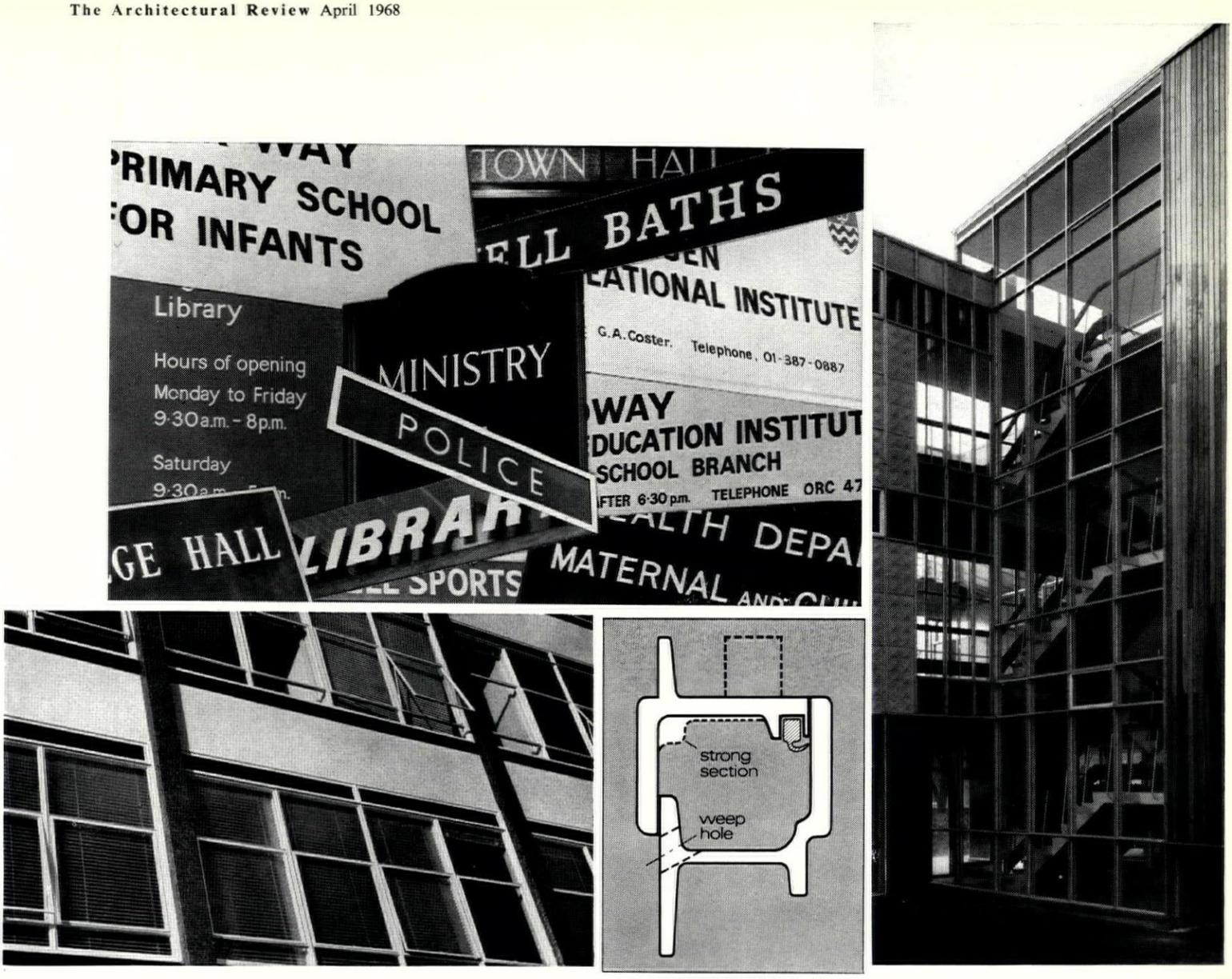

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Ian Nairn

STOP PRESS

A monthly anthology from all over Britain of townscape problems, outrages and opportunities compiled by Ian Nairn, with drawings by G. J. Nason.


1


3

have had a cathedral to stir the mud-stuck local imagination. Anyway the present situation is this: a great gap in the High Street, 1, which when explored reveals the most eloquent of car parks, 2; build up the alley on the right-hand side to get some idea of what Shepton Mallet used to be like. The front side of the right hand buildings in 2 faces the market place, 3. Admirable for a small town; yet it is all to be demolished, and replaced by the elevation shown in 4. The council refuse to have a model made of the development—the biggest thing to happen in the town this century. So the local society will have to make and pay for one themselves. It is an extraordinary situation.


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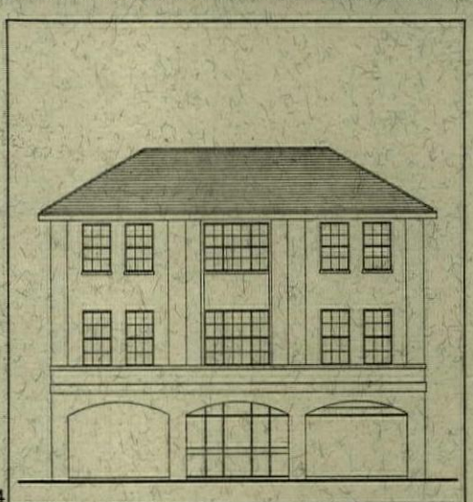
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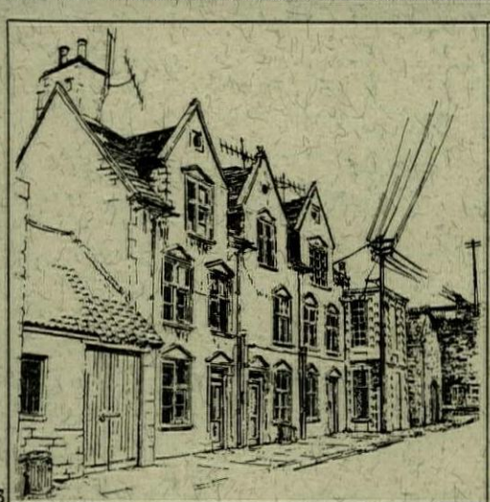
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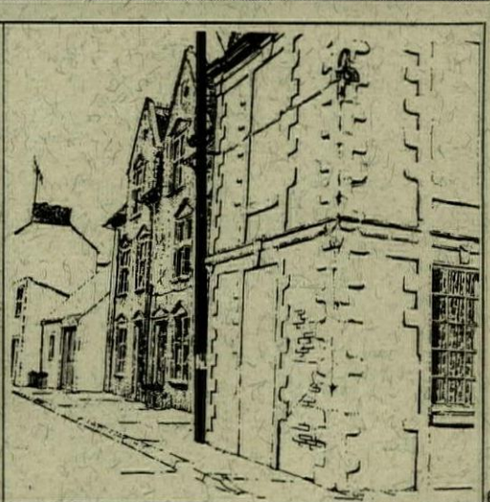
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S.O.S.

On March 31 representatives of local authorities all over Britain met in York to debate conservation. Here are two towns which ought to be considered alongside the Farnhams and Stamfords. But what chance have they got?

SHEPTON MALLET, SOMERSET

A great town—'look at me, I'm here' said Gordon Cullen eleven years ago. Too subtle, maybe; perhaps it should


7

And meanwhile the best house in the lower town of Shepton Mallet—and the town is one of the sights of Britain, if we could raise our eyes above what we think to be tourist attractions—is sliding into dereliction, 5 and 6. Yet all the time there are ideas buzzing, even if they are a bit over-contrived; 7 shows new housing on the western side of the valley.

WHITEHAVEN, CUMBERLAND

A neglected place in the nation's economy; all the more reason to keep up the good things in the town to act as a magnet. Instead, there is one large CDA and all the nuances go to rubble or neglect. Yet this is what conservation is all about. These photographs by Geoffrey Gale, 8-14, show the death-throes of what could have been a splendid place. Where does Whitehaven go from here—into the dereliction of Maryport? (see AR, December 1967).

The moral, for every local official, is simple. Look first at the town, not the Ministry lists; and if you find something worth preserving then hold on to it, whether it is the curve of a staircase tread, 9, the beak-shaped splay that preserves a sightline without destroying the townscape, 10, a pair of eloquent figures above a Gothic shop, 11, the random rhythm of an unlisted piece of commercial design, 12, the cupola of the local market, 13, or the doorway of some anonymous pub, 14. You'll find none of this in the Ministry handbook. Too shabby, not old enough, not significant enough. Just alive.

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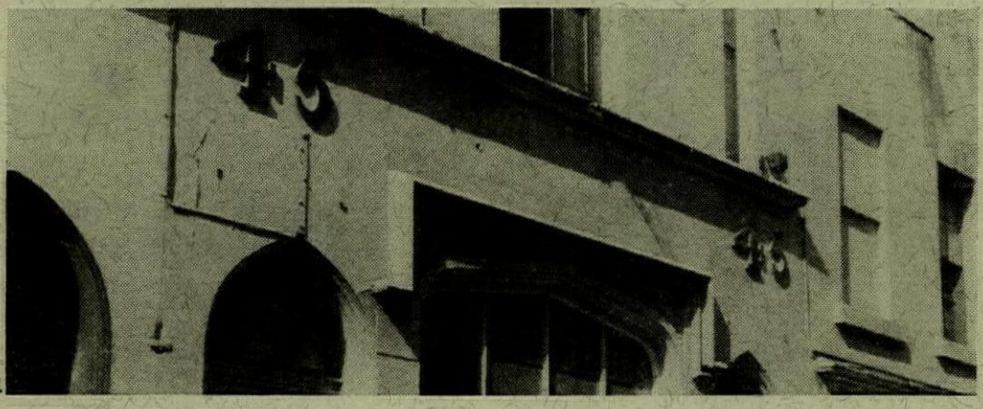
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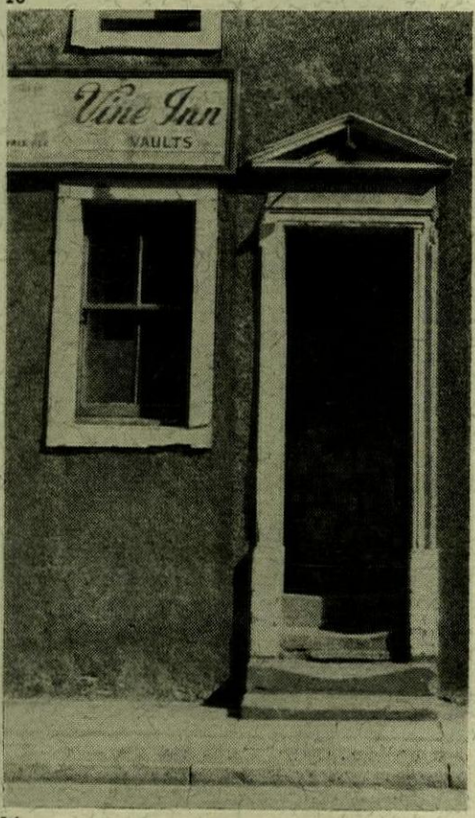

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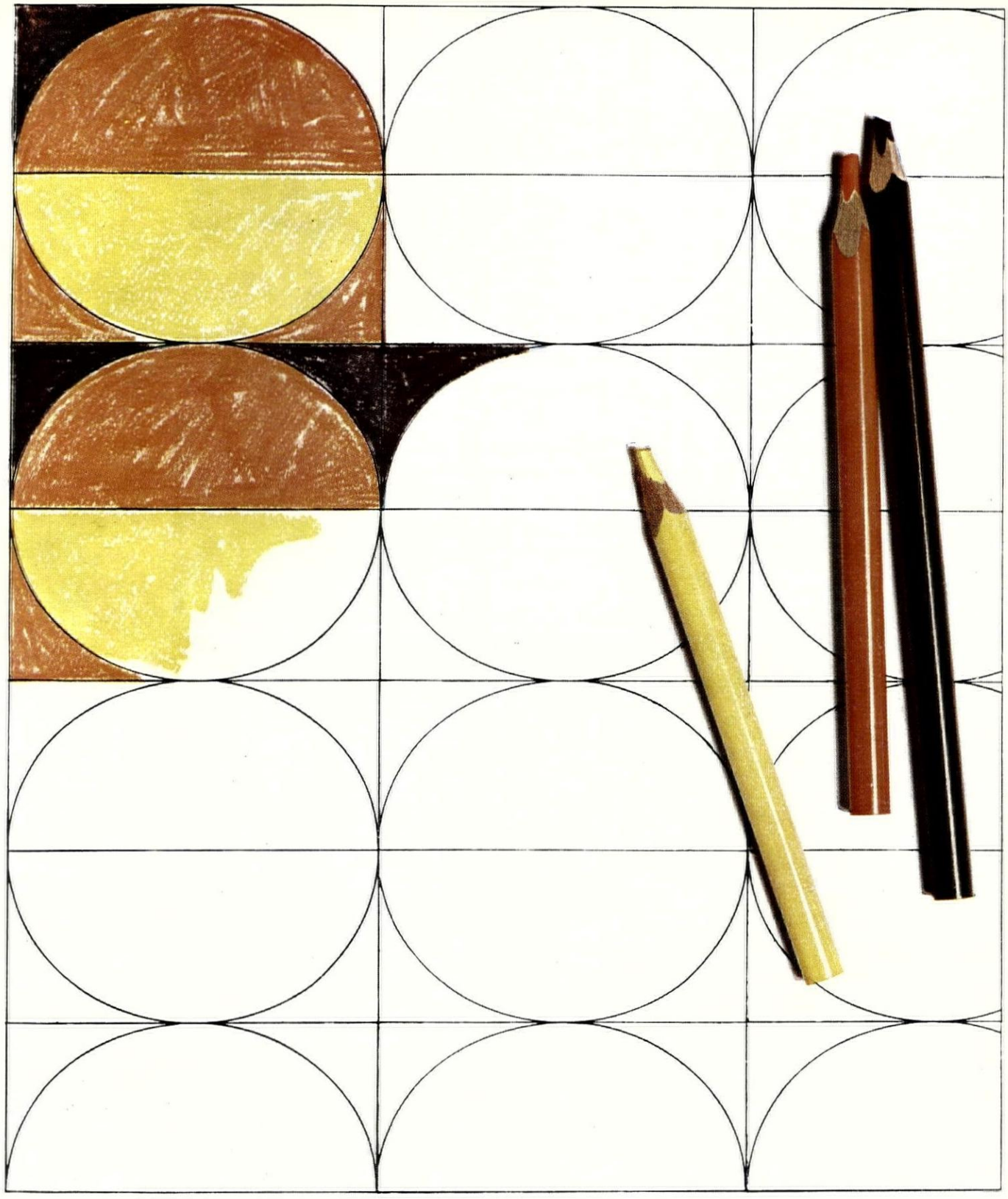

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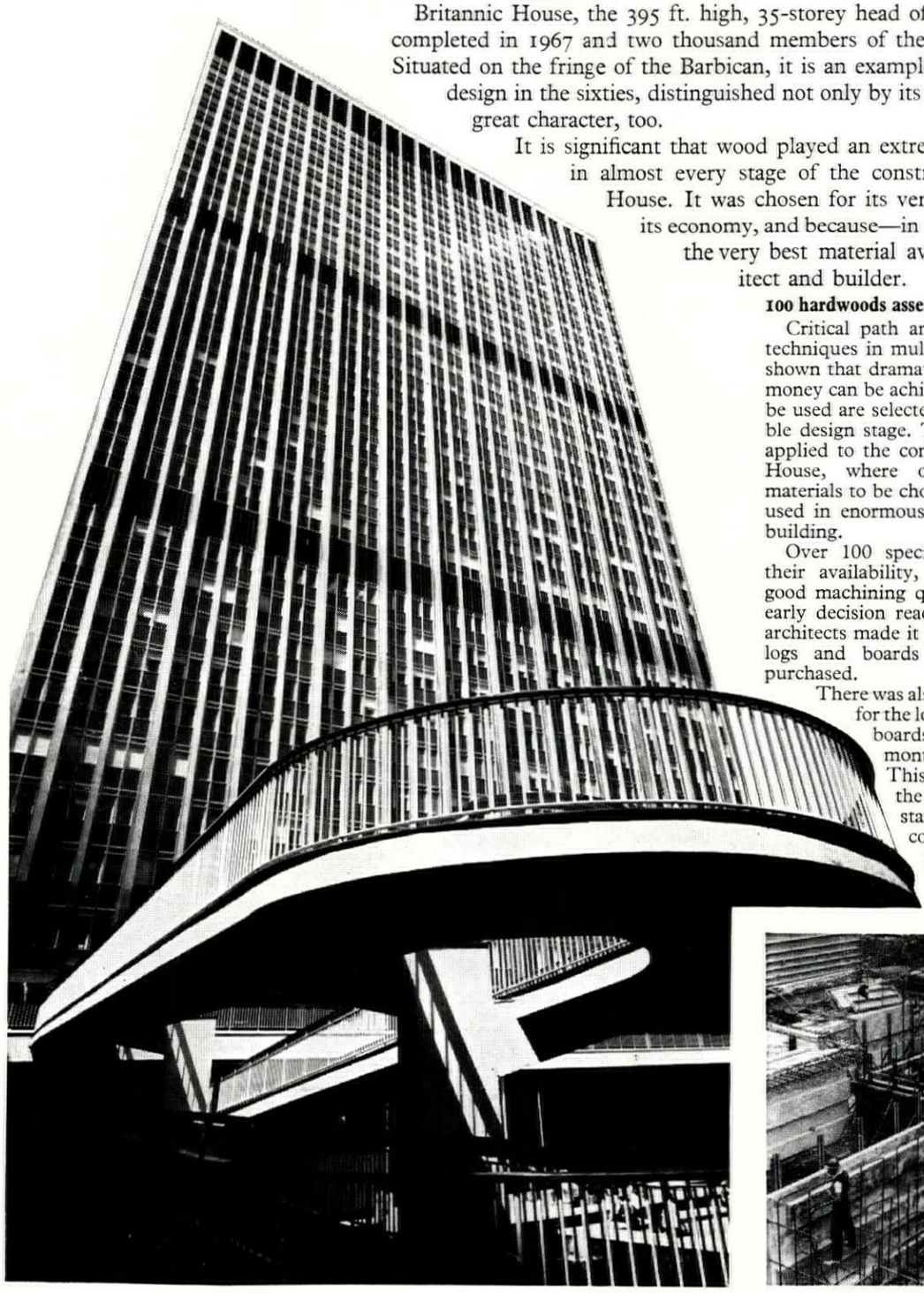
Britannic House: a success story that can be told in wood

Architects: Joseph and F. Milton Cashmore and Partners. Consulting Structural Engineers: Ove Arup and Partners. Consulting Mechanical and Electrical Engineers: G. H. Buckle and Partners. Quantity Surveyors: Langdon and Every. Interior Design of Special Areas: Design Research Unit. Main Contractors: John Laing Construction Limited.

For many years the British Petroleum Company occupied nine separate buildings in London. But, with world demand for oil continually growing, there was pressure on the BP group to both heighten efficiency and expand in readiness for increased company staff. The decision was therefore made to bring the company under one roof.

Britannic House, the 395 ft. high, 35-storey head office in London, was completed in 1967 and two thousand members of the BP staff moved in. Situated on the fringe of the Barbican, it is an example of the very best of design in the sixties, distinguished not only by its great size, but by its great character, too.

It is significant that wood played an extremely important role in almost every stage of the construction of Britannic House. It was chosen for its versatility, its strength, its economy, and because—in so many ways—it is the very best material available to the architect and builder.



100 hardwoods assessed

Critical path analysis of construction techniques in multi-storey buildings has shown that dramatic savings in time and money can be achieved if the materials to be used are selected at the earliest possible design stage. This was the principle applied to the construction of Britannic House, where one of the primary materials to be chosen was the hardwood used in enormous quantities within the building.

Over 100 species were assessed for their availability, performance, colour, good machining qualities and price. An early decision reached by BP and their architects made it practical for top grade logs and boards to be selected and purchased.

There was also enough time allowed for the logs to be converted into boards, air-seasoned for six months and then kiln dried. This was very necessary as the wood needed to withstand the effects of air conditioning and ventilating systems set at specific temperatures for summer and winter.

LEFT *Timber struts supporting sides of tunnel*
(Photograph by courtesy of John Laing & Son Limited)

RIGHT *The Entrance Hall*
(Photograph by courtesy of Design Research Unit)

Timber shuttering

Meanwhile, Britannic House was growing. From start to finish of construction rift-sawn Oregon pine board shuttering was employed for concrete formwork and it was used many times. The strength and durability of the timber shuttering enabled the main contractors to save considerably in time and money. Wood was also chosen for the formwork for the reinforced concrete floors. It is estimated that as much wood was used at this stage of construction as the vast quantities used in the finish of the building.

Plywood formers

Trough-shaped plywood formers were laid for each floor to be constructed. Then reinforcing rods were placed in position and concrete poured over the whole. When the concrete had set, each wooden mould was removed and set in position for the floor above. These moulds were used up to five times.

In this way construction went exactly to programme, maximum efficiency being maintained throughout the operation.

Fire-resistant

Wood particle mouldings were used throughout the contract for radiator casings and wall linings. Laboratory tests for surface wear and screw holding properties were carried out by the manufacturer. The fire-resistant properties of the product were checked and confirmed by the Fire Research Station who ran tests of their own.

Marble and wood

It would be difficult to enumerate all the ways wood decorates Britannic House. Like the teak and muninga handrailing, it always seems to be there, discreetly or boldly, wherever one travels in the building.

The entrance hall displays an exciting combination of marble walls and Rio rosewood veneered panelling. Exciting, too, is the treatment of the wall finishes in the exhibition hall, conference suite and ante room. Here the veneers are cut in a repetitive pattern to show a sapwood centrepiece within each panel.

Wood, wood, wood . . .

Rosewood panelling can be seen again in the board dining room, this time complemented by rosewood sideboards and table.

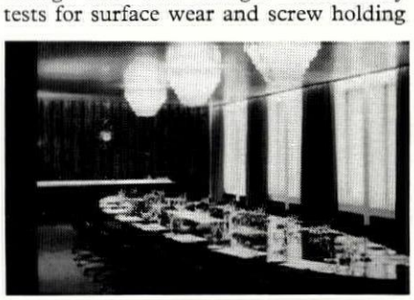
In the main staff restaurant the mood is teak. In the coffee room and snack bar and the first floor foyer there is a handsome maple strip boarded floor over 2,000 sq. ft. in area. It is interesting to see how walnut has been used for furniture and slatted walls in the senior staff restaurant; olive ash veneered walls with rosewood topped tables are featured in the directors' and senior managers' dining rooms.

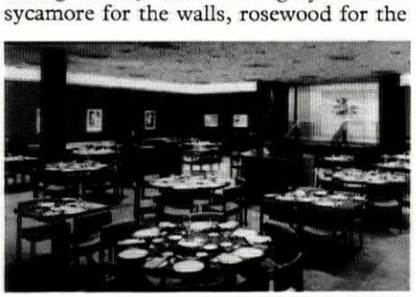
. . . and still more wood

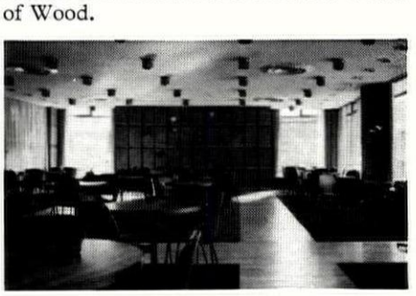
Wood again in the chairman's private dining room, this time grey stained sycamore for the walls, rosewood for the table. Even the walls of the small cinema are veneered with Indian laurel panelling. This much abbreviated list of the wood contracted for use within Britannic House gives some idea of the vast scale of the project:

17,000 cu. ft. hardwood for door frames, door lippings and general joinery, including eight miles of iroko skirting boards.
11,000 wood particle moulded radiator casings, wall linings and complementary materials.
1,200 sq. ft. olive ash veneered panelling and veneered doors for podium second floor entrance.
2,900 sq. ft. elm veneered panelling and veneered doors for club room.
834 hardwood veneered plywood core doors.
49 lead core hardwood veneered plywood doors.
14,000 sq. ft. maple for flooring of $1\frac{1}{8}$" nominal thickness.

So many projects, large and small, offer opportunities to exploit the speed, economy and design applications of timber that the field seems virtually endless. British Petroleum, their architects and builders took advantage of those opportunities when they built Britannic House. We welcome it to the New World of Wood.





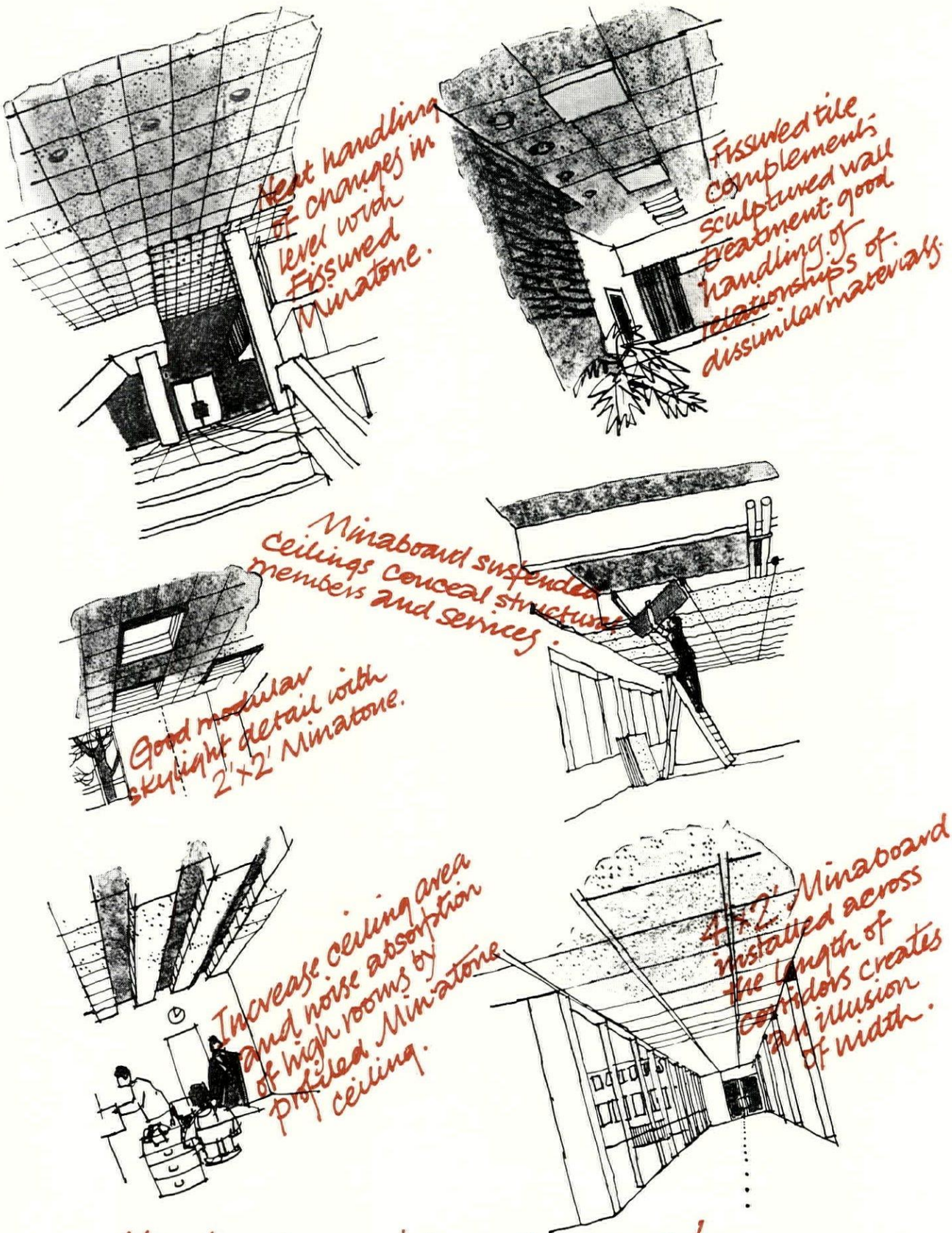


LEFT *Concreting in progress, showing wood shuttering*
(Photograph by courtesy of John Laing & Son Limited)

ABOVE *Directors' Dining Room*

CENTRE *Senior Staff Restaurant*

RIGHT *Coffee Room and Snack Bar*
(Photographs by courtesy of Design Research Unit)



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