The Architects' Journal
October 4 1961 Vol 134 No 12 Price 1s

SfB (11)
SfB (12)

This issue of the AJ should be filed, as it contains two parts of a 49-part technical information library which the AJ is founding. For the normal AJ cover we have substituted the most important elements from Table 1 of the SfB classification. These are the key to our library production programme. Normally we shall publish, with each week's AJ, a supplement dealing with one of these elements. This week's is a special issue containing two supplements, one dealing with SfB (11) and the other with SfB (12). The remainder will be published in subsequent issues. This is a token preclassified file cover for the special articles within and for all subsequent articles and digests on these subjects which an architect needs to keep. At the end of a year readers will have a design manual covering all the functional elements listed below. This will form the nucleus of a technical library.

(11) Ground: General

(12) Drainage: General

(13) Retaining structures
(14) Roads and pavings: General
(15) Garden: General
(15) Garden: Fences, gates, walls
(16) Foundations: General
(2) Structures: General
(2) Structures: Concrete: General
(2) Structures: Sections, metal
(2) Structures: Sections, wood
(21) Walls: External load-bearing: General
(21) Walls: External non-loadbearing: General
(22) Partitions: General
(23) Floors, ground: General
(23) Floors, structural: General
(24) Stairs and ramps; General
(25) Ceilings, suspended: General
(26) Roofs, structural, flat: General
(27) Roofs, structural, pitched: General
(30) Accessories, ironmongery: General
(31) Windows: General
(31) Windows: Sections, metal
(31) Windows: Sections, wood
(32) Doors: General
(34) Handrails and balustrades: General
(37) Roof-lights and traps, etc.: General
(38) Roof eaves, verges, gutters, rails: General
(41) Finishes, external: General
(42) Finishes, internal: General
(43) Finishes, floor: General
(46) Finishes, flat roofs
(47) Finishes, pitched roofs: General
(51) Installations, refuse disposal: General
(52) Installations, drainage and sanitation: General
(53) Installations, water, hot and cold: General
(54) Installations, gas, compressed air, steam, refrigeration: General
(56) Installations, heating: General
(56) Installations, heating: Equipment and fuel
(57) Installations, ventilation, air conditioning: General
(63) Installations, electrical: Lighting and power: General
(63) Installations, electrical: Lighting equipment
(64) Installations, communications: General
(66) Installations, mechanical: General
(68) Installations, special: General
(72) Rooms, fixtures and equipment: General (fixed furniture)
(72) Rooms, fixtures and equipment: General (loose furniture)
(73) Kitchens, fixtures and equipment: General
(74) Cloakrooms, bathrooms and lavatories, fixtures and equipment: General
(75) Laundries, fixtures and equipment: General

2/- A PINT

If you use a powder waterproofing compound for concrete and cement work, it probably costs from 3/- to 6/6 per cwt. of cement used. If it is a liquid type waterproofer, it can cost anything from 2/6 up to 8/- for each cwt. of cement used. This means that it costs from 11/3 up to 36/- for waterproofing a cubic yard of 1 : 2 : 4 concrete.

In contrast, with FEBPROOF it only costs 2/- for waterproofing a cwt. of cement or 9/- a cubic yard of 1 : 2 : 4 concrete. Independent Test Reports confirm that in waterproofing efficiency, FEBPROOF is superior to most and inferior to none, but that is not all—for in addition to waterproofing, FEBPROOF also impoves workability and plasticity and increases compressive strengths to a marked degree.

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2/- A PINT

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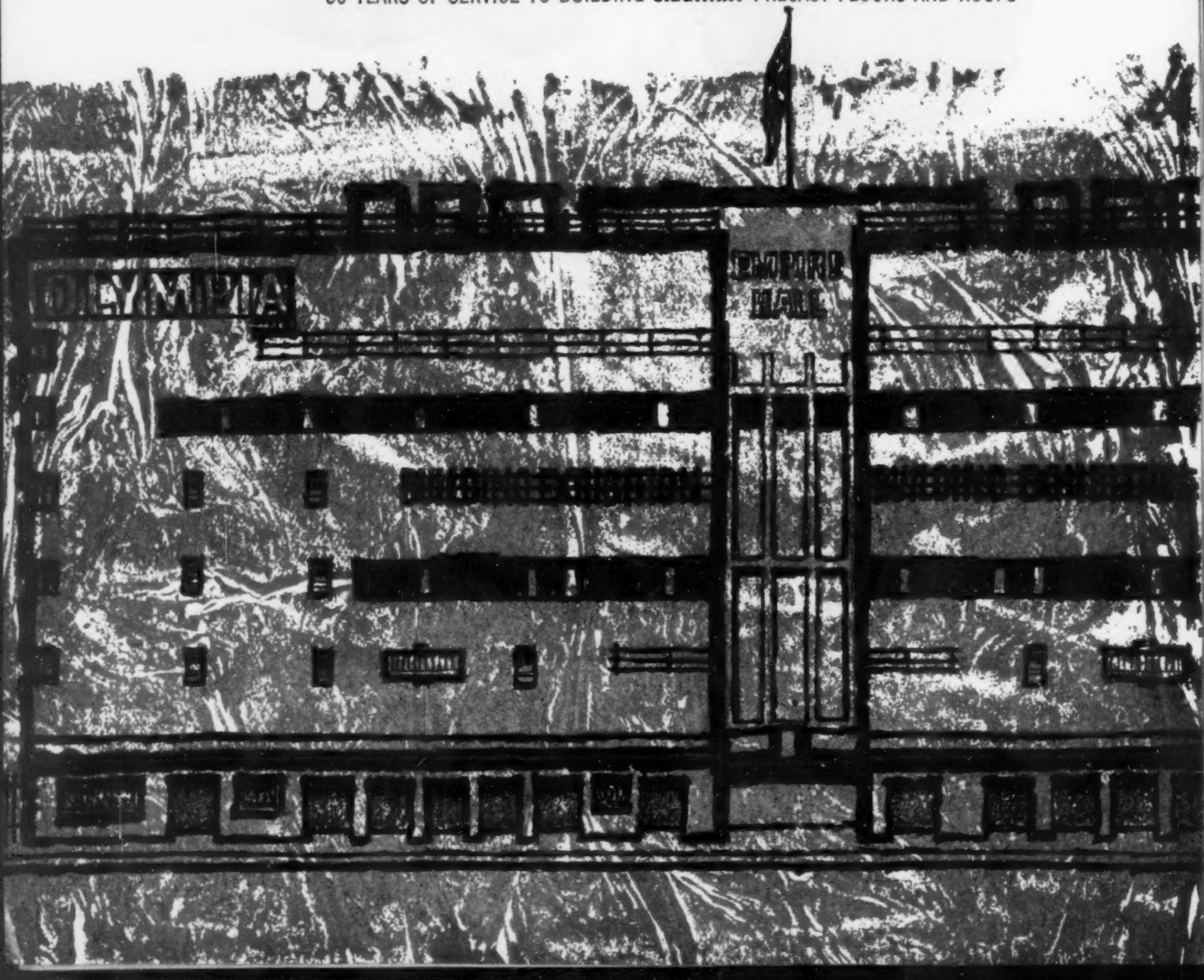
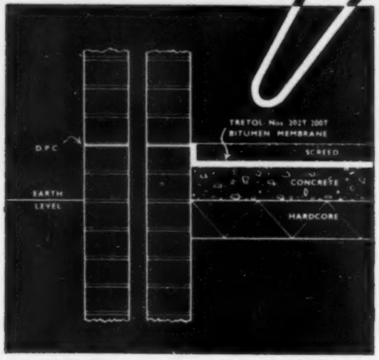


Essex County Council Supply Depot, Widford, Essex.
Architect: H. Connolly, CBE, FRIBA, County Architect.
Main Contractors: Coseley Civil Engineering Co. Ltd.
Structural Framework: A. & C. Barvis Ltd.



This detail is taken from the Tretol Specification Sheets, complete sets of which are available on request.

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Atlas insulated cavity decking

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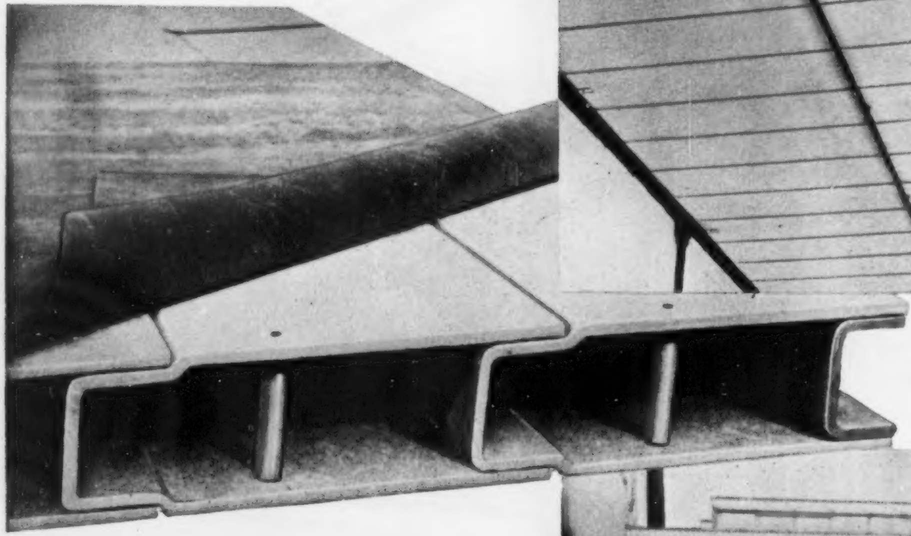
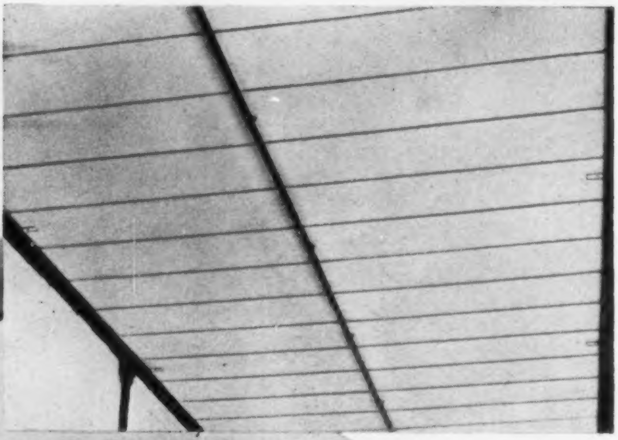
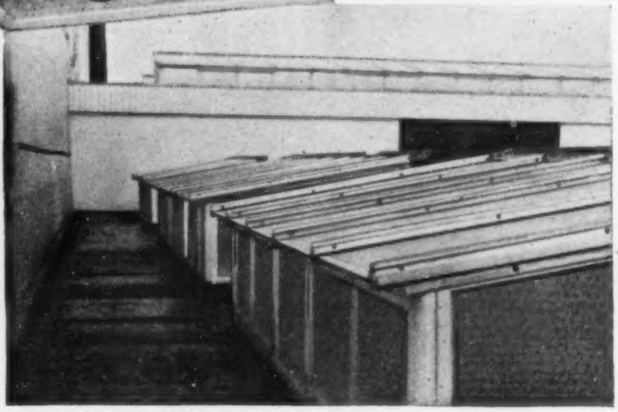




Interior of Barratts Packaging Ltd., Grantham.
Architects Cecil Howitt & Partners, Nottingham



Exterior of Meads Garage, Purfleet
Architects Watkins and Park, Leigh-on-Sea

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BARBOUR INDEX FILE NO. 108

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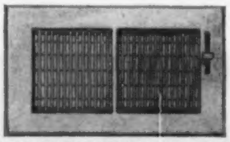

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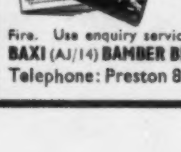

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★ **Selective heating**—all grilles continuously adjustable

★ **Easy maintenance**—fan is only moving part

★ **Easy installation**—bends in lightweight ducting can be fabricated on site

★ **Attractive price**—£200-£250 retail, if installed during building

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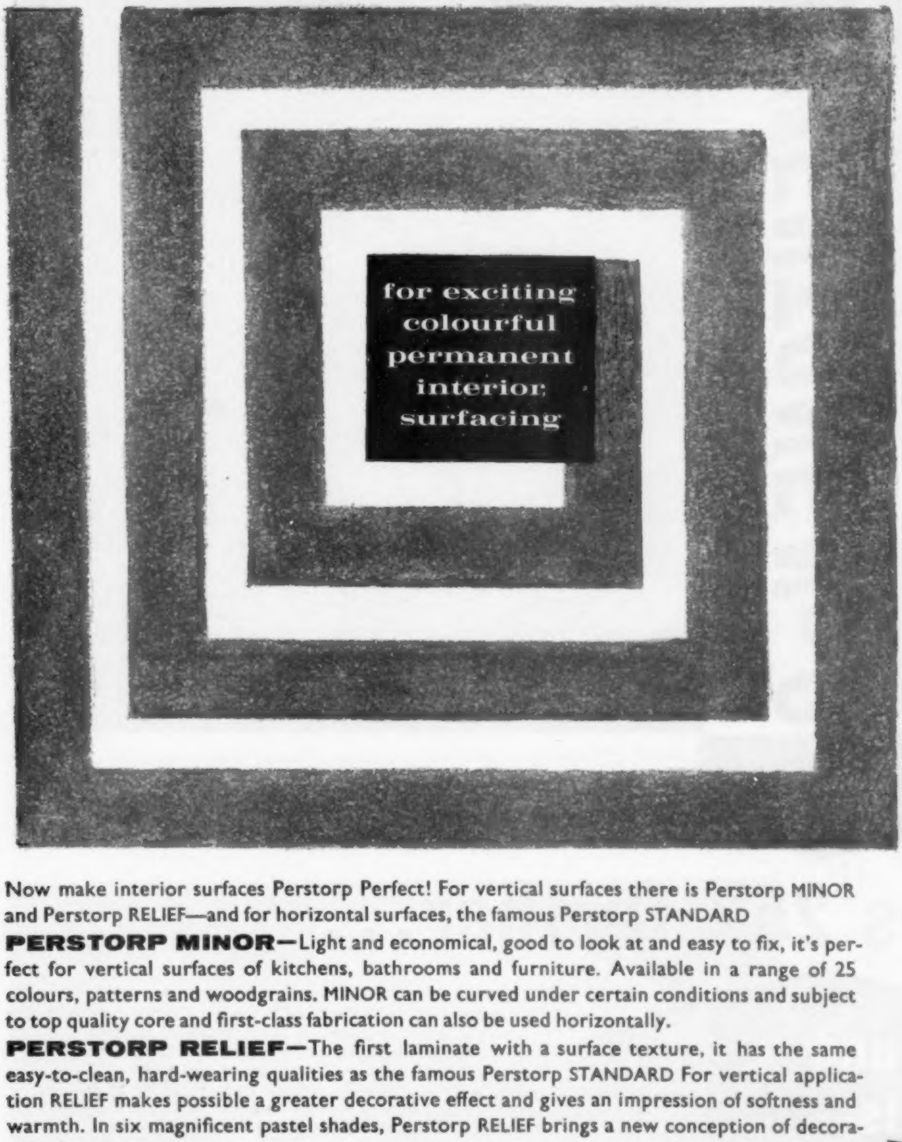

Now make interior surfaces Perstorp Perfect! For vertical surfaces there is Perstorp MINOR and Perstorp RELIEF—and for horizontal surfaces, the famous Perstorp STANDARD

PERSTORP MINOR—Light and economical, good to look at and easy to fix, it's perfect for vertical surfaces of kitchens, bathrooms and furniture. Available in a range of 25 colours, patterns and woodgrains. MINOR can be curved under certain conditions and subject to top quality core and first-class fabrication can also be used horizontally.

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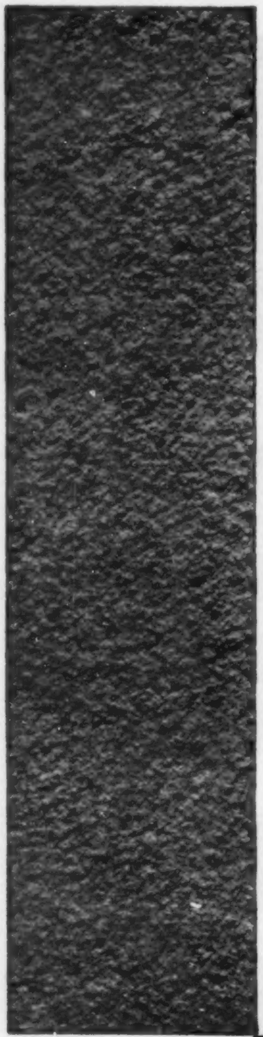
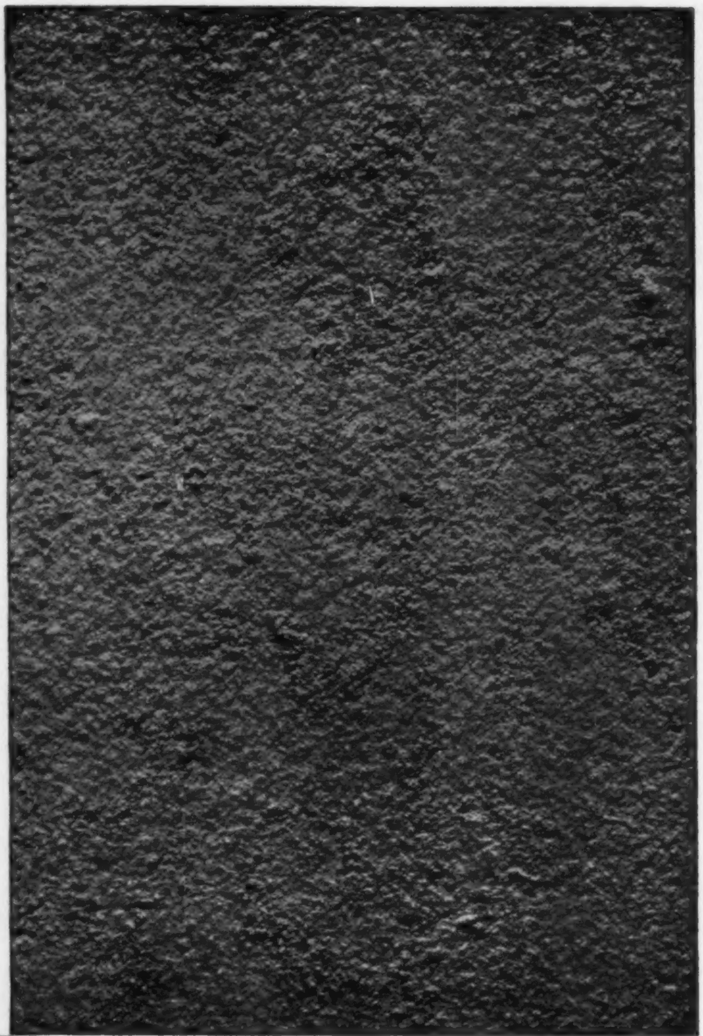


NEW CEMENTONE No 9



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When you cost a job in future, remember that new Cementone No. 9 Waterproof Stoneface Composition will give you 25% more coverage. It is compounded from an indestructible aggregate and a special medium which gives a stone finish that is both waterproof and alkali resisting. No primer is necessary and there are 20 colours. New Cementone No. 9 is mnch easier and therefore faster to apply. The quality of course, is the same.

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News from Hull

New Flats for Old at Hendon

'Standard' Hostess Sinks in Modern Kitchens

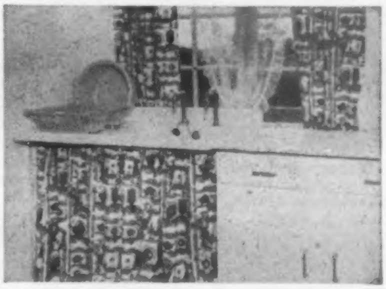
52 pre-war council flats in the Bittacy Hill area of Hendon are being modernised and transformed into comfortable homes at a cost of £23,000. They were originally equipped with combined kitchen bathrooms.

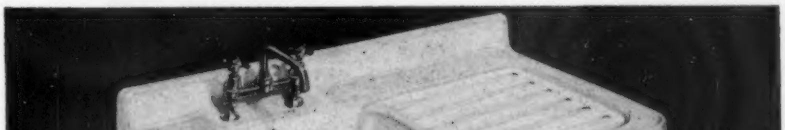
The flats have been re-designed to provide a separate modernised kitchen fitted with a 'Standard' Hostess sink. The Hostess sink is made from cast-iron heavily coated in high quality, acid-resisting porcelain enamel. It is the most rigid sink available and for this reason, is popular with many Councils including the L.C.C.

The design is also unusually good; there is a roomy bowl, and the draining board is at just the right angle to obtain efficient drainage, while not allowing the crockery to slip into the sink and be broken.

The flats have been re-decorated throughout; more electric power points added; constant hot water laid on; modern fireplaces installed and more storage space added both inside and out.

Careful programming has ensured the minimum amount of inconvenience to the tenants, who are mainly older people whose children have left home. The scheme, which qualified for a grant under the Housing (Financial Provisions) Act, 1958, and the House Purchase and Housing Act, 1959, is being carried out by the direct labour staff of the Housing Department under the direction of Mr. W. A. Plevin, A.A.I., A.I.Hsg., the Borough Housing Officer. The work is being supervised by Mr. B. J. Storey, M.R.S.H., A.I.Hsg., Senior Assistant in the Housing Department.

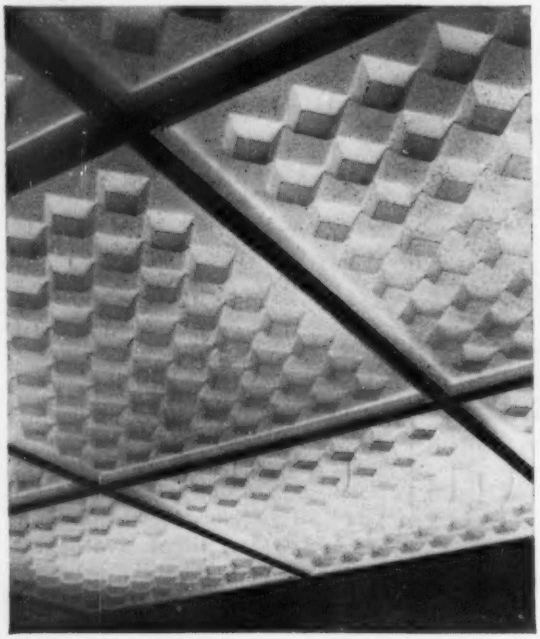




THE HOSTESS SINK

The 'Standard' Hostess sink is ideally suitable for council dwellings. It is rugged, long-lasting, and has been designed to withstand rough treatment. High quality porcelain enamel covers a tough, rigid cast-iron basis. From the Housewife's point of view, too, the Hostess is extremely practical. There is a generous sink area, and the draining board is set at exactly the right angle to allow efficient drainage without the risk of crockery slipping into the sink. The draining board is available sited on either the left or right—there is also a double draining board model. Hostess sinks are made in white, cream and opal green. For full details of the Hostess and other 'Standard' equipment, contact **IDEAL STANDARD LIMITED, Ideal Works, Hull.**

Diffusing panels made from vacuum-formed 'Flovic' by S. C. Errington (Hanwell) Ltd., Uxbridge Road, Hanwell and fitted in a showroom at Messrs. Harold Webb Motors Ltd., London Road, Hadleigh, Essex.



For luminous ceilings such as this specify 'Flovic'

The diffusers used in this luminous ceiling are tough, free from the risk of discoloration, resistant to burning and optically very efficient. They are vacuum-formed from 'Flovic', an I.C.I. plastics material, special grades of which have been formulated for luminous ceilings. The profile pattern can be chosen to suit the site and can, where necessary, be specially designed to give the lighting designer the effect he requires.

If you would like more detailed information on the properties of 'Flovic', any I.C.I. Sales Office will be pleased to help you.

See the I.C.I. Plastics in Building Exhibition at
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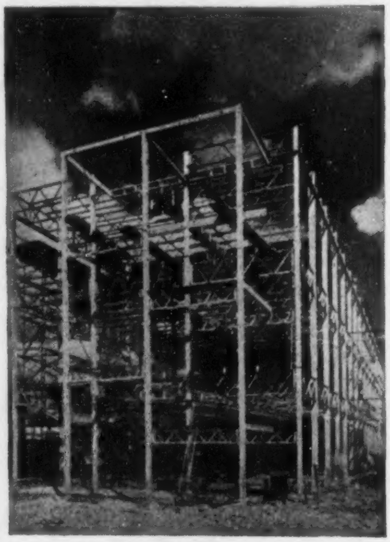
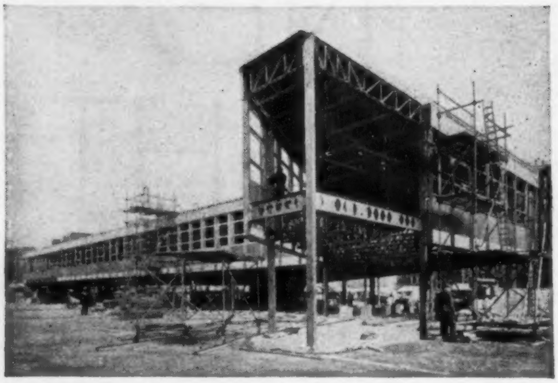
structural steelwork

THE BOWATER PAPER CORPORATION LIMITED. The Architects for the new Office Blocks at both Mersey and Northfleet designed for Lattice Steelwork on a modular grid which allowed service lines to be run between floor and ceiling and gave complete flexibility for internal arrangements.
Architects: Messrs. Farmer & Dark.



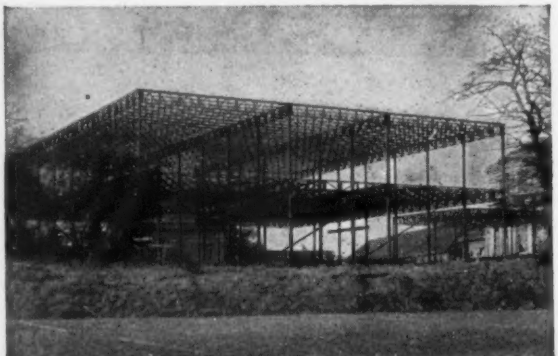


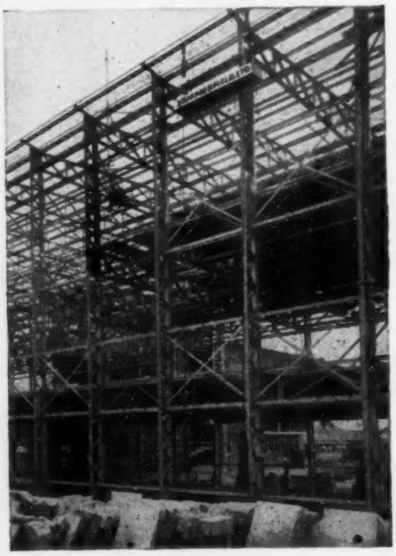
B.E.A. For this B.E.A. Building, speed was the essence of the Contract. Sommerfelds designed the Steelwork and from unloading the first lorry on site to the completion of a 250 ton steelwork erection took three weeks.

General Contractors: Messrs. Richard Costain Limited.

YORK. For the City of York a Grammar School. Sommerfelds designed the Steelwork on a 3 ft. 4 in. modular grid allowing complete freedom for the Architect to use curtain walling and internal arrangements.

Architect: E. Firth, F.R.I.B.A., A.M.T.P.I., City Architect.





I.C.I. For I.C.I. a Laboratory Block. A multi-storey building with a height to eaves of 44 ft. and uninterrupted spans of 50 ft. on each floor. Deep Lattice Beams and light stanchions were used with considerable saving in steel requirements.
Architects: Messrs. J. Douglass Matthews & Partners.

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This aerial view shows a part of the existing buildings of the University of Manchester and the area where new extensions for Science Departments are being erected.

The large building partially erected is the Simon Engineering Laboratories. Architects: Harry S. Fairhurst and Son. Consulting Engineers: G. H. Buckle and Partners

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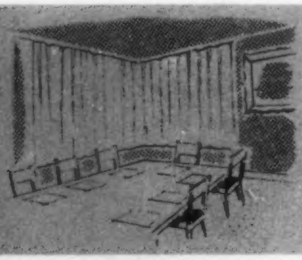
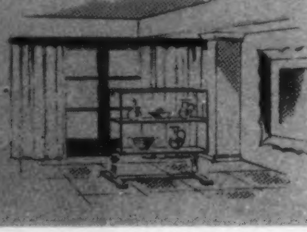
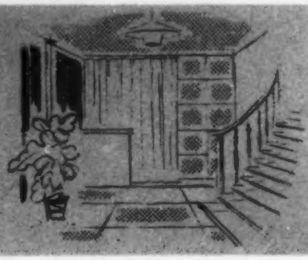


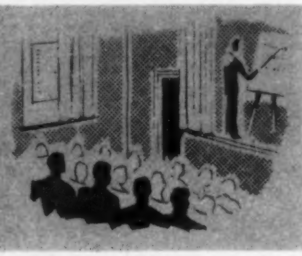
BOARD ROOMS
Welfare Rooms, Canteens, Recreation Rooms.



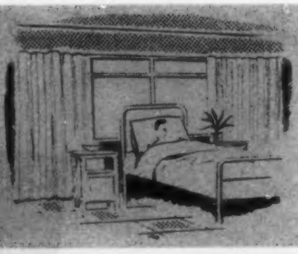
RESIDENCES
Private Houses, Universities, Colleges, Consulting Rooms.



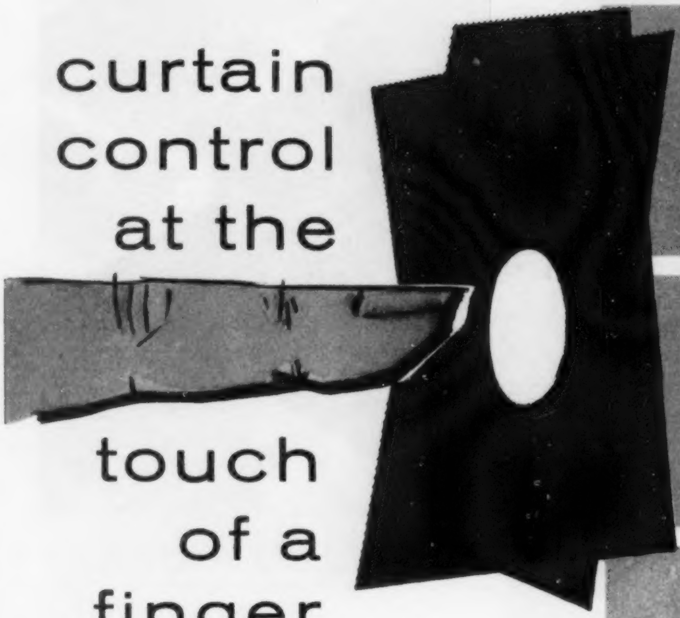
HOTELS
Country Clubs, Libraries, Art Galleries, Stately Homes.



LECTURE ROOMS
Laboratories, Cinema Rooms, Showrooms.



HOSPITALS
Wards, Cubicles, Lecture Rooms, Consulting Rooms, Nurses' Homes.



Electrically-Operated Curtain Track. The luxury of drapes that quietly open and close at the touch of a finger. It's the most advanced "Rufflette" contribution to more efficient, more convenient, more gracious curtain control.

At windows, as room dividers; for stage and lecture theatres—its wide application to imaginative interior planning will be readily apparent; and the specification of power-operated drapes can strongly influence favourable client reaction.

'Rufflette' BRAND ELECTRICALLY OPERATED CURTAIN TRACK

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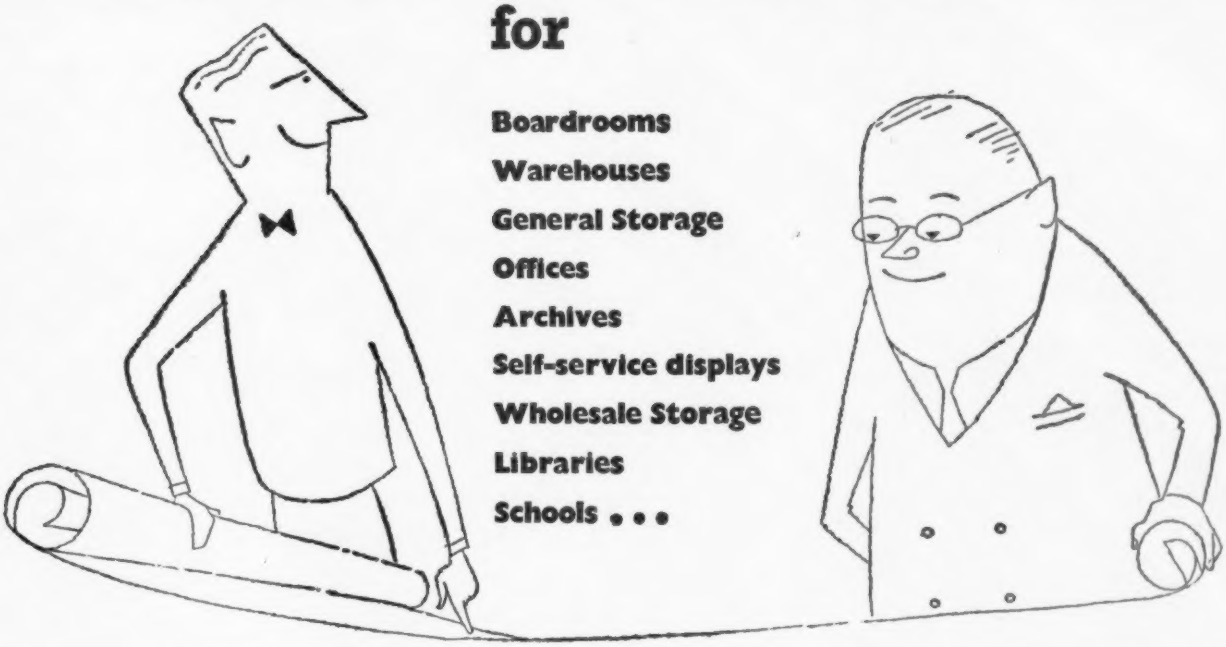

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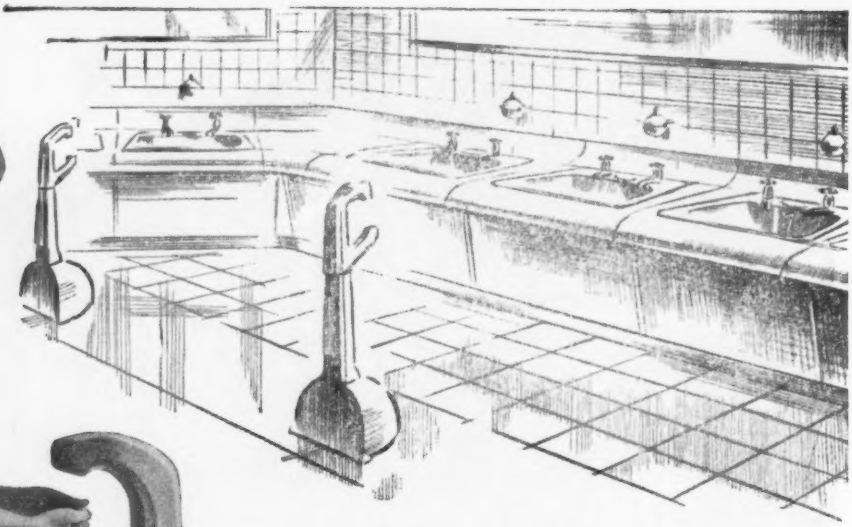

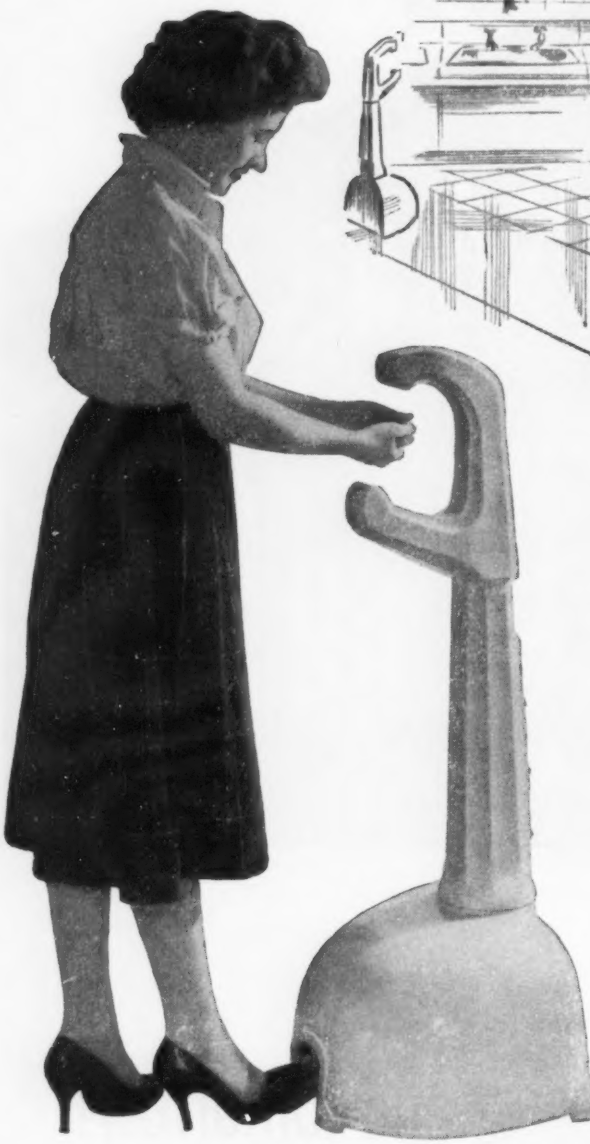

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MEM

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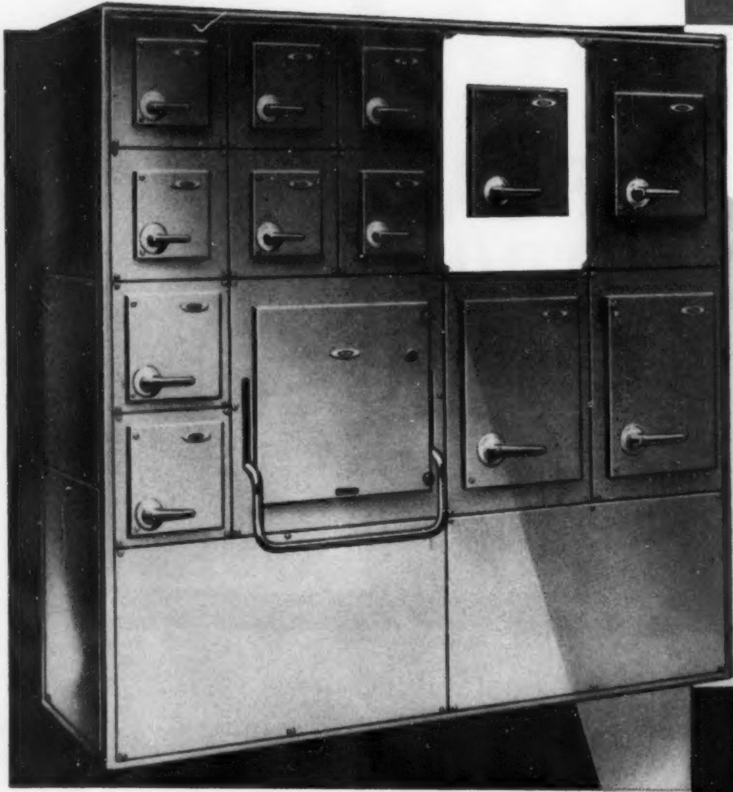
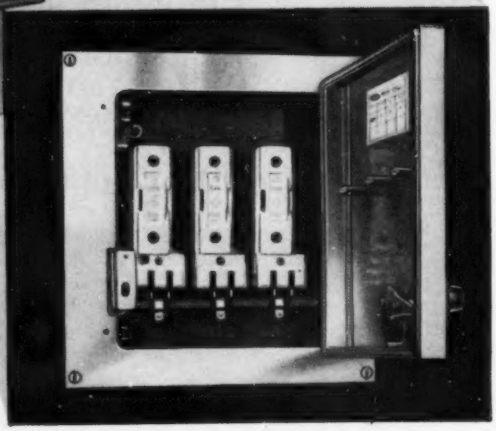


A range of Cubicle Units designed to facilitate the construction of Cubicle Panels in the Workshop or on site. This range of Switchgear is available in ratings from 15 to 800 Amps.



The "Exel", "Glasgow-Rex" and "Glasgow-Exel" ranges of Switchgear in ratings from 15 to 800 amps. is now available in the form of flush mounting Cubicle Units, with front operating switch handles.

The flush plates which carry the complete Switchgear Chassis are made in a limited number of standardised plate sizes, and each Cubicle Unit is ready drilled for direct mounting on the framework of cubicle switchboards, which can be built by electrical engineers to suit the requirements of any installations. Alternatively the M.E.M. Panels Department will be happy to quote customers for complete built up Cubicle Switchboards incorporating these units.

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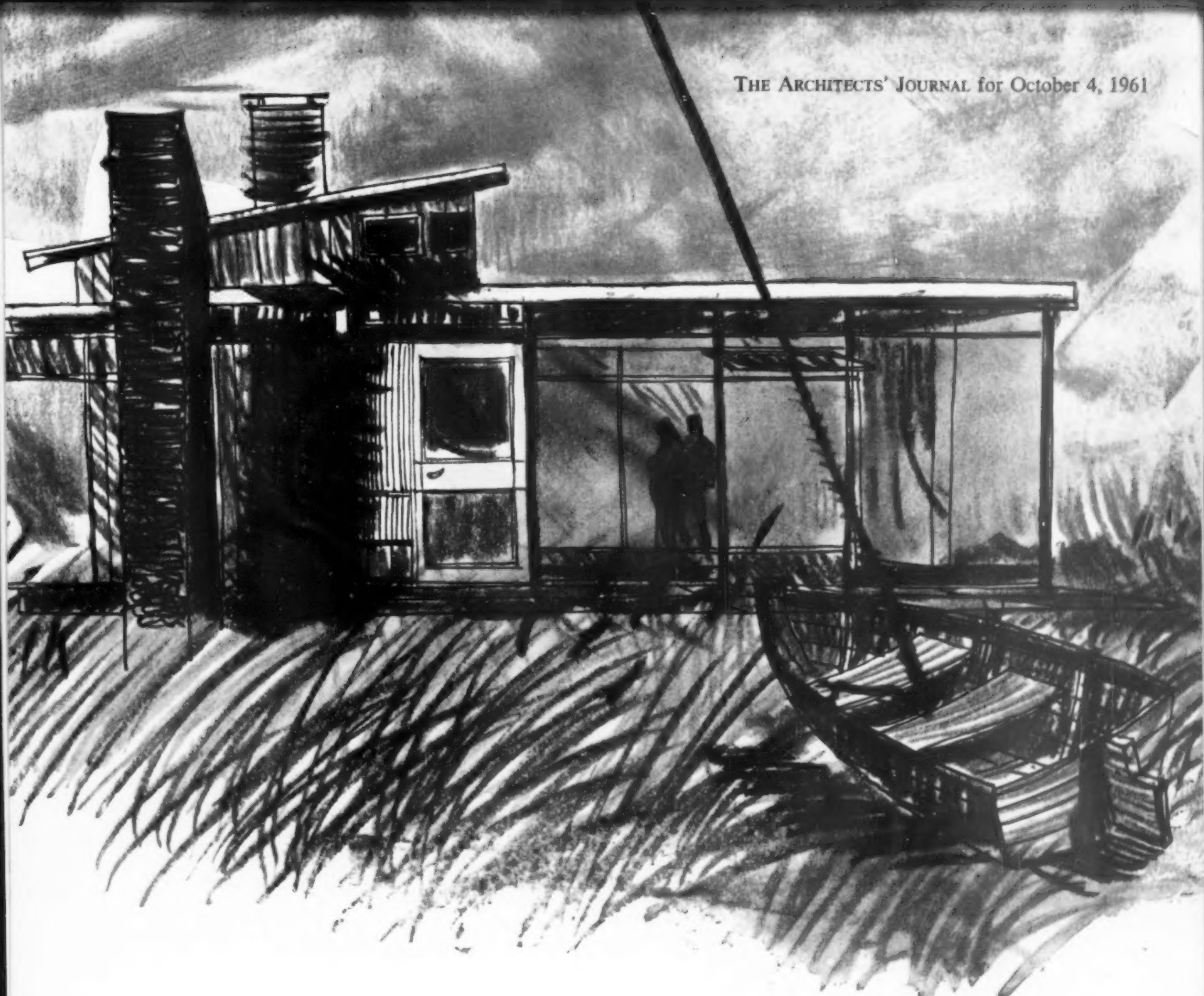

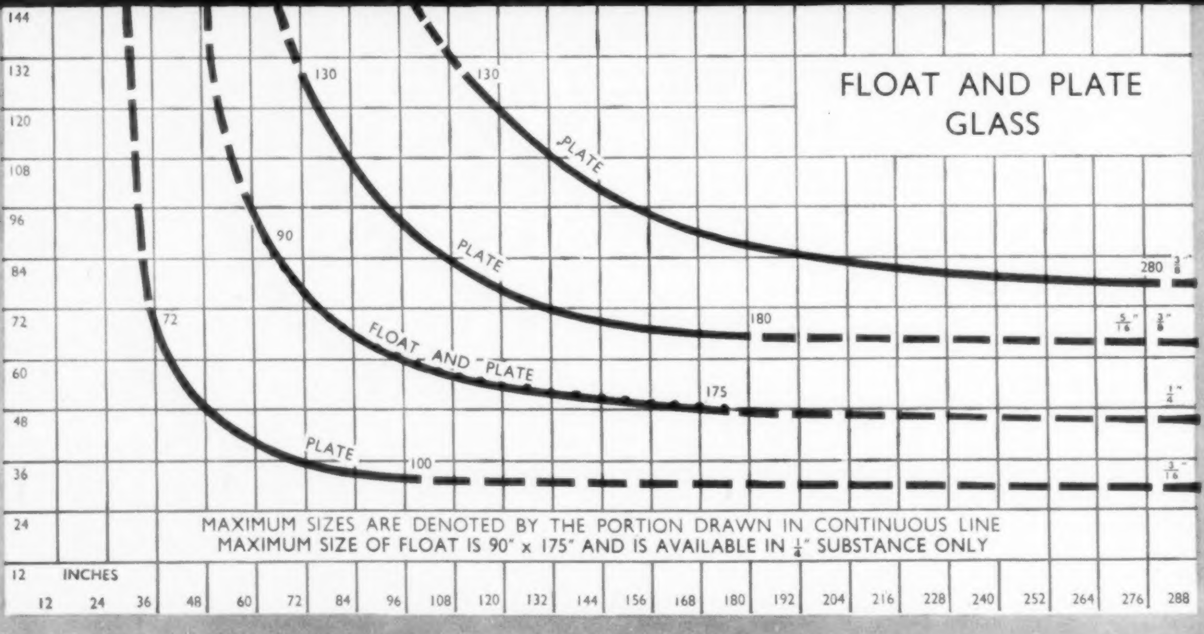

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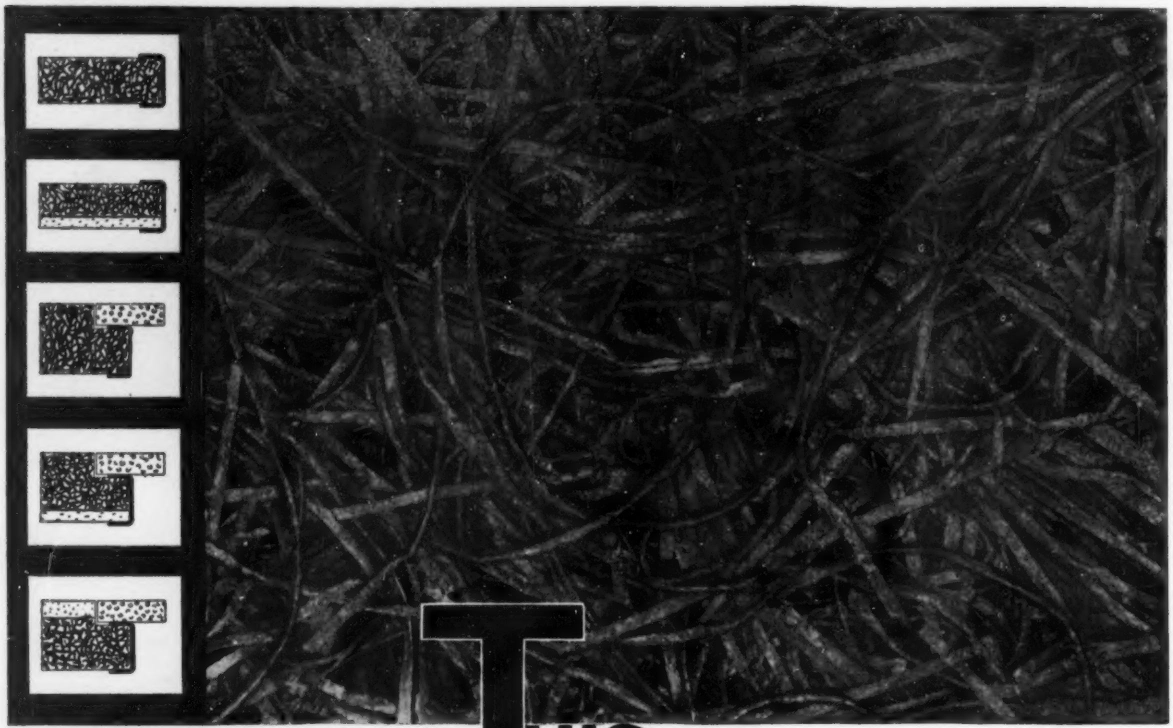

Reproduction of unretouched photograph actual size. Small illustrations show some of the range.

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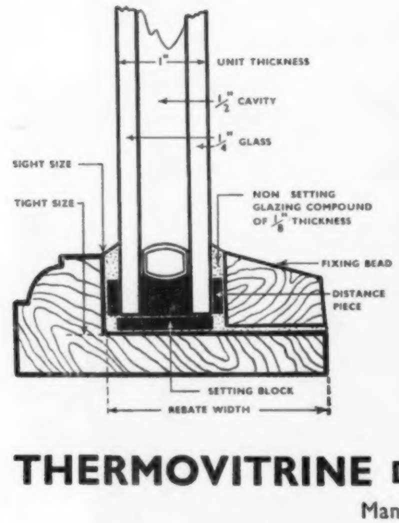

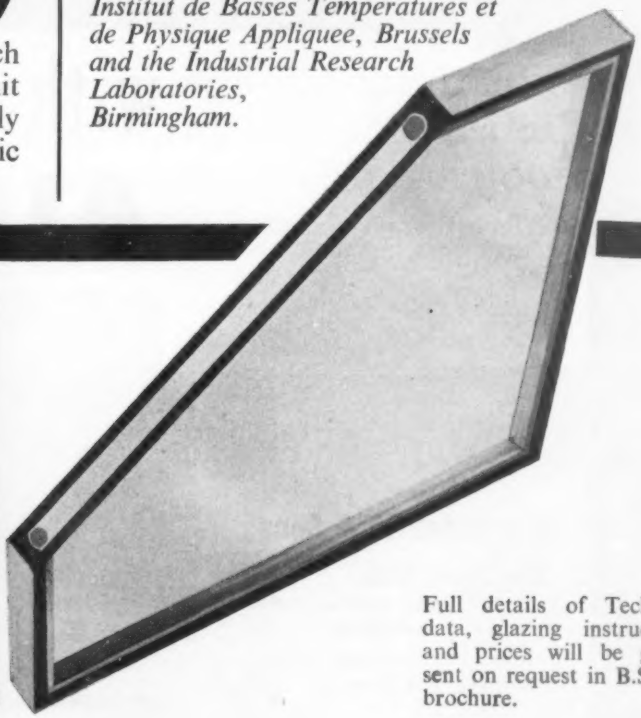

Full details of Technical data, glazing instructions and prices will be gladly sent on request in B.S. size brochure.

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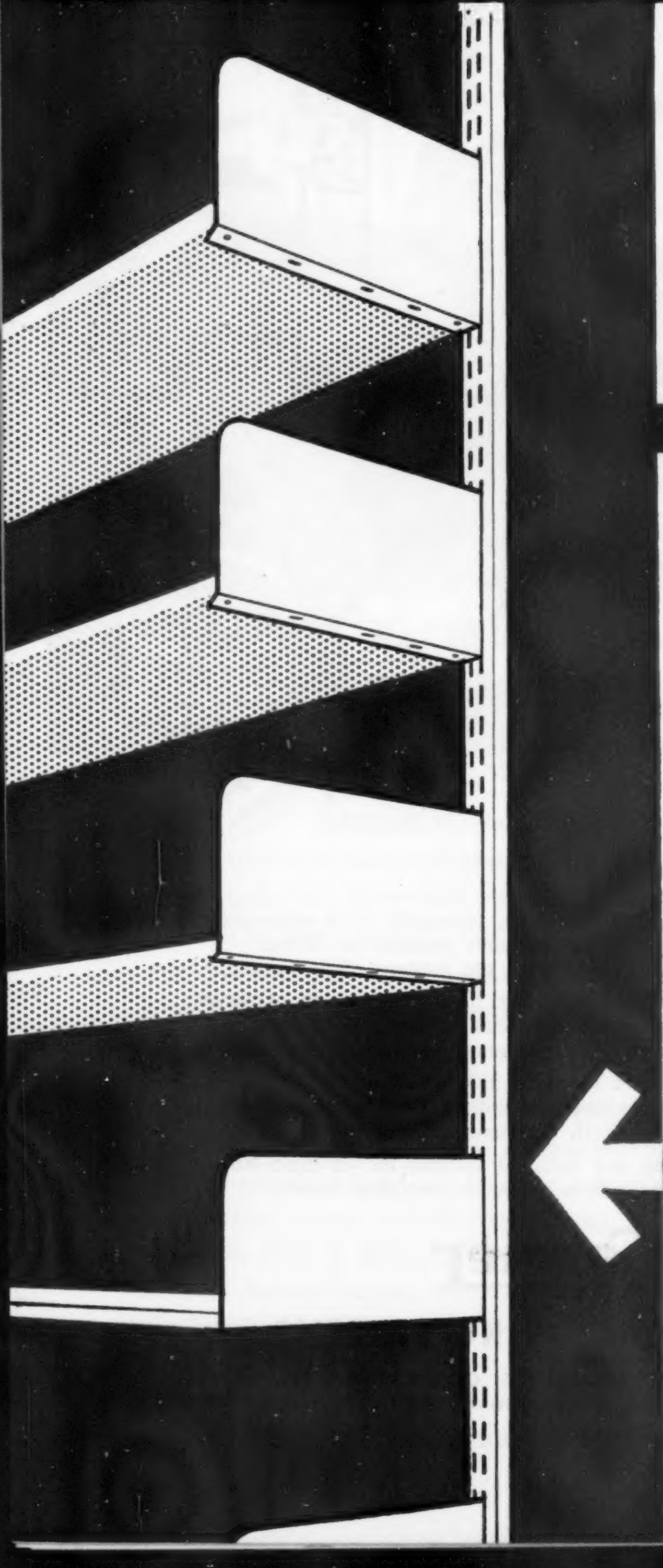

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This is just one example of cost for part of a Spur installation. Other layouts can readily be designed to suit your own particular requirements.

TGA SI 17

This is what you do

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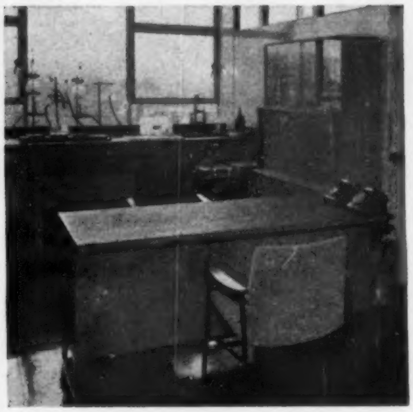

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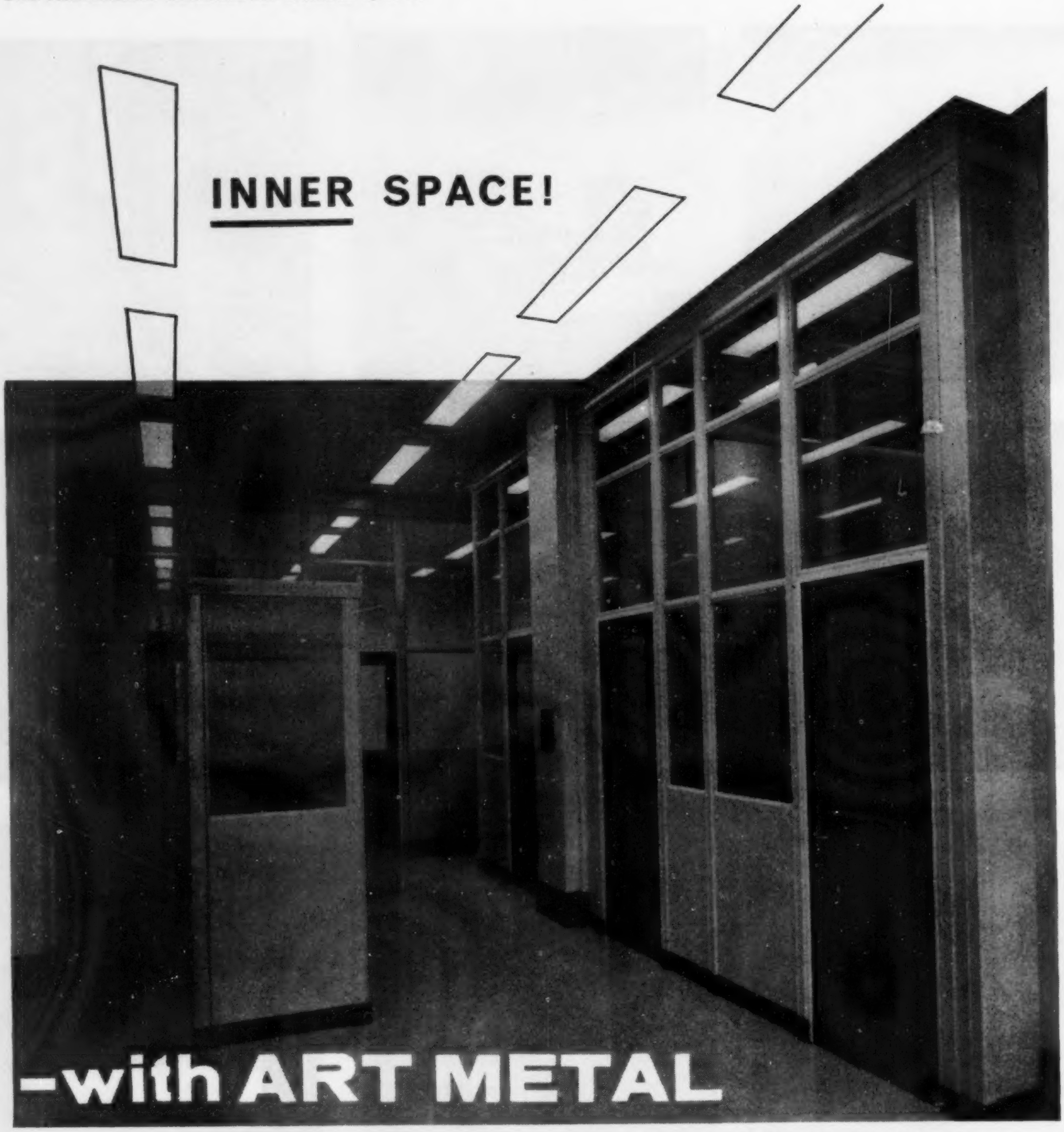

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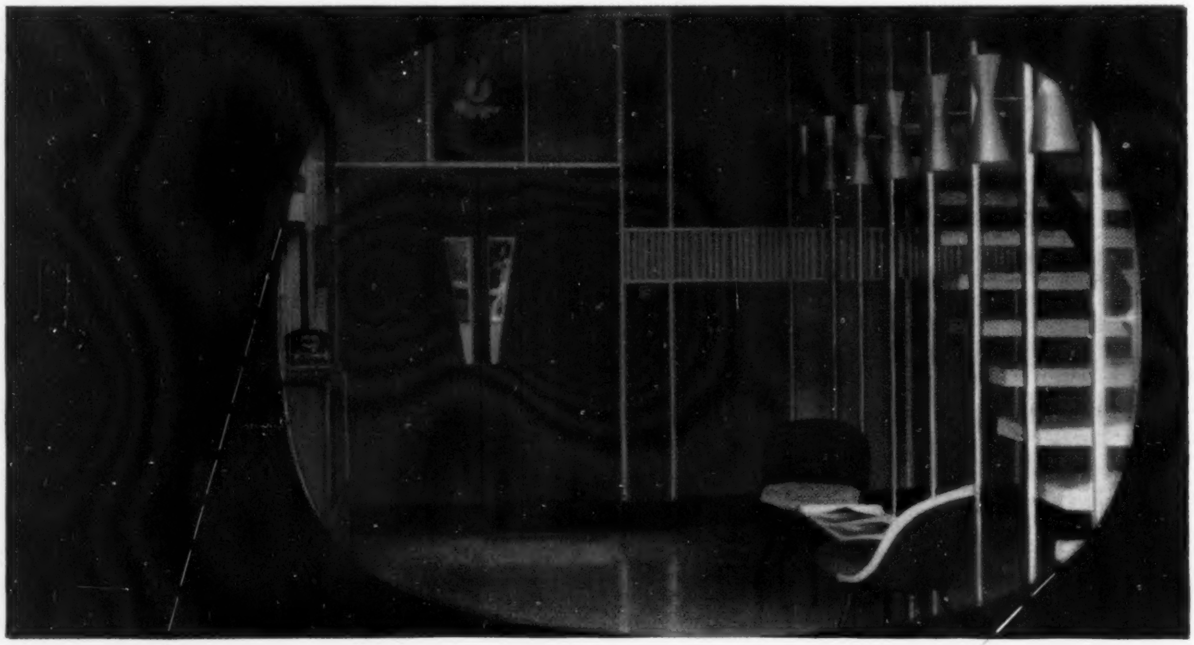

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STELVETITE is a plastic-steel laminate which provides architects with a new medium for adding colour and strength to their structures. It is available in any colour, and is ideal for panelling, partitioning, ceilings, external cladding and decorative ducting.

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Stelvetite

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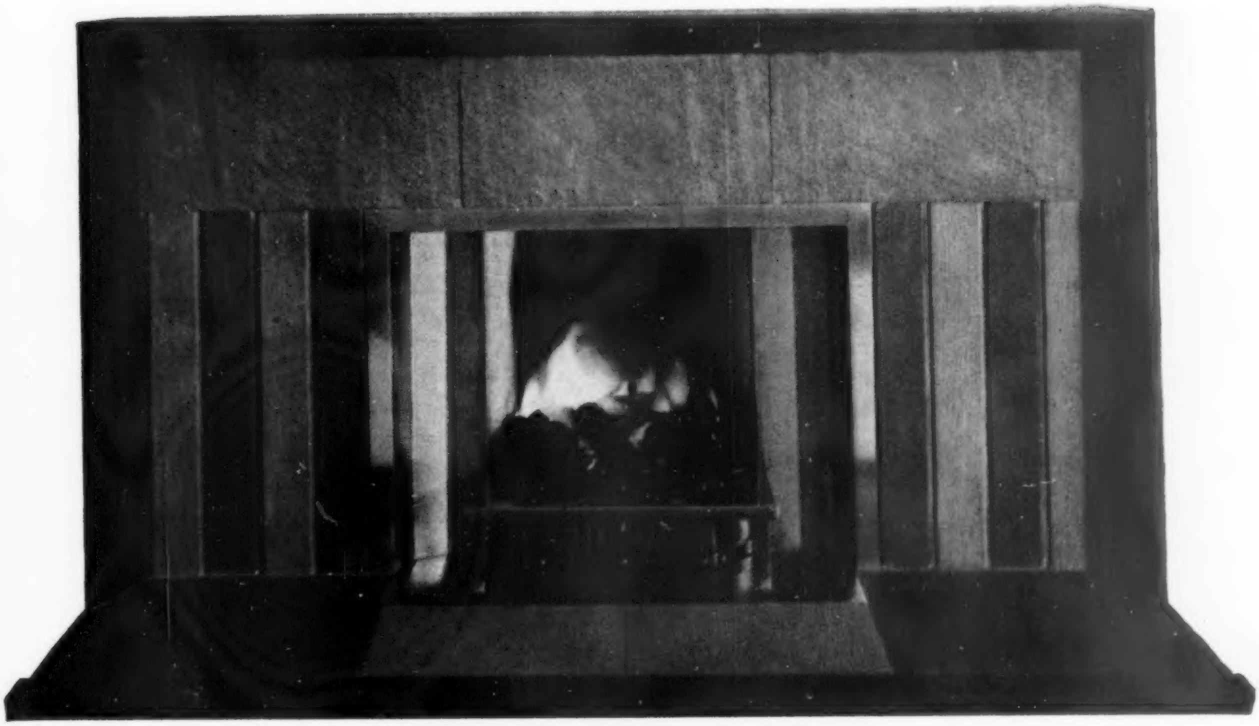

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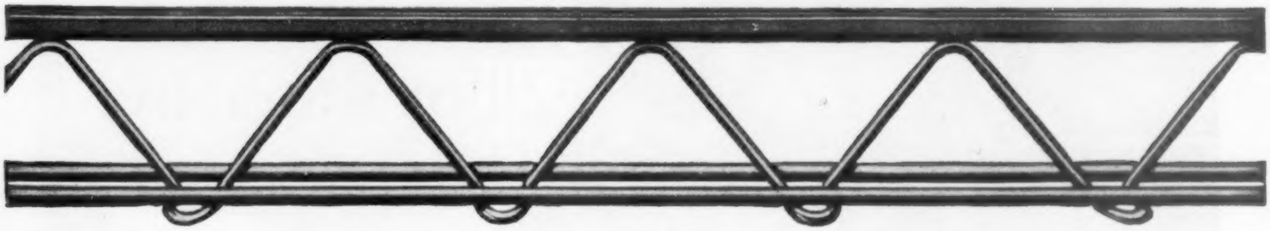

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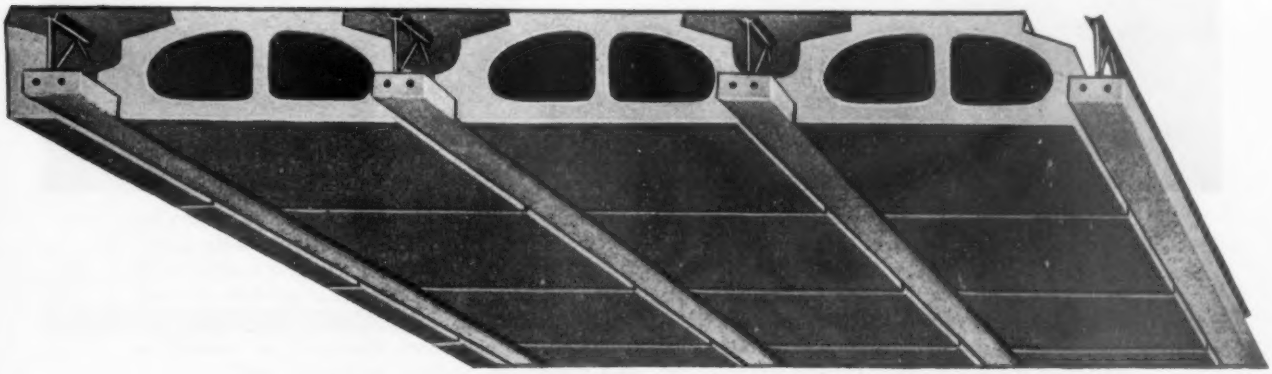

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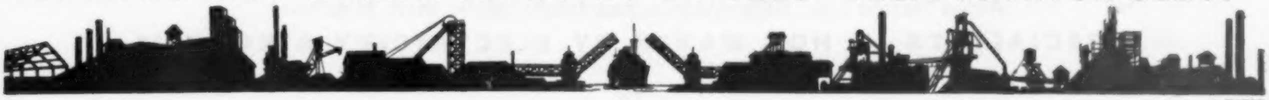

P6595

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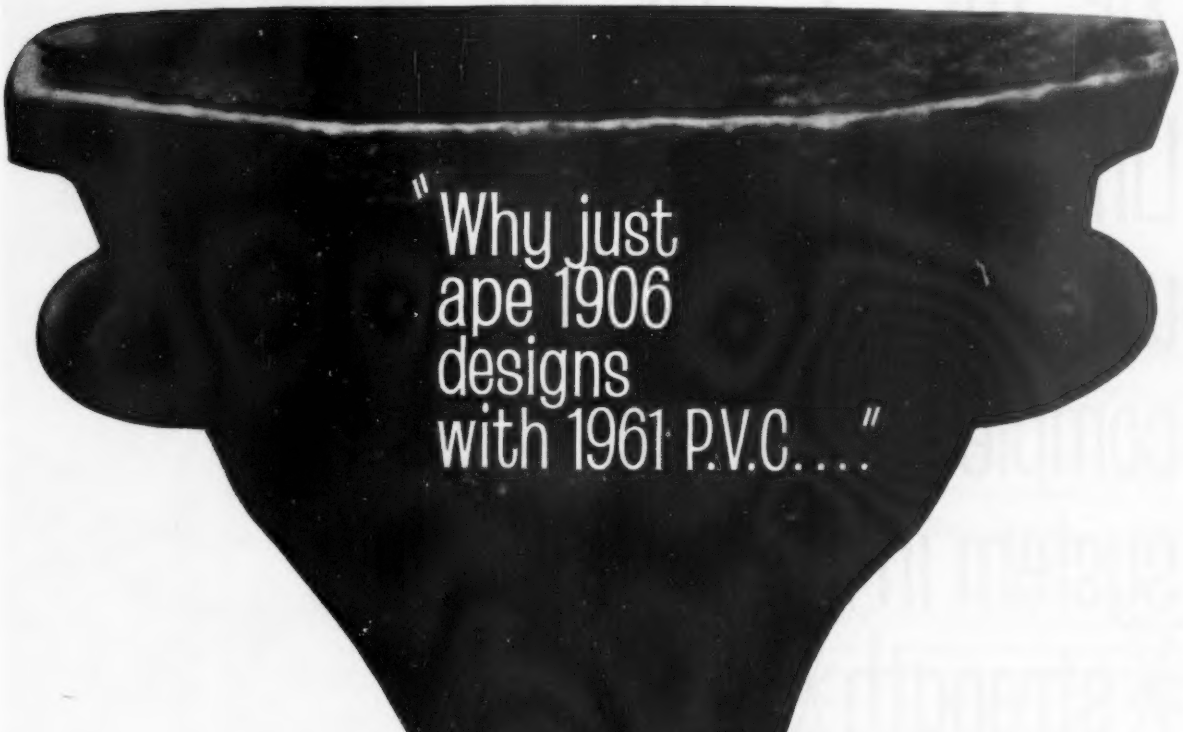

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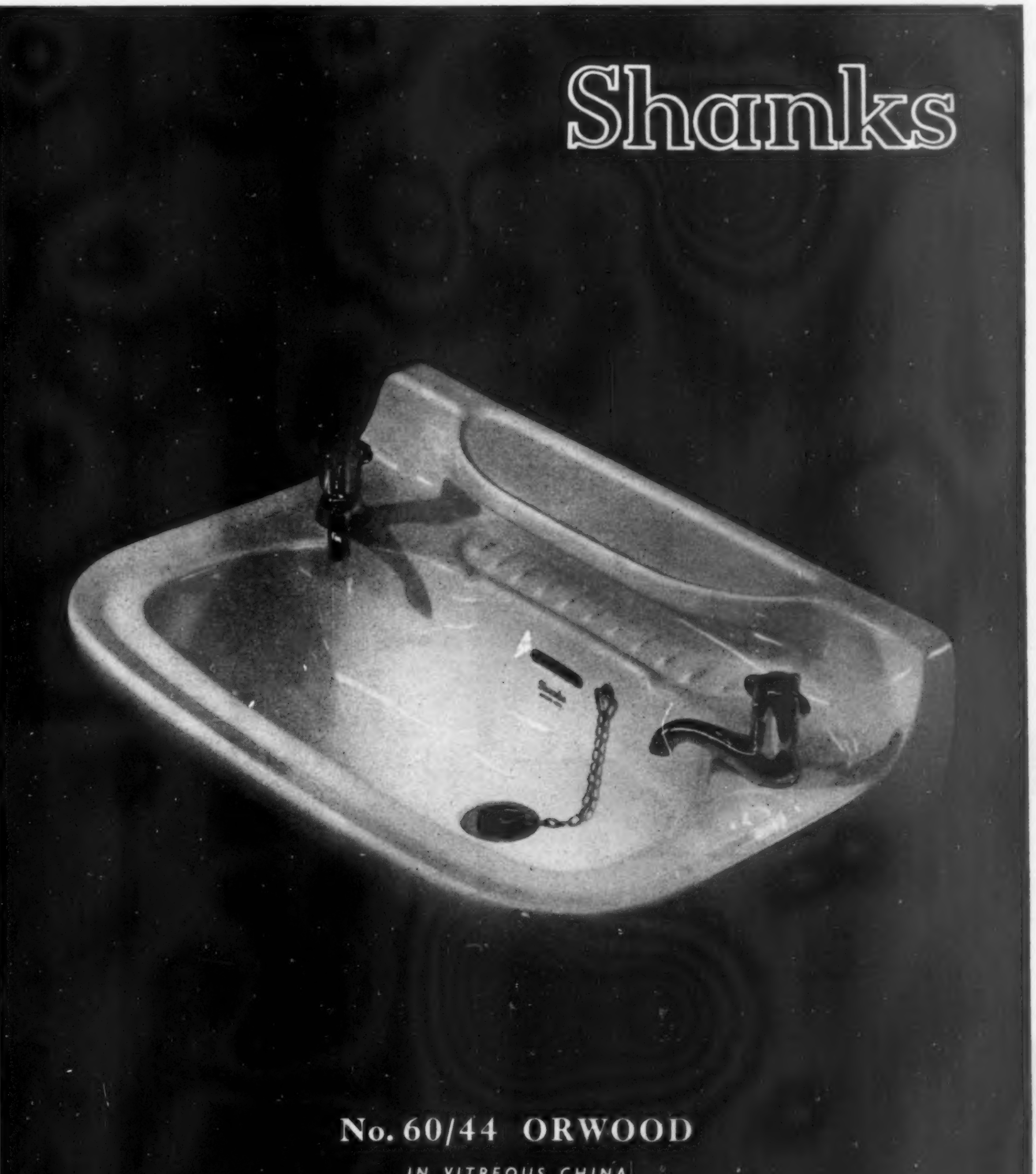
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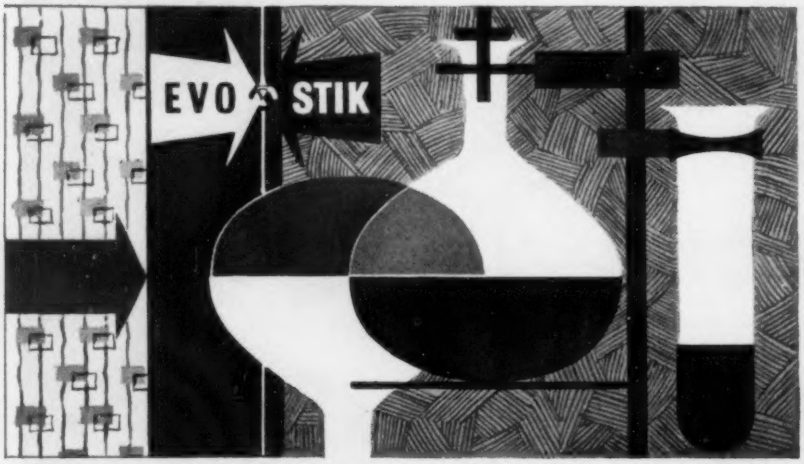

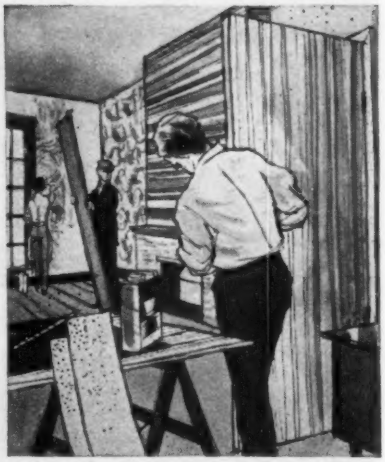

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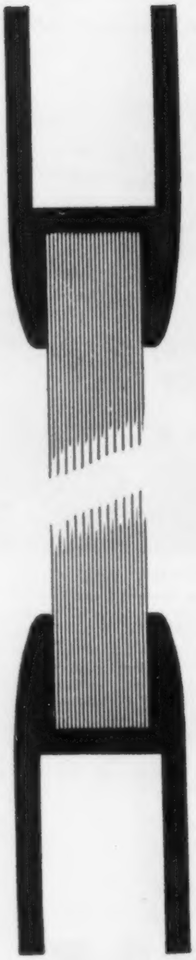

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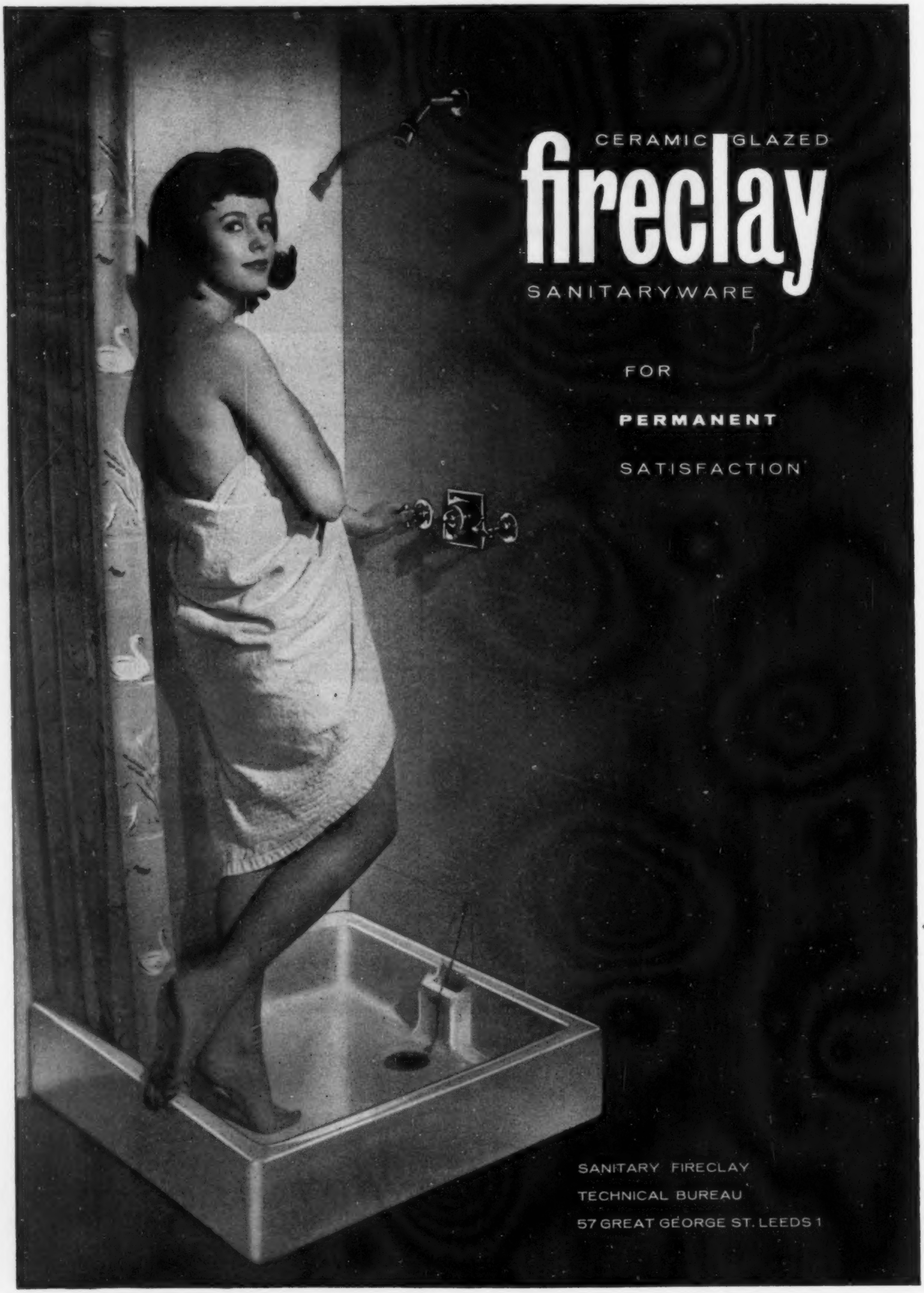
Ask Your Glass Merchant for a Leaflet

All details can be found in the 'Barbour' Index, File No. 53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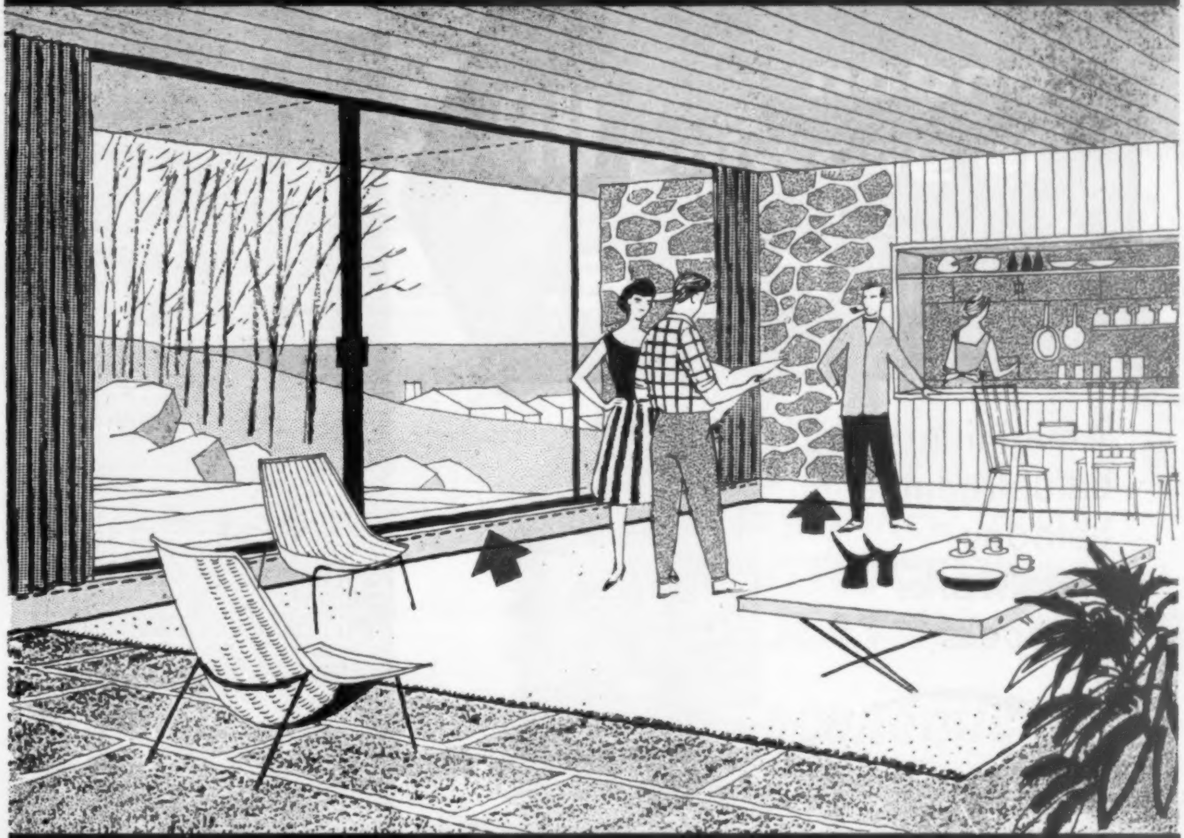


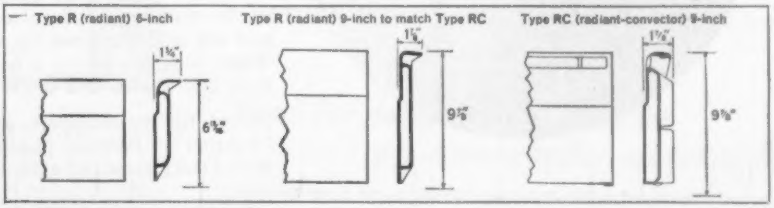
Where heat loss is high

Even in the case of a private house, where normally the cubic space to be heated is in relatively small units, the existence of a large window area in any of these units will appreciably increase the amount of heat required to maintain a steady, equable temperature.

Fortunately this loss of heat can now be countered very efficiently, and very much more simply than might be imagined, by the installation of Crane Skirting Heating. This system of heating, which is more and more widely recognized by the architect and heating engineer as the answer to heating problems in general, owing to its unobtrusiveness and even distribution of warmth, is particularly suitable to this problem.

Crane Skirting Heating takes the form of heating panels which 'stand-in' for normal skirting boards. The Type RC (radiant-convector) panel is nominally 9-inches high and in the example illustrated is used beneath the window to offset the heat loss. To match this, 9 inch Type R (radiant) panels are used along the adjacent wall. The panels are indicated by arrows.

3 types of Crane Skirting Heating
Type RC 9-inch is particularly suitable for installing beneath picture-windows and similar features, using elsewhere Type R 9-inch to match. Type R 6-inch meets smaller heat requirements. Panels are in 2-ft and 1-ft lengths and are made in cast iron for resistance to damage and corrosion. ***Decoration;*** *this can be done after installation to suit any colour scheme*



ZIL.R

everything points to **CRANE** skirting heating

Crane Ltd., 15-16 Red Lion Court, Fleet Street, London, E.C.4. *London Showrooms:* 118 Wigmore St., London, W.1 and Great West Road, Brentford, Middlesex. *Branches:* Birmingham, Brentford, Bristol, Glasgow, Leeds, London, Manchester. *Works:* Halifax and Ipswich.

London is growing UP —with E.S.E.

Aluminium alloy* balustrading, balcony metalwork, droppers,

Fabricated and installed by ***East Sussex*** *Engineering Co. Ltd.*

Hubert Bennett, F.R.I.B.A. Architect to the Council.

L.C.C. DWELLINGS, CLIVE STREET, STEPNEY, E.1.

Wates Ltd.—Main Contractors.

This contract covers three blocks of flats and maisonettes, each seventeen storeys high. The East Sussex Engineering Co. Ltd. are supplying and erecting some 39 tons of aluminium alloy balustrading and metalwork for the balconies, consisting of prefabricated welded panels which form a continuous front, with vertical division screens and end panels to ensure the privacy of each living unit.

The vertical 'droppers' or columns form an interesting feature of the construction. Fixed outside the balconies and stove enamelled black, they enhance the detailing and stress the height of the buildings. The droppers have a fabricated hollow section and act as down pipes for surface water from roofs and balconies. Water is taken off by a horizontal pipe suspended under the first floor and thence to a single drainage point.

Except for the droppers, all aluminium work is left unpainted to 'weather'. Balcony panels and screens are glazed after erection with Georgian wired glass.

*** Aluminium Sections by The British Aluminium Co. Ltd.**

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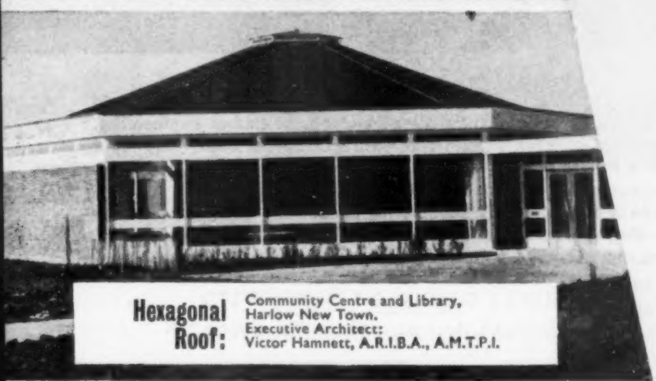
GD 610

Low-pitch Roof: Transair Ltd., Hangar & Offices, Gatwick Airport. Architects: Clive Pascall, A.A. Dip., F.R.I.B.A. and Peter Watson, Dip. Arch., A.R.I.B.A.

Barrel-vault Roof: John Perring Ltd., furnishers, Crawley New Town. Chief Architect: A. S. Howgrove-Graham, A.R.I.B.A., A.M.T.P.I.

Monitor Roof: Tunbridge Wells Technical College. Architects: E. Mayorcas, F.R.I.B.A. in collaboration with E. T. Ashley Smith, F.R.I.B.A., County Architect.



Hexagonal Roof: Community Centre and Library, Harlow New Town. Executive Architect: Victor Hamnett, A.R.I.B.A., A.M.T.P.I.

Parabolic Roof: Maidstone Masonic Temple. Architect: Clifford Worthington, F.R.I.B.A., F.R.S.A.

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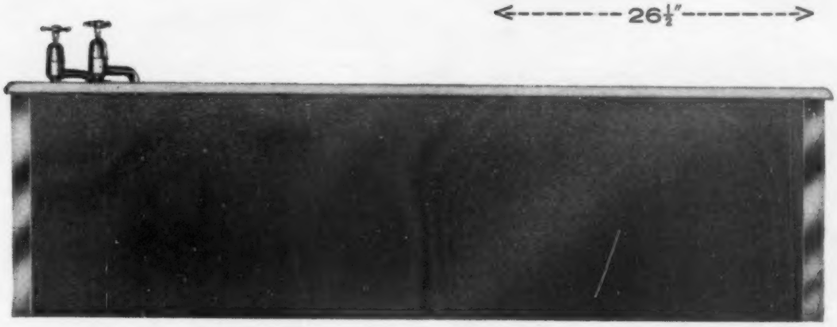

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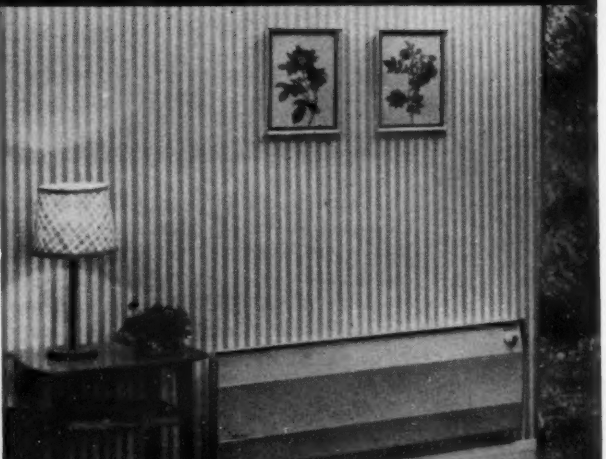
NEWCASTLE UPON TYNE: *33 Bath Lane. Telephone: 26940*



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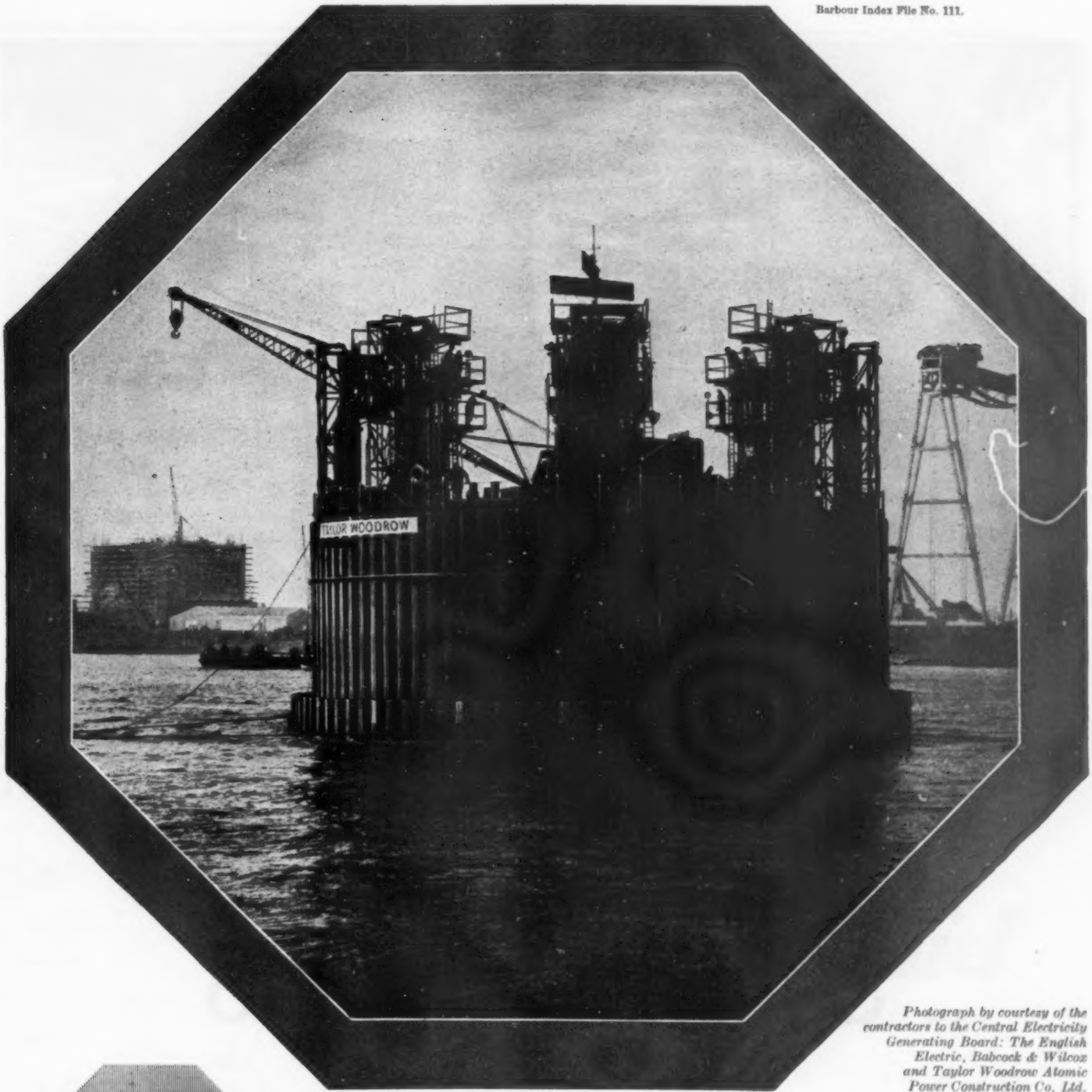

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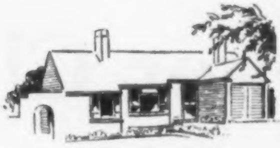

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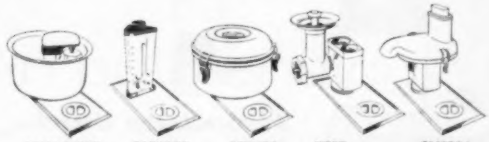

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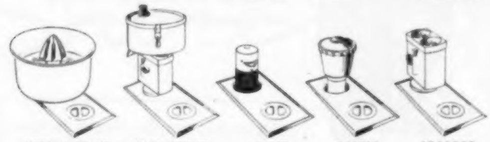

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EASY TO INSTALL. *Figs. 1 & 2. Using template provided, mark out and cut cabinet top. Figs. 3 & 4. Apply sealing compound, fit Power-Maid and clamp in position. (Screw in switch housing). Figs. 5 & 6. Remove nameplate, make electrical connection and replace.*

Fig. 1

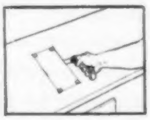

Fig. 2

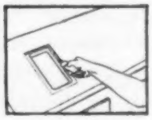

Fig. 3

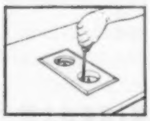

Fig. 4

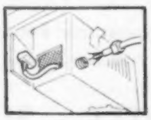

Fig. 5

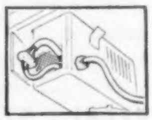

Fig. 6

THE BUILT-IN

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The Cannon Multi-purpose Power-Maid is of revolutionary design, making possible the use of 10 labour saving attachments.

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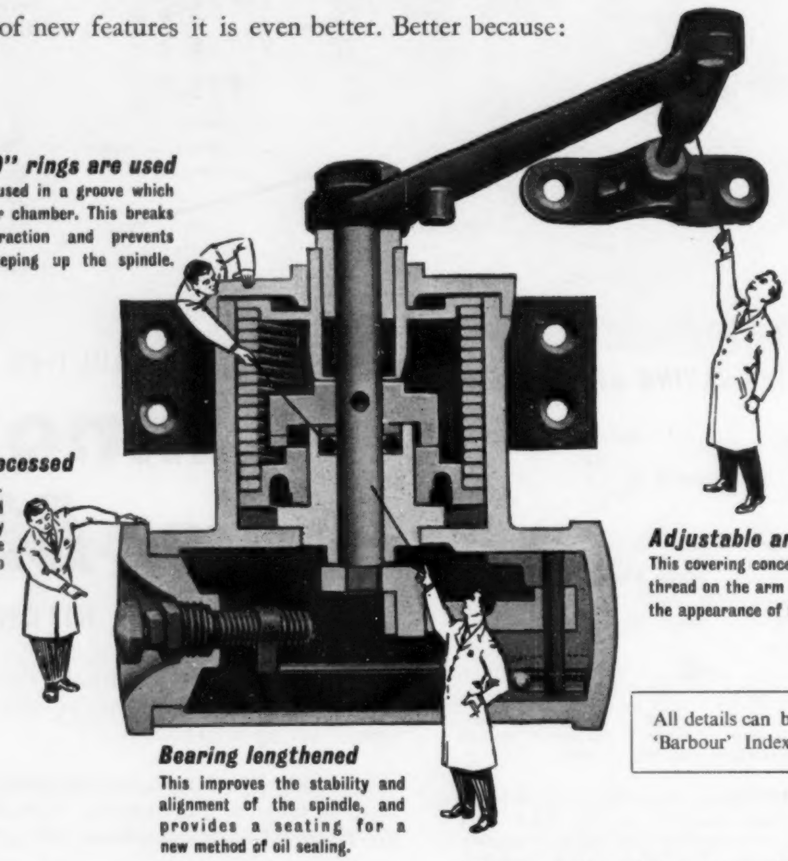
The Inside Story The "Briton" Door Closer is well known. For years it has been the best in the World. Now, with the introduction of new features it is even better. Better because:

Rubber "O" rings are used
These are housed in a groove which creates an air chamber. This breaks capillary attraction and prevents oil from creeping up the spindle.



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This improves the appearance of the Closer, and removes all possibility of damage either before or after it is fitted to the door.

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This covering conceals the screw thread on the arm and improves the appearance of the Closer.

Bearing lengthened
This improves the stability and alignment of the spindle, and provides a seating for a new method of oil sealing.

All details can be found in the 'Barbour' Index, File No. 53

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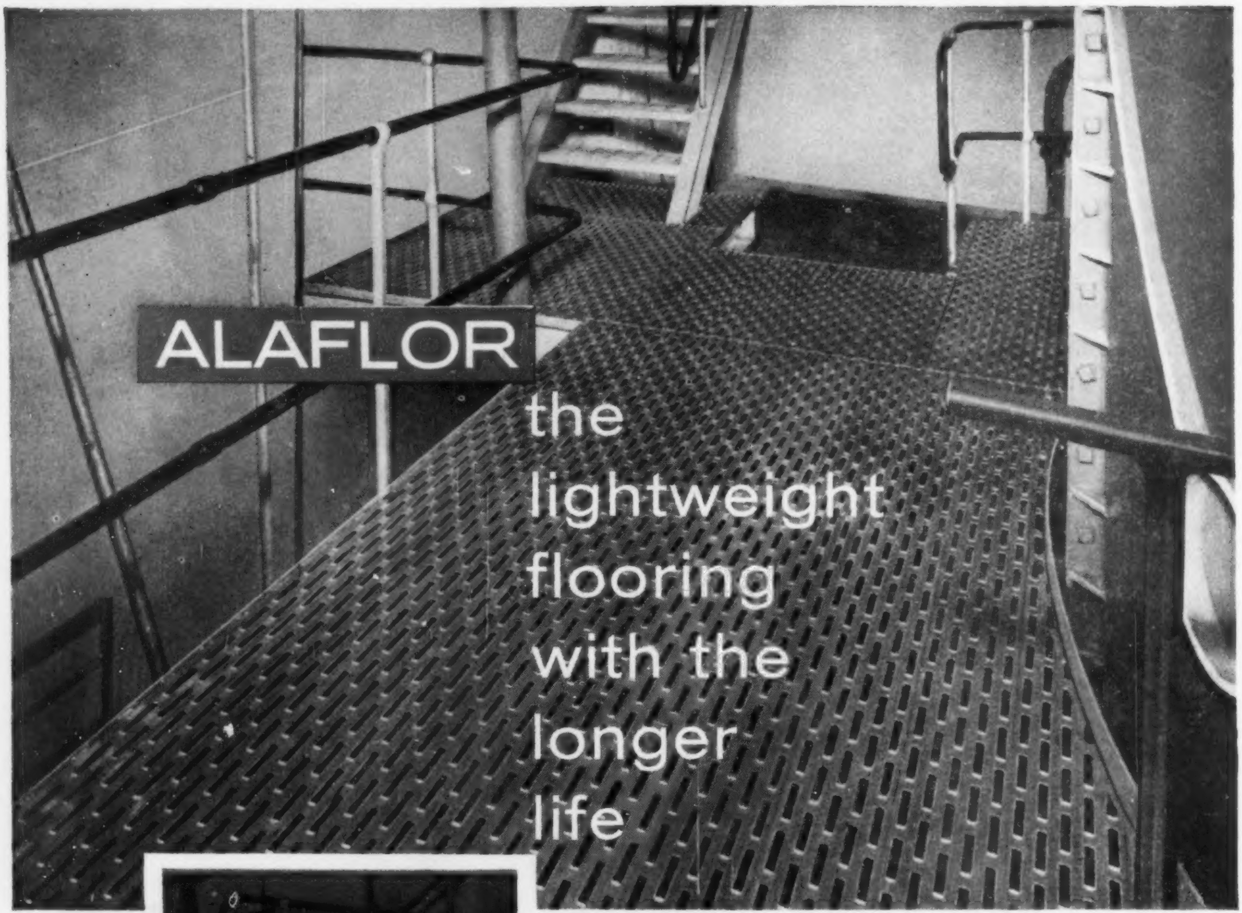

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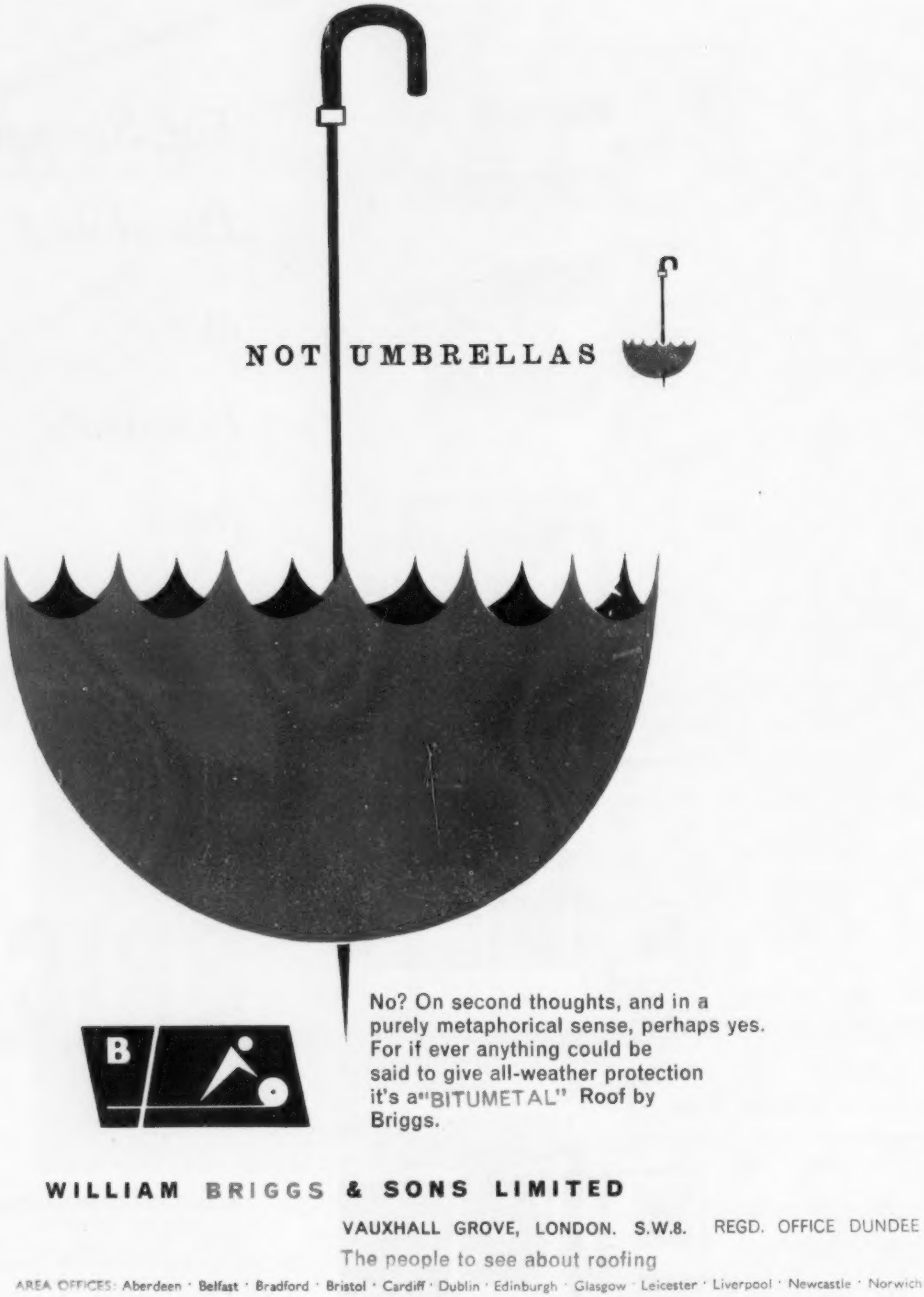
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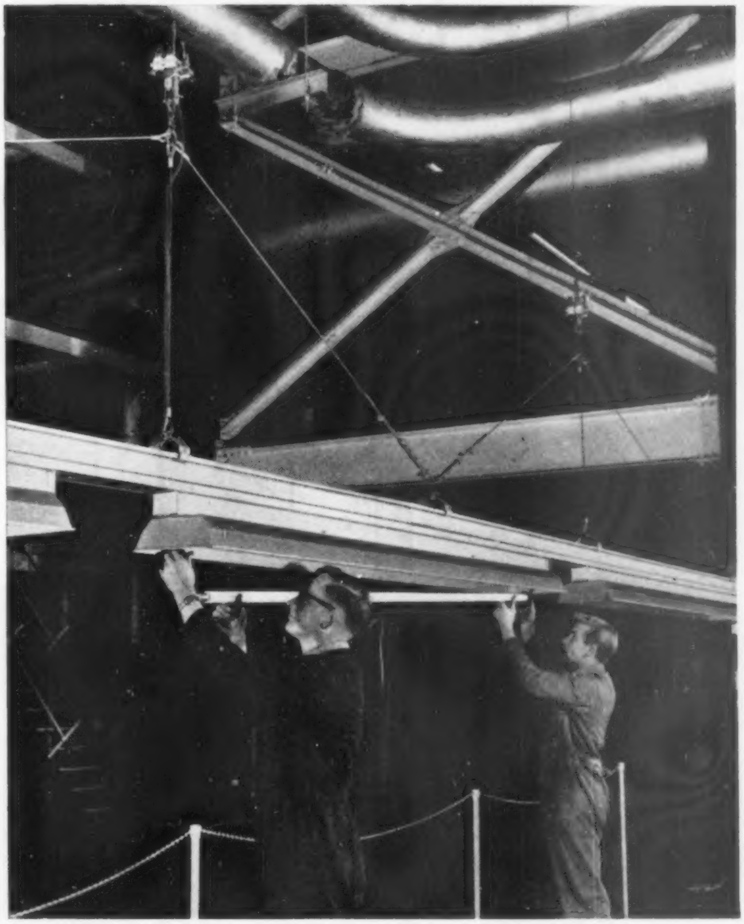

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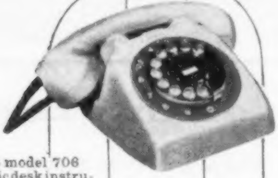

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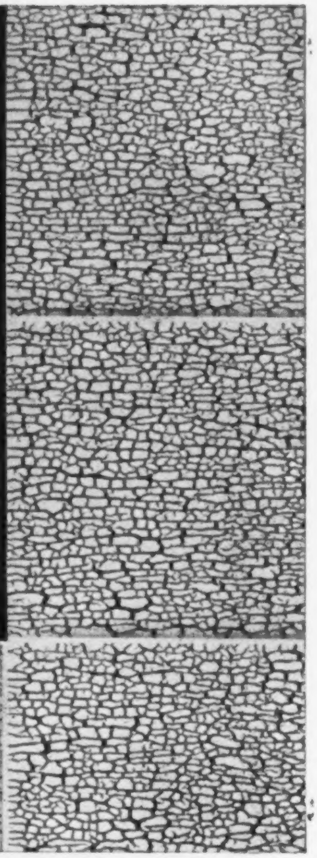

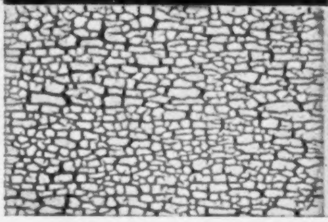

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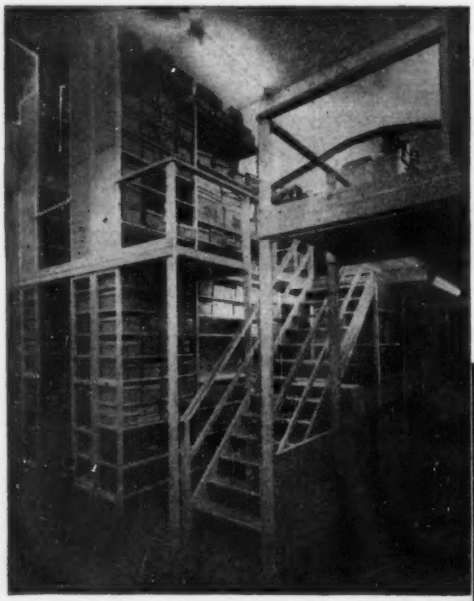

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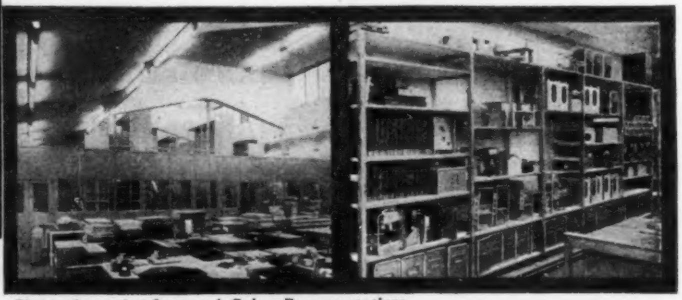
Our literature is in Barbour Index File No. 5.



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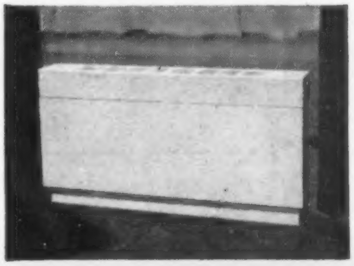
POWER FOR HEATING, ETC.

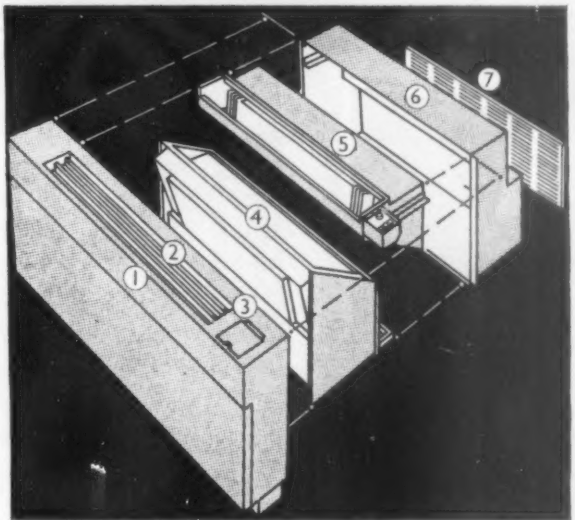
AIRAD uses steam, circulating hot water or electricity for heating. Electricity is used for cooling and all other functions of true air conditioning which AIRAD so cheaply provides.

**AIRAD is made under licence from the Remington Machine Co. USA—producers of personal comfort equipment for 24 years.*



INDOOR VIEW OF AIRAD CONDITIONER

Designed to be used in multiple and available in choice of attractive finishes. Ideal for hotels, hospitals, colleges, blocks of flats, etc. In existing buildings AIRAD usually occupies less space than the radiator it replaces.



EXPLODED VIEW OF AIRAD CONDITIONER

(1) Room Cabinet—front panel snaps off for easy access to Air Filter, Heater Section and Cooling Chassis
(2) Discharge Grille—air to be conditioned enters Room Cabinet near bottom of front panel and returns to room through top Discharge Grille
(3) Controls—consist of 3-position selector switch for *off, cool* and *heat,* plus Automatic Thermostat which controls both heating and cooling
(4) Cooling Chassis containing Compressor, Cooling-Drying Coil, Condenser, 2-Stage Positive-Pressure Ventilation Unit and Air Filter which filters both room and ventilating air
(5) Heater Section—Circulating Fans and Heating Coil which uses steam, circulating hot water or electricity
(6) Wall Cabinet
(7) Outdoor Louvre—made of anodised aluminium for corrosion resistance

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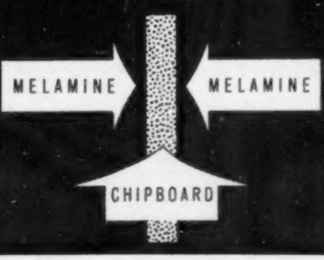

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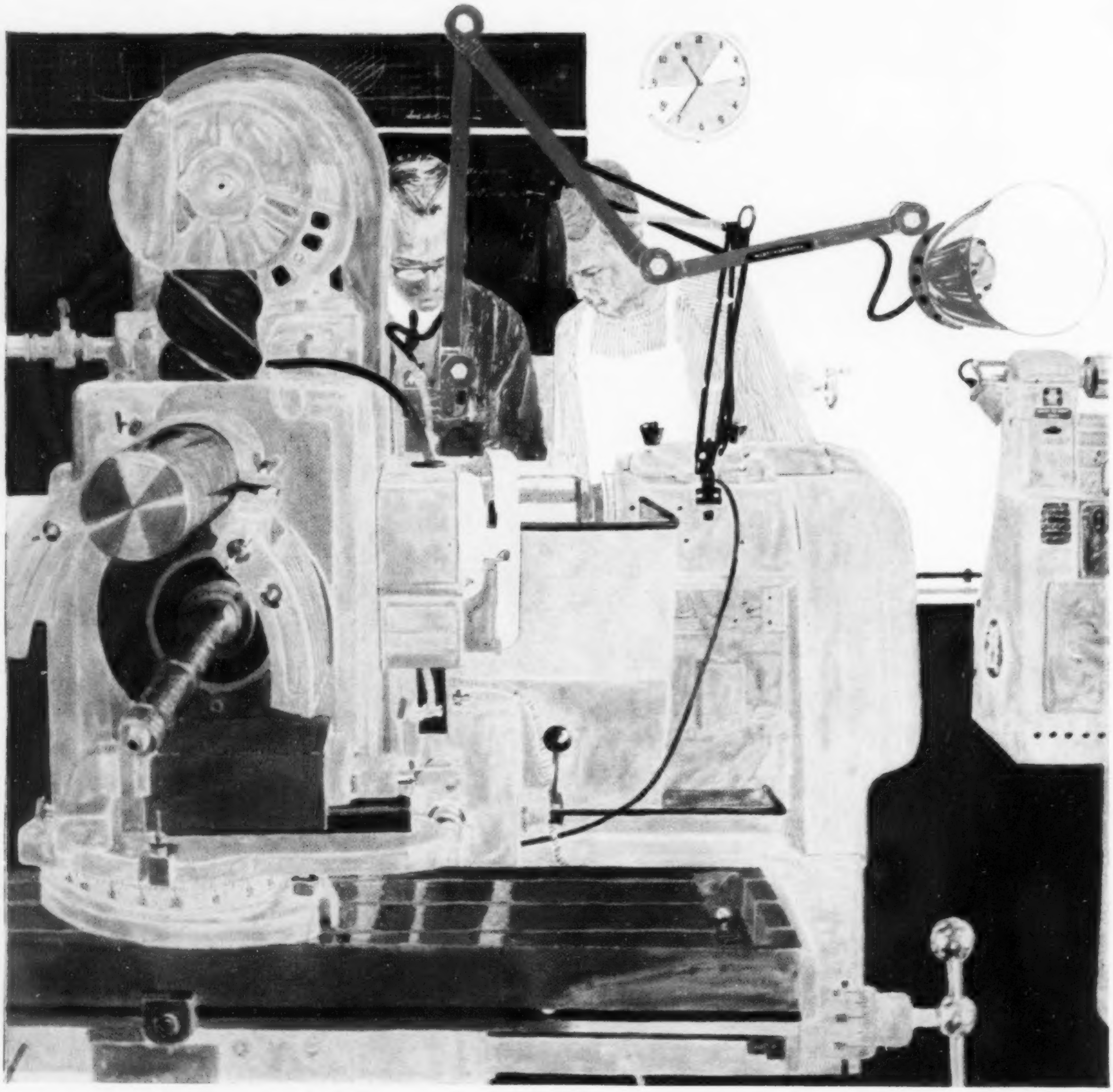

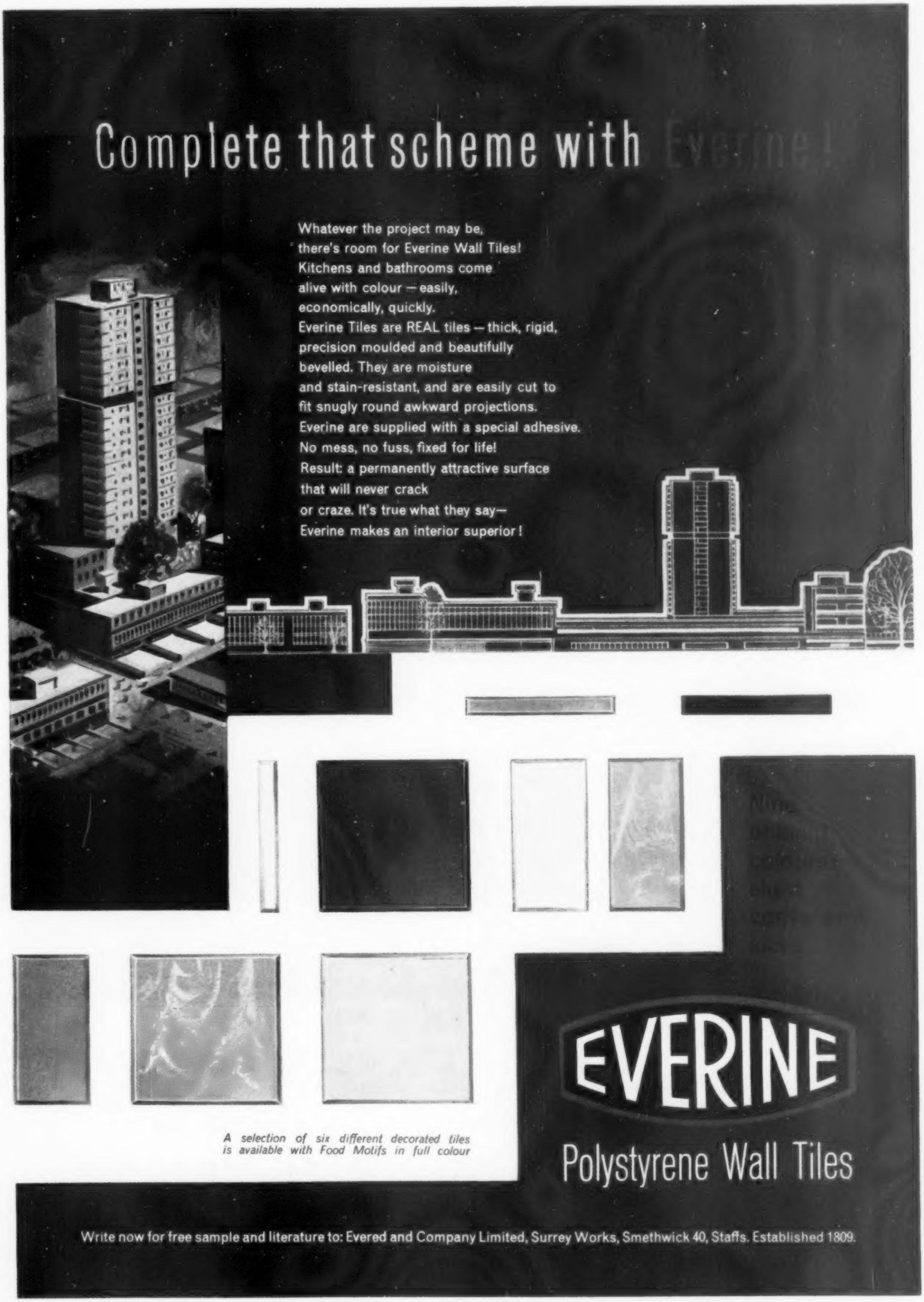
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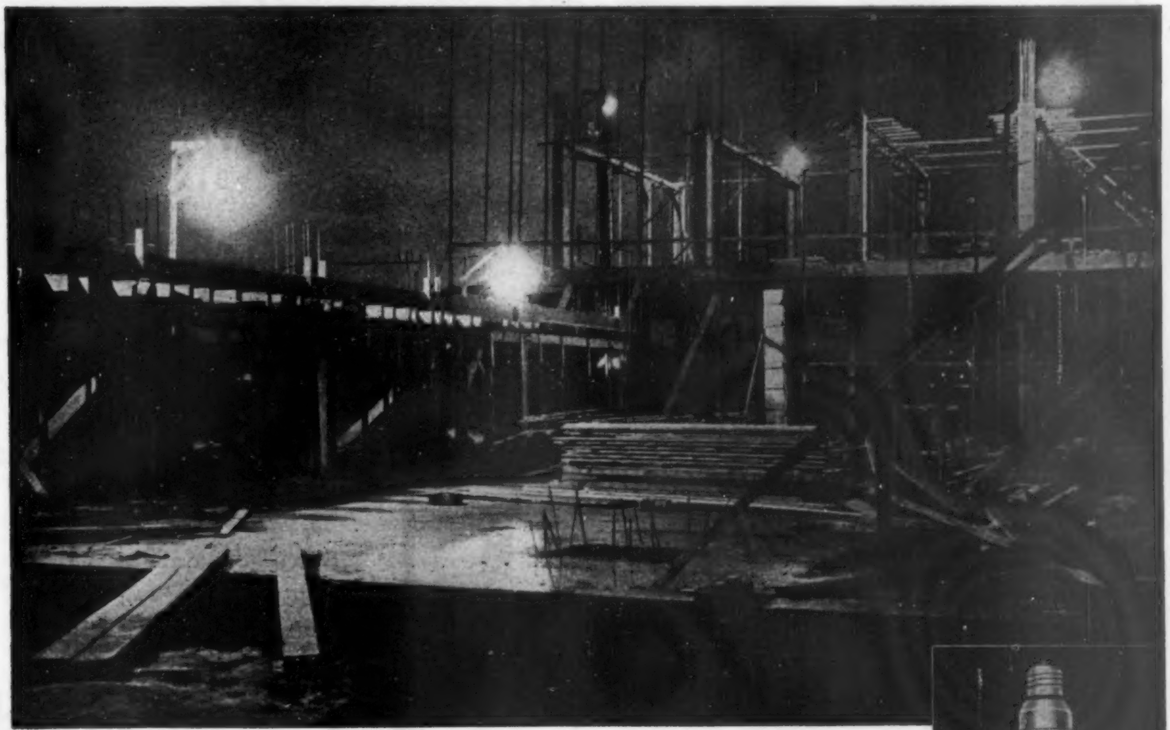

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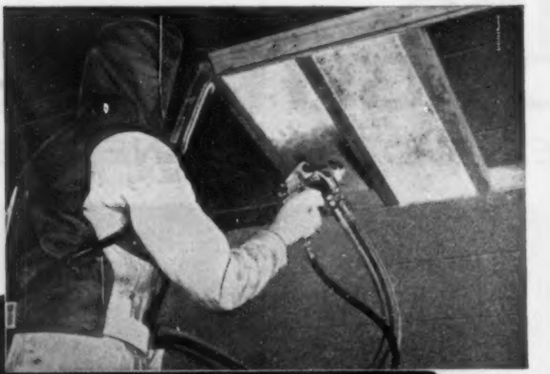

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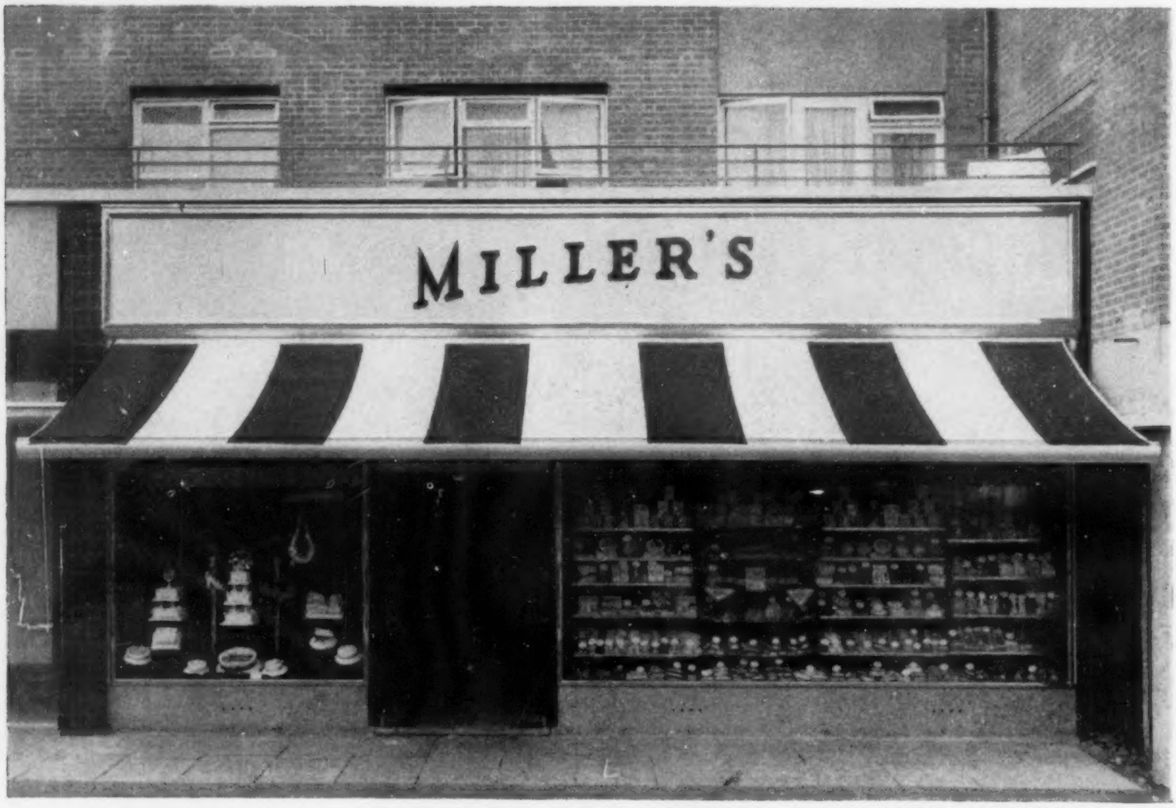

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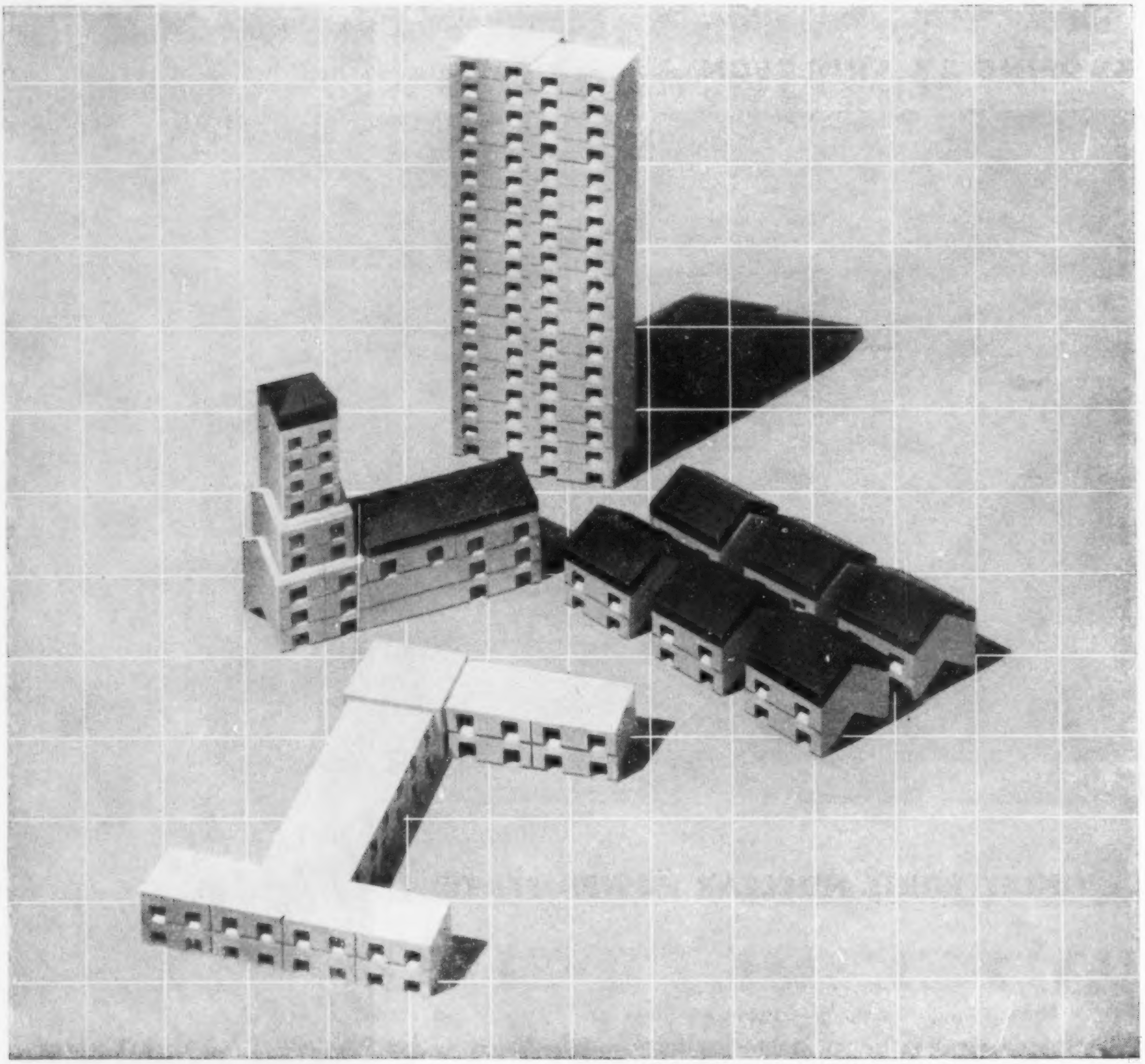

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AJ

The Architects' Journal

Volume 134 Number 13 October 4 1961

Registered as a newspaper

The Architectural Press Ltd
9-13 Queen Anne's Gate, London SW1
Whitehall 0611

Subscription rates: post paid, inland £2 15s a year abroad £3 10s per annum. Single copies, 1s; post paid, 1s 6d. Special numbers are included in subscriptions; single copies 2s; post paid 2s 6d. Back numbers more than 12 months old (when available), double price. Half-yearly volumes can be bound complete with index in cloth cases for £1 17s 6d; carriage 2s extra.

The new AJ is:

A4 size

Glue-bound (so pages can be easily extracted)

SfB classified (see SfB Classification Tables in the AJ September 27, and obtain the RIBA Filing Manual, 36s) Marked for punching filing holes

This new AJ contains:

Elemental Files SfB (11) and SfB (12). If you keep these, and each element file which we will publish weekly, you will create the nucleus of an SfB classified library.

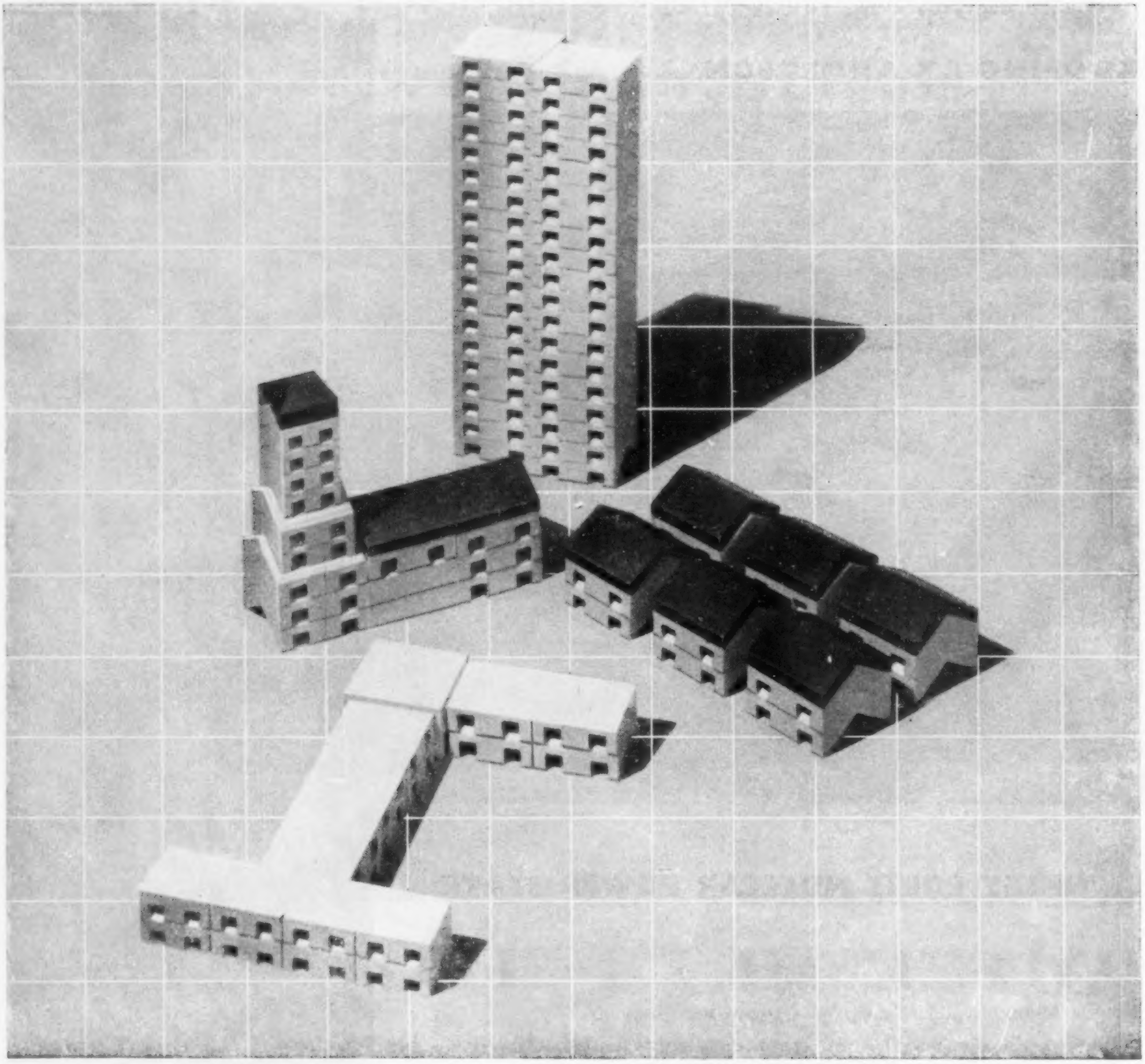
The Files each consist of:

A Technical Study extra to the normal AJ technical articles.

An Elemental Design Guide, giving a design procedure and a list of technical references.

Information Sheets. This special series was fully described in the AJ for September 20. The SfB classification number is given on the front of each sheet. The old Information Sheet classification numbering is now printed on the reverse of each sheet after the date line at the top of the page. Henceforth Information Sheets will be identified, when referred to elsewhere, by the serial number.

Informative advertisements: preclassified advertisements giving basic information are also included.
Technical studies, Building studies, working details, and the normal news and comment complete this issue.



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ISSUE NUMBER INCORRECT, SHOULD BE VOL 134 No 14

AJ

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This is the AJ's D-day, or rather SfB day, when we publish our first two Element Design Files (pp 525-580), and at the same time introduce a number of other changes throughout the AJ, which will not make it any less readable, but will reflect the fact that we are going over completely to SfB. This is

what the AJ is doing

This entails changes in the way we handle information, since although SfB is only a system of classification, like all systems it imposes a way of thinking on those who use it, starting from where you file information of all kinds and ending with what should go into the files.

Hence it was inevitable that once SfB was established our technical section would become a filter—or rather, perhaps, a post office—for information, directing it into the SfB classifications and processing it to fit them.

Material pours into the JOURNAL from many sources—in reports of events, the presentation of a new building, in books and publications, and as trade literature on a new product. Any of these bits of material may be interesting as news, or they may provide technical information, and many are both newsworthy and technically interesting.

How to treat each item is a constant problem for a journal wedded, as we now are, to the provision of information for the architect in a readily fileable form. For "news" should be given to readers quickly, whereas technical references should be given in an orderly manner, which may well need processing and take time. Consequently everything that comes in has to be looked at from the point of view of its news value, its value as an original reference, and, now, for its bearing on the SfB functional elements.

News

News will be treated in the front of the AJ, usually as at present, and strait-jacketed as little as possible. News items will not carry an SfB number, with *two exceptions:*
(1) In the case of products. These will be written up as usual by Brian Grant, but his feature will in future be called Products File (see p 514) and the items will be designed to fill a quarter-page, and carry an SfB number, so that readers can cut them up and file them under their individual headings, or tear out each whole page and keep the pages together.
(2) There are publications, such as a major MOE Bulletin for instance, which are news, but readers may wish to keep particular reviews for reference. We are arranging reviews, therefore, so that they are easy to tear out and file. All publications which rate a review will be treated in the news pages, the old division between "aesthetic" and "technical" interest being abandoned. (ASTRAGAL will probably continue to comment on novels with architect heroes, or architect heroes who write novels.)

For reference

This means that Information Centre is now ended. All publications, whether they receive a news review or not, will be recorded in a brief note and whenever sufficient notes have been assembled they will be published as a one-page Publications File (see p 513), listed in SfB order, with essential data only.

Additional to this change is that in Information Sheets, which was fully described in AJ 20.9.61. Briefly, the sponsored Sheets are to be suspended at least for the duration of the supplements, and a new series of editorial product review Sheets will be published within the Element Files.

Processing information

From the reader's point of view, changes appear to stop here, for there will be no visible change in our treatment of buildings, either as Buildings in the News, or Building Studies (called Building Studies, 2nd series since November 10 1960, to distinguish them from earlier cost analyses, since that date there was a change in the break-down for cost analysis) or in Working Details. All the same, a lot will be going on behind the scenes, for all incoming information provides material which will be fed into the Element Files to keep them up to date. All these features, and those already men-

Information comes in to the Journal as:

- An event
- A building
- A publication
- A trade product

1 **It is considered first for its news value, when it is published as:**

- Leader
- Astragal
- News
- Book review
- Publications File
- Products File

2 **Some of this information will qualify for presentation to readers as an original reference:**

- Building Study
- Cost Analysis
- Working Detail
- Technical Study

3 **Lastly some of the foregoing information will affect the design of a functional element. It will then be prepared for ultimate publication as:**

- Information Sheet
- addition to element file

tioned, may have something to add to an Element File. We have therefore established at the AJ a set of element files similar to those we hope readers will compile for themselves, and each new piece of information which comes in, from any source, will be considered for the bearing it may have on any of the functional elements. If it bears on one or more of them, it will be recorded in each file which it affects, and when enough new matter has gathered in any one file, we shall publish an Information Sheet of Technical Study summarising it.

Later, when the functional element headings have been completed, we hope to deal with sections from Table 1 (8) and (9), which deal with different building types.

There is one more change which readers may notice, though it has nothing to do with the JOURNAL's subject matter. It is that henceforth both Working Details and Information Sheets are to be printed on the same paper as the rest of the JOURNAL. This greatly simplifies our printing arrangements and is a natural expression of the fact that these items are no longer the only ones designed to be torn out.

In theory there are many different kinds of JOURNAL reader, but we believe that all architects directly concerned with design should have their own personal information file, no matter how well serviced they may be by a librarian.

This is

How we can help you

Because technical literature is getting more voluminous every day, we believe that there is an immense work of simplification and compression to be done, and that technical information, if it is properly organised, can—most of it—be gathered into quite a small compass, giving the answers perhaps 95 per cent of the time and making reference to more specialised works necessary only occasionally. Clearly this aim of compression and simplification cannot be achieved at once. The instrument the AJ is mainly using to achieve it is the Element File; but, though each Element File contains much information which is immediately useful and complete in itself, most of the information is in the form of a reference: you must look elsewhere to find the answer and, though you know where to look, where are you to find the publication? Publications like BRS Digests and the BS Handbook each architect should keep near his drawing board, but the bulk of publications could not possibly be kept at hand. Some will be in the office library, some only in a public library. It is the JOURNAL's plan, over the years, to transfer into the architect's personal file as much as possible of the information which is now dispersed and at a distance.

what you should be doing

As explained last week, the architect can file the material published by the AJ with other A4 size material, or separately.

If he puts it with other material, he will probably need a filing cabinet, though a standard two-drawer cabinet will be big enough for his personal use. It is an advantage to have everything together; but on the other hand it is more complicated to take something out of a file and put it back in than it is to turn up a page in a bound reference.

If the architect keeps all JOURNAL material separate, he can keep it in binders of the kind described last week. Two such binders will hold all the JOURNAL will produce during the first year. After that it might be wise to transfer everything except the Functional Element Files and their additions from the binders into a general filing system. The reason for this is that the Functional Element Files perform a different function from other material published in the AJ. They are a *first reference* for the architect at the board. The other reference material he will usually only want to refer to after he has got all he can from the Functional Element Files.

The Functional Element Files, in short, when taken together, will form in effect a *design manual* and it is reasonable that they should be kept in manual form. There is the consideration besides that, whereas ordinary reference pages in the JOURNAL multiply at the rate of about 1,000 pages (*ie* 500 sheets) per year, the Functional Element Files, having reached completion, will expand only at a very slow rate; and if they become too bulky from accretions, will be re-written in a more concise form.

How to use the element files

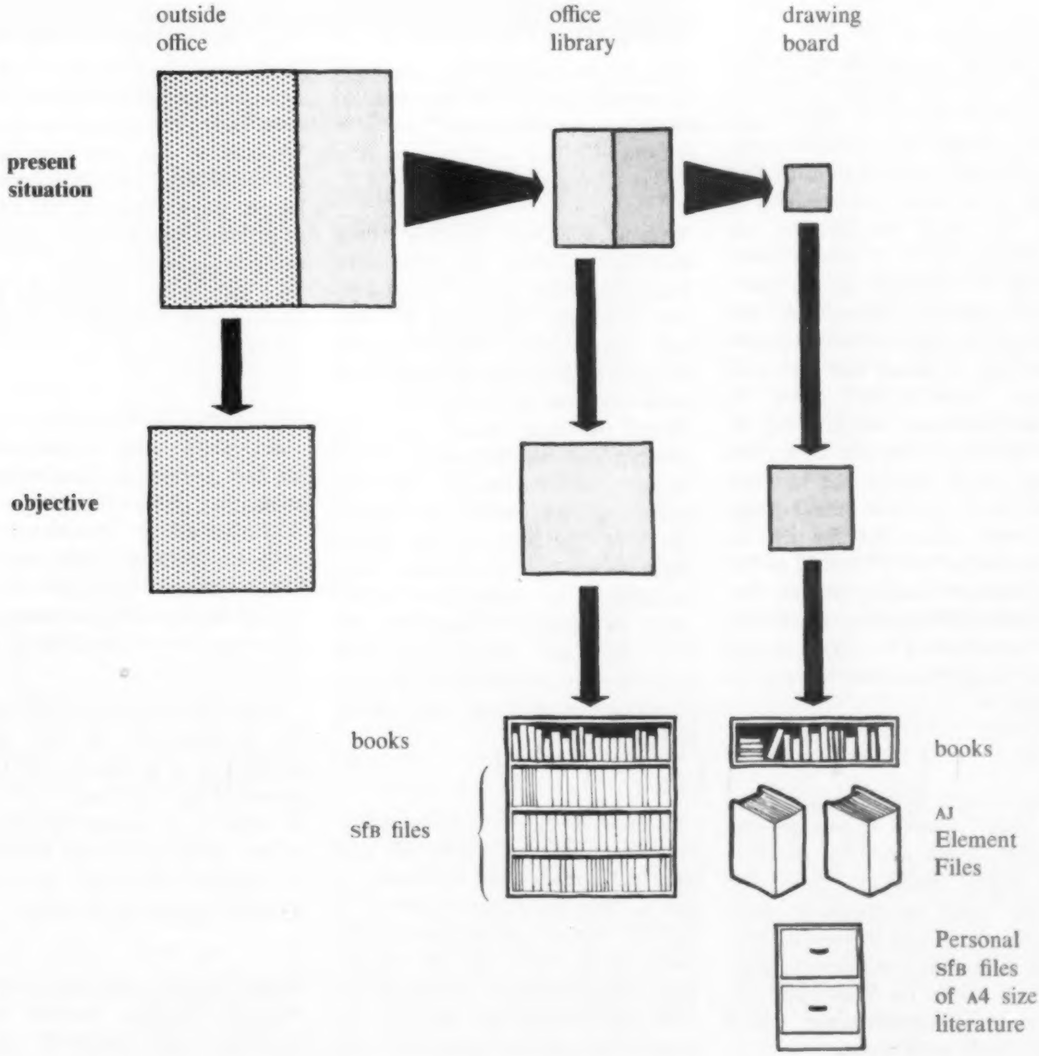
The Functional Element File safely in its binder, how is it to be used? Its most important service is to provide a rational approach to design; but older and more experienced readers may find it irksome to follow the Design Guide step by step when designing each element. Moreover, there is nothing significant in the *order* in which the items are taken. Every job tends to suggest a different order of priorities and so is unlikely to fit exactly the order given in the Element Design Guide. Besides giving a rational approach, it can also be used as a *check*, to make sure that nothing has been forgotten, and to provide a certain *standard of practice* in respect of each item of design. In this the EDG is like an unofficial code of practice. Readers may disagree with the standard put forward in respect of some items (and, if they do we hope they will tell us); but it is of value to have these things set down on paper.

The articles in each file are like ordinary technical references, but they will be more useful than most, since they have been compiled to fill a specific need, brought to light as a result of a prolonged study of the element in question.

Lastly, the Information Sheets are intended to be used as a *first reference* when choosing products. Readers have the general anatomy of the product field spread out before them in a small compass. This will not, of course, get them all the way, for eventually they will have to approach the manufacturers in question; but some of these will have included trade literature of the specific products in the File itself.

To sum up, the Element Files are essentially references prepared *for architects*. Most of them have been written *by architects* and all by men who are themselves in practice. Though many of them have special experience, none are " specialists " in the full sense of the word. Therefore, the files as a whole reflect the broad outlook and sense of relative values characteristic of the architect. Sometimes the information given will fall short of what is wanted. Often, however, this will be the fault, not of the authors, but of the present state of knowledge, for one of the last and most valuable purposes of the series is to throw into relief those parts of the information spectrum which are the worse served. Sometimes it is as useful to show how little is known as how much.

Diagram showing movement of information towards the architect: The areas toned with large dots represent information referred to so rarely that it must always be sited outside the architect's office. The areas toned with small dots represent information which, if suitably compressed, is capable of being sited in the office library but is not referred to so often to be needed at the architect's desk. The hatched areas represent information which ought to be referred to often and should, therefore, be within arm's reach of the drawing board. The horizontal diminishing arrows represent the action of the JOURNAL *in transferring information towards the architect: from outside into the office library and from the office library to the drawing board. The arrows diminish because the information, if it is to be housed conveniently, must usually be compressed.*



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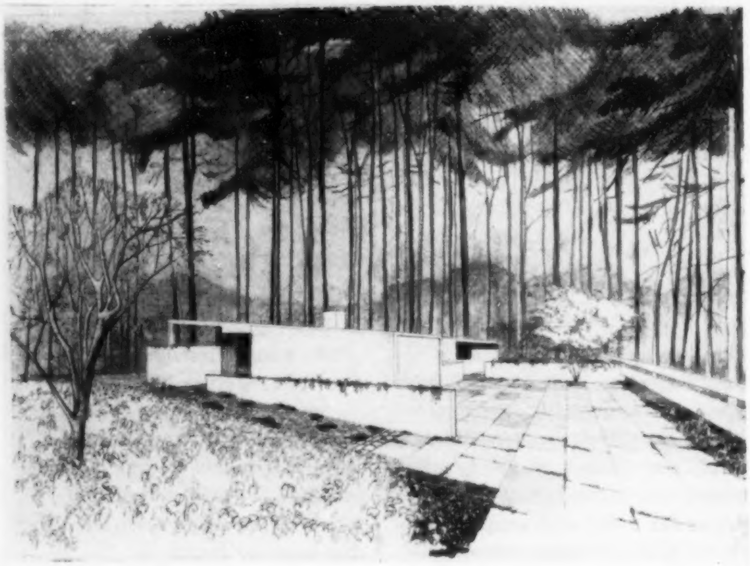
NOTES & TOPICS



See "Surrey You've Been Troubled"

SWEET FANNY B—

This AJ will weigh heavily, in two senses: it is the largest ever published and it will be no light weight on the consciences of architects who, like ASTRAGAL, keep technical information in the waste paper basket or under the brick samples on the mantlepiece. But it is now or never if architects are to master the handling of technical information, and ASTRAGAL has duly ordered a couple of binders, a punch and the RIBA Manual, cleared a shelf, pinned up the SfB schedules and is ready to start. He's obviously not alone: the Editors report that in the last two weeks over 850 new subscriptions have been taken out for the AJ. Having studied SfB 11 and 12 in this issue ASTRAGAL cruelly reckons that next week 5,000 architects will turn their subscriptions in: these earnest lists of design procedure are not for nit-wits.

*

What, people are always asking, does "SfB" mean? It has nothing, of course, to do with that sweet or silly fellow Bullivant, who has improved upon the system he enterprisingly discovered in Sweden, but, as the Gorco Bureau reports elsewhere, it stands for Samarbetskommitten for Byggnadsfragor, which means—well, work it out.

Incidentally, there is a story that when the AJ's printers were bravely struggling to cope with this mammoth production problem, an enquiry by an Editor as to why more SfB proofs were not ready received the near-desperate reply: "we have run out of 'f's'."

*

Unless someone devoted their weekend to making the Minister of Transport think again, the demolition of Euston Arch will by now have begun. Last minute appeals and protests however were still being made when the AJ went to bed.

What the last week's activities revealed was the hollowness of the Minister of Transport's previous expressions of regret for the "necessity" of demolishing the Arch. Those soothing statements were revealed to be completely hollow when on Monday, September 25, John Betjeman pledged the Victorian Society to raise the money for re-erection of the arch—but nobody budged.

*

The possibility of its being taken down carefully and stored till that time had already been canvassed in the AJ, but persistent inquiries at the MOT and BTC could not discover that anybody had given the suggestion one moment's consideration. True, the idea was not new—it was done in the case of Temple Bar, but it was too new for transport officials to assimilate (no wonder we suffer with traffic blocks!)

Had Mr. Marples sincerely desired to preserve the Arch, he could have done so: perhaps by now he has even been persuaded to preserve it. We hope so, but even if he has, the change of heart has come rather too late to acquit him and his advisers of planning and defending to the last ditch an act of vandalism.

We may add that those who put up the arch also knew how to run the railways.

NEW SCIENTIFIC THOUGHT

Incidentally, can anyone explain the *New Scientist*'s schoolboy gabble about the "filthy-dirty Doric arch." Why, it asked, should anybody wish to preserve "this uncleaned lump of stone?" Surely the scientific way of dealing with something dirty is to clean it, not demolish it.

*

Would the same writer kick against the preservation of the useless mementoes of science which are the glories of our museums? Or would he want to demolish the first dissection room at Padua University, so admirably described by a correspondent in the AJ recently?

SURREY, YOU'VE BEEN TROUBLED

One of Surrey's prettier towns, Farnham, was castigated in the

This picture was sent to ASTRAGAL *by the Fibre Building Board Development Organisation Limited, accompanied by a handout which read: " Village Shop, 1961. Can you modernise a village store without destroying its village-store personality? It has been done successfully at . . ."*

August *Architectural Review* for its near-fossilisation. As though to cock a snook at such a rebuke the town council has refused planning permission—against the advice of the Architect's Advisory Panel—for the house shown on p 490. It was designed, by C. E. Broad, to be built in a pinewood at Moor Park, overlooked by one other house, and its opponents give the usual reason for their decision as " incompatibility " with surroundings. The surroundings, where they can be seen, are the incompatible kind you might imagine, and the real reason for planning refusal seems to be that the house, which passed all byelaw regulations, will be much cheaper than its neighbours. It must take a particularly interesting mind to use æsthetic control as a way of enforcing means tests on house owners.

NO BLUEBELLS IN SCOTLAND

Branch railway lines are to be closed in Scotland, thus confirming that we are now replacing our unplanned economy (and community) with an anti-planned one. You may remember that British Railways were intended to support unprofitable lines with their profitable ones, as a social service. The BTC's present preoccupation with " increasing net revenues rather than gross receipts " seems to show little regard for the social service side of railway operations. It's also very well to say that services are being cut only " where railways are no longer the principal carrier." It may well be that in areas where rail revenue is declining the real reason is not road or air competition but simply a decline in the number of inhabitants. The closing of branch lines may leave thinly-populated areas without public transport, or increase the traffic load on a very scanty road system. In any case, Dr. Beeching's savings will only be made at the expense of other forms of transport—making the railways run at a profit (if ever) by off-loading traffic on to rate-and-tax subsidised roads. No gain, in fact, to the country. How about reviving such ideas as comprehensive traffic planning?

LOOK—MUM NO HANDS

Architects who wonder what results the LCC gets for the £20,000 a year it spends on commissioning and purchasing sculpture for schools, housing estates and so on have just had the chance of seeing examples of this patronage in an exhibition at the Festival Hall. Those who went along found nothing of the grizzly municipal sentimentality they might have feared. A local authority that wants sculps of " netball players " or " mother and child " (top favourite, I'm told) might be said to be asking for it. However, the achievements are good, thanks to the choice of sculptors, intelligent placing, well-chosen plinths and a splendid readiness on the part of the patrons to accept what the chosen artist has provided even if it takes a bit of getting used to.

REPULSIVE ATTRACTION

Mumford's new book is full of stuff about " the city as a magnet," but even he cannot recommend a method for repelling people instead of attracting them into our increasingly repulsive and chaotic centres. Still, it's nice to know that one planning authority—Surrey—is determined to stop further invasion of its territory by office development. This county, which has already annoyed speculative builders by resisting housing encroachment on the Green Belt, is banning office building in Dorking, Leatherhead, Sutton, Walton, Weybridge, Guildford and poor old Richmond (a town recently ruined by a complicated one-way street system which has destroyed all its charms for the mere pedestrian). It is willing to make exceptions, however, for firms moving out of London. This sounds admirable; it is a policy which supports the Housing Minister's recent attempt to persuade 200 firms to decentralise themselves. But what happens to London offices when they are vacated? The LCC can't afford to buy them up and use them for something else, so the Lancashire lad, debarred from Surrey, finds a ready-made corner in London itself. In short, one determined planning authority bales out the boat while others stand by and watch the leak grow bigger.

ASTRAGAL

NEWS

The next five million houses

Those architects who maintain that the future housing needs of the great conurbations can be met without encroaching further on the countryside, by building at much higher densities within the conurbations themselves, are talking nonsense. So said Mr J. R. James, chief planner at the Ministry of Housing and Local Government, when he addressed the annual general meeting of the Housing Centre Trust on Thursday (September 28).

To keep pace with the obsolescence of our stock of houses, he explained, we must replace at a rate of at least 1 per cent (or 150,000 dwellings) a year; and so long as we remain prosperous we shall have to build an extra 100,000 houses a year to keep pace with the proliferation of households demanding separate homes. These two requirements alone call for five million new houses over the next 20 years, and this is an absolute minimum, including no allowance for the backlog of slums and overcrowding, or for local industrial expansion and decline: abandoned houses in Pennine valleys cannot help to meet the needs arising from new refineries on deep-sea estuaries. The demand will be much greater if, as a nation, we become affluent enough to afford decent housing for all.

Moreover, these national requirements are unevenly spread. The effective demand for private housing is strongest in the South-east, where 38 per cent of the population secured 52 per cent of the new houses built in the last 10 years; but the proportion of sub-standard housing is vastly higher in the North. Even on the optimistic assumption that we can restrain the growth of the city-regions based on London, Birmingham, Manchester and Liverpool, so that in future they get no more than their share of new housing, they will together take two-fifths of the national output, and the London region alone will account for one-fifth, or one million houses over the next 20 years.

Mr. James then proceeded to demonstrate the impracticability of making room for more than half this number within the built-up area of the conurbation by building at high densities, even if the fullest use is made of inessential open spaces, infilling, and the redevelopment of low-density Edwardian properties. This he did by means of a table showing the gross density equivalents of a series of net densities, given in each case an allocation of only eight acres per thousand people ("substantially short of what it ought to be") for local open spaces, playing fields, primary schools, shops and car parks.

It was evident from this table that in the built-up areas of the conurbations, where existing provisions for such ancillary uses fall short of this standard, and where clearance areas are already being redeveloped at well over a hundred persons to the acre, any further increase in this net density could yield no significant saving in land, and consequently no material reduction in overspill. At the other end of the scale, however, it was equally evident that in many places outside the conurbations, where ancillary uses are amply provided for, and where new development is taking place at about four houses to the acre, the capacity of the sites still available for housing would be very substantially increased if the density standard were raised to a more reasonable level. Good design ought not to be confused with high density, said Mr. James; but good design could secure privacy and amenity at densities much higher than are now applied in many areas of new development. It was these places, and not the built-up cores of the conurbations, that the Minister had in mind when he called for a reconsideration of density standards in Circular 37/60.

At least half a million London families, then, will have to be rehoused beyond the green belt in the next twenty years. Since commuting across the green belt will be too expensive for most of them, there must be a corresponding dispersal of employment; and in view of the magnitude of the problem we must look for the main solution to sizeable established towns between 50 and 70 miles from London, where existing communications, shopping centres and labour pools make rapid expansion possible. Admirable and courageous as have been the efforts of such small authorities as Thetford and Haverhill, they cannot in the nature of things meet the whole need; but Mr. James could see no reason why a contribution should not come from the entry of private enterprise into the profitable field of new town building, as is indeed beginning.

Within all these areas of expansion, he concluded, net densities would in future have to be of the order of fifty persons to the acre on local-authority estates and thirty persons to the acre on private-enterprise estates. Modest as they were, such standards would represent a great advance on the very low figure characteristic of the original development plans for these places. As to the household that wanted an acre or so to itself, it would have to do as the Victorian carriage folk did—seek a site a few miles from a railway station somewhere over 70 miles from London.

DEREK SENIOR

How housing standards could be raised

The fact that housing design generally is lagging behind modern patterns of living comes out very clearly from a report which was submitted to the Institute of Housing annual conference at Eastbourne on September 21-22, when the subcommittee set up in 1959 by the Institute put forward its recommendations. Both local authority and private enterprise housing was considered and the first point made by the report was that "the most obvious matters of which relatively little account has so far been taken in the design of dwellings are: television; space for modern household equipment such as washing machines, spin dryers, etc.; quiet places for children and adolescents to study; cars." That, if you think about it, is a pretty scarifying statement.

The sub-committee, which collected its evidence from members employed by various types of local authorities and by housing trusts, considered the amount of space in the average home was reasonable "if cost is to be taken as the ruling factor," but 38 per cent wanted a little more space, mainly in the kitchen, the so-called "third bedroom" and for

New pattern for old borough. Camberwell's most recent housing project—shown at the recent exhibition at the South London Art Gallery before the glue was dry on the model—is for a sloping 13-acre site at Dawson's Hill, where it is proposed to provide 380 dwellings, with shops, laundries and garages, and pedestrian circulation. 260 dwellings would be in five 10-storey blocks at the top of the site, while 120 two-storey houses are grouped down the slope in thirty clusters of four houses, each with a terrace and garden space contained in a partly enclosed court. Designed by H. C. Connell, borough architect

storage. Of open planning, they reported that "a number of local authorities have no experience of open planning. Generally, the system seems unpopular for council dwellings." The problem here was the adequacy and cost of whole house heating, and the question of privacy for members of the family from one another and from visitors.

On heating, the committee found a noticeable move away from coal and towards electric floor heating, even in mining areas, and a strong demand for whole-house heating, particularly in the North of England. They gave a unanimous "Yes" to the somewhat loaded question "Would it be true to say that . . . the possibility of better heating at low cost depends upon improved insulation?"

In a section on domestic equipment, the sub-committee plumped for clothes washing facilities in the kitchen rather than the bathroom, and commented: "women like washing in own kitchen where they can keep an eye on children and cook a simple meal. . . . Washing it NOT a problem. Drying IS a very serious problem." Spin and tumbler driers are increasingly popular, but heated drying cabinets are not because they are expensive and not entirely efficient.

Housewives like to be able to hang out washing in the sun and air, and some local authorities have provided small communal heated drying rooms, and launderettes in blocks of flats, the disadvantages of which are the need to carry heavy loads quite long distances, and in the case of launderettes, the cost, for the housewife.

A number of criticisms are made of plumbing, from the elementary (as one would think) recommendation that "rising mains should be frost-proof," to the fact that silent WC cisterns should be provided, and that "in multi-storey flats acute discomfort and annoyance can be caused to the ground floor tenants where the soil pipes are internal and where suitable provision for clearing stoppages is not made." The Committee suggests separate connections for ground floor appliances in such cases. Heated towel rails, it points out "are very popular and can be incorporated in the hot-water system at little cost."

The report suggests a desirable minimum scale of provision for electrical and gas points, and points out: "It's very desirable to provide communal television and radio aerials within the roof space or on the roof of all blocks of 4-storeys or more. This avoids festooning the blocks with individual aerials." Booster equipment to give a stronger and more selective signal should be provided where necessary.

On storage the committee was generally satisfied with houses, but found it inadequate in flats and maisonettes unless each dwelling has a separate store. It points out that lifts in blocks must be large enough to take a pram, and that mothers dislike external stores for prams as being chilly and damp.

A series of safety precautions are recommended: electric and gas fires should all have guards (as now required by law) and all open fires, built-in eyelets or hooks to secure an efficient BSS fireguard. Windows are often too low and too easily opened; balconies should be "at least 3 ft. 9 in. high and should have no horizontal features which might enable a child to climb them. Completely solid balconies are not desirable as they encourage small children to find a box or chair to stand upon . . . should therefore have occasional open features." No gaps however of more than 4½ in. and no toeholds. Sound insulation the committee found simply of too low a standard and it urges "More experiments should be carried out on walls, floors and plumbing."

A final section is devoted to the related problems of cars, play spaces and access. For the first it proposes multi-storey garages on housing estates; and on play, puts forward a plan to provide playing areas for children up to 12 (older ones must look to the Parks and Education Committees for provision), in small areas, partly grassed, partly paved and provided with "stimulants to imaginative play, *e.g.* mock-ups of railway engines. . . ." These forms of equipment incidentally are safer, and produce lower maintenance costs than the usual swings and roundabouts, as well as being more fun for children.

Asked finally to list in order importance "any of your suggestions for improvement which are likely to cost more money," the committee voted, in this order, for: larger kitchens; better sound insulation particularly in flats; better drying facilities in flats; more playing facilities in flats; avoidance of developing extensive areas at high densities, say over 120 per acres; better heat insulation; an extra WC where only one is provided; and more garage space.

Finally on standards generally the committee was asked "how the future standards can best be formulated without imposing undesirable restrictions upon freedom of internal planning," and replied: "Fuller consultation between Ministry, architects and housing managers. Regular revision and widespread publication of books such as the Housing Manual as guides not regulations, but in their compilation more regard should be paid to maintenance costs which are often increased as a result of shortsighted attempts to trim a little off the capital cost."

Talking to the Conference about "Housing policy since the war," D. V. Donnison remarked sardonically that if Britain had never had it so good it was about time this were reflected in new housing. "To plan for a doubling of living standards within 25 years—a modest enough target by Continental standards—while building houses without garages or parking space, that cannot accommodate an effective washing machine, refrigerator or central heating system is to lay up serious problems for the future," he remarked.

Pointing out that the small modern house did not lend itself to conversion or division like the older house, he said "We need both wider variety of house sizes and greater flexibility of design that will enable us to adapt houses to the needs of future generations." He wanted a new form of house ownership, which a small down payment, repayments rather higher than council rent, and insurance for the occupier against of major repairs.

Mr. Donnison wanted to see a deferential rate of interest charged to borrowers—eight or 10 per cent as a normal "open market" rate, and two to four per cent for local authority housing and for defined categories of private borrower, who might have to go over to a higher rate of payments if their circumstances improved.

Opening the Conference, Dame Evelyn Sharp commended her Ministry for making a modest start in providing £25 million for Housing Association schemes, and hoped this might be the start of a major scheme "which over the decades might transform the present ownership and management" of much old property. Local authorities, she thought, could do more to overcome the "intertia" of property owners who fail to make use of improvement grants.

DIARY

TPI *Gold Medal:* presentation to Sir William Holford, Carpenters' Hall, Throgmorton Avenue, EC2, at 6 pm. Tea 5.30.
OCTOBER 4

Architects' Christian Union meeting: speaker, J. N. D. Anderson, professor of oriental studies at London University, at the RIBA, at 7.0. Buffet, 6.30.
OCTOBER 5

Modern stained glass: Arts Council Gallery, St James's Square.
OCTOBER 5 TO NOVEMBER 4

Colour in architecture: Course at York Institute.
OCTOBER 6 TO 10

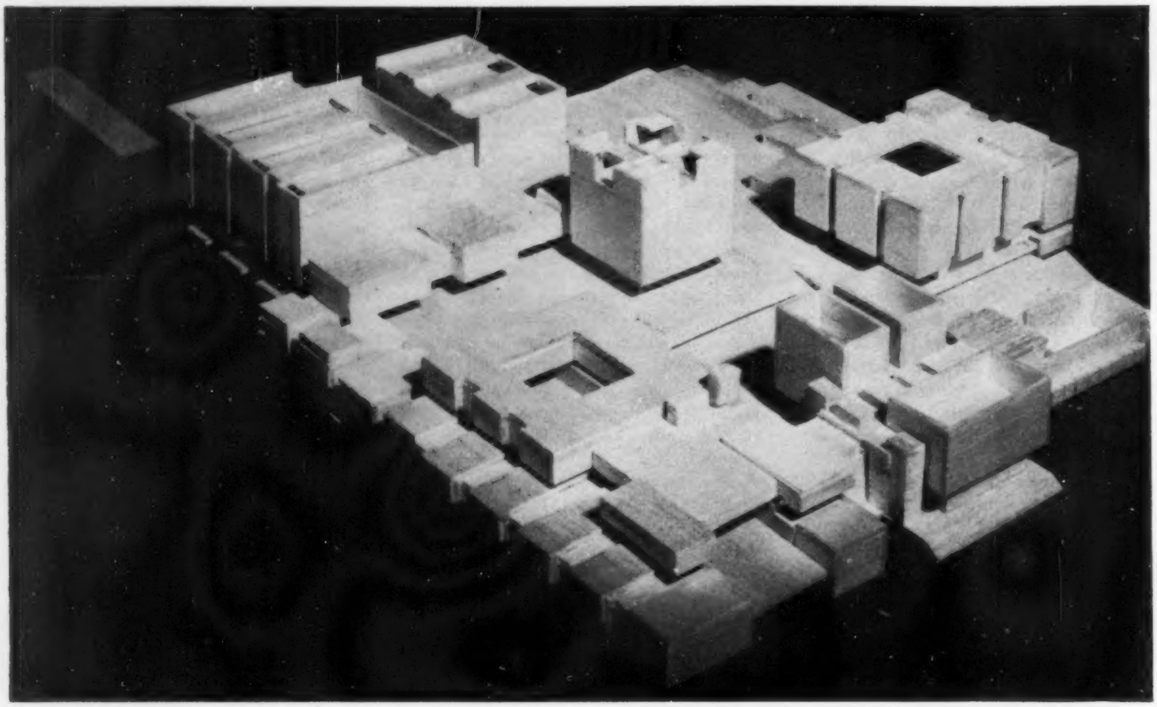
Heating, ventilating and air conditioning: Exhibition at Olympia.
Until OCTOBER 6

Design from Sweden: Design Centre, Haymarket, London.
OCTOBER 6 TO NOVEMBER 4

Swedish Tour Reunion: Slides and photographs, Judith Ledeboer in the chair, at the Housing Centre, at 6 pm.
OCTOBER 10

Correction

In the AJ for September 20, page 398, it should have been stated that the Russian shop in Holborn was designed by John Boissevain in association with Christian Hamp.



From the south-west

Lincoln Civic Centre Competition

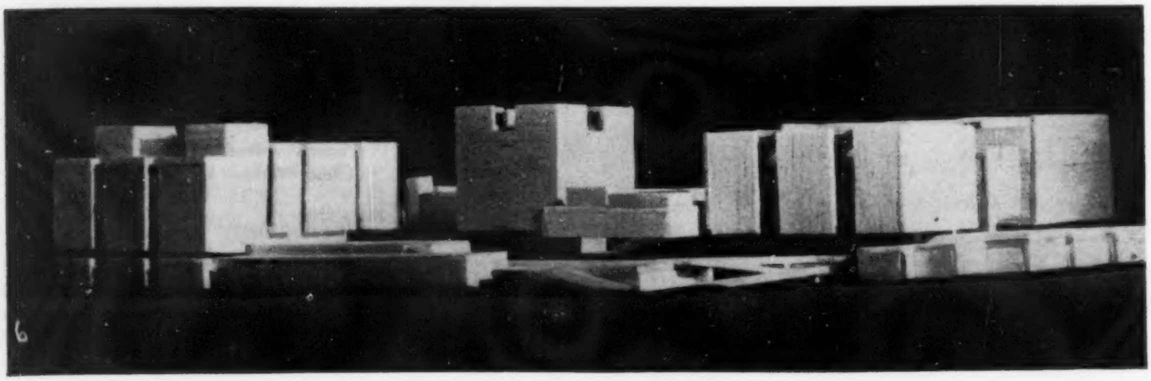
Prize winning design by Eldred Evans and Denis Gailey

As announced in last week's AJ, *the first prize of* £4,000 *has been awarded to Eldred Evans, and Denis Gailey and the assessors, Geoffrey Jellicoe, Sir Leslie Martin and J. M. Richards, have divided the remainder of the prize money equally between three entries, which are awarded* £1,000 *each. These were submitted by Gollins, Melvin, Ward & Partners; Andrew Renton, Peter Howard, John Kennett and Gerald Levin; and James Bourne, David Button, Stephen Osgood (of Burton, Osgood, Bourne and Button) in association with H. Werner Rosenthal. Out of a total of seventy-six entries, the assessors also commended the three designs submitted by A. M. Thompson, Birkin Haward, and a group consisting of J. Attenborough, J. Roberts, W. Chalk, D. Crompton, R. Herron, T. Kennedy, A. Teague and A. Waterhouse*

The spate of competitions for civic centres in the last few years shows no sign yet of ebbing. They are vital competitions for the towns and cities which commission them, because the influence of their architecture tends to permeate through the surrounding central areas. They are usually sited in a central area, which is often in a decayed state. The present movement for the rebuilding of these dead centres can receive a good fillip from such a competition, as briefs often include amenities, squares and assembly halls, which attract the public and can provide a nucleus for the rebuilt central area. Neath, Taunton, Motherwell, Reading, Roxburgh, Corby, Ipswich, Enfield, Carlisle, Finchley, among others, have held or are planning civic centre competitions, though the results have not been universally satisfactory, and in some cases disastrous.

The site at Lincoln is between the cen-

From the north-east

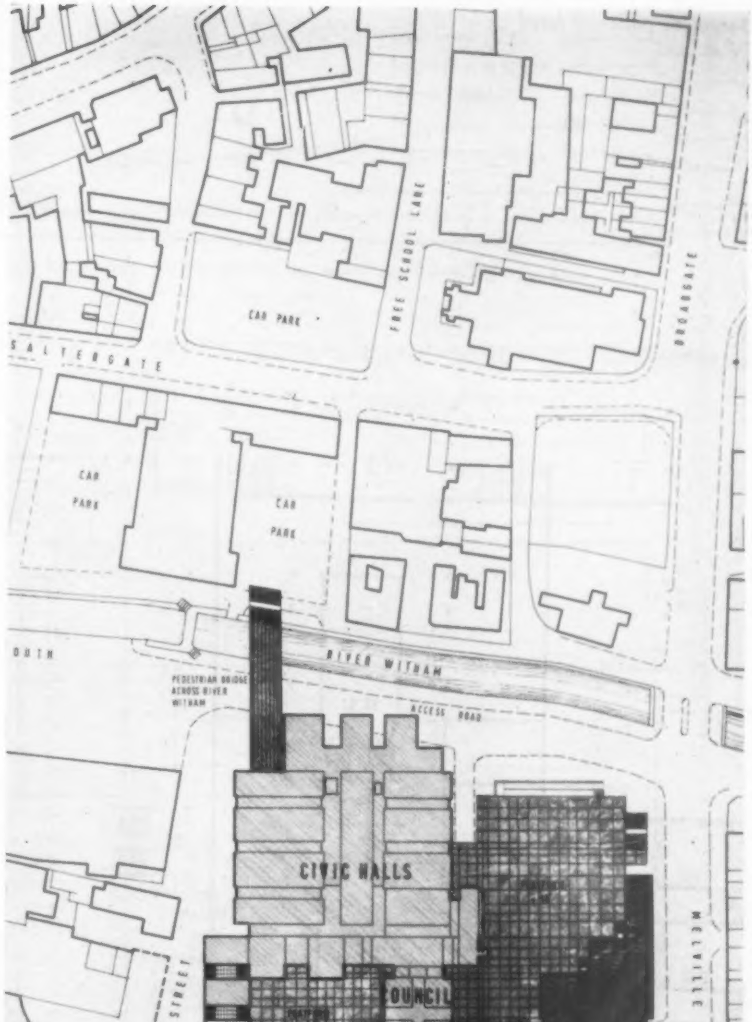


tral railway and bus stations and the old city on the hill across the River Witham. Thus the new centre will stand astride the circulation routes for pedestrians, who cross the river at present by a small footbridge or by the main road bridge. The river itself looks more like a Dutch canal, and the new building gives an opportunity for the development of a riverside walk, although unfortunately on the north side of the river there is the undistinguished side elevation of a cinema and a department store being built in a light buff brick quite alien to Lincoln. At present the civic centre site is partly car park with some early industrial brick buildings, and ragged shops on Sincil Street.

The assessors had a comparatively easy job in choosing the winner, which stands out a long way ahead of the other 75 entries in quality of scale, massing, circulation planning and presentation. In tackling the design of any such civic centre, the major problem is to weld many disparate elements satisfactorily into one whole. In this case there are two public halls, council chamber, offices, mayor's and committees' rooms, law courts, police offices, and canteens. These each have complex and different circulation and security problems which all have to be solved. The winners chose to express these as separate elements rather than to group them in larger volumes, a pattern followed, in fact, by the three other prize-winners. A feature common to many schemes, including the winner, was the idea of a raised podium. On this subject the winners' report states that "car parking areas occur under the podium and with these are combined the ancillary requirements of the various centre buildings so that the major elements themselves may be expressed as pure forms and their functions and relationships to each other made clear." The winners' podium is on several different levels, however, which achieves a pleasant informality. The conditions required the inclusion of a minimum of 27 lock-up shops, which they have cleverly brought into the scheme, instead of leaving them on the perimeter of the site.

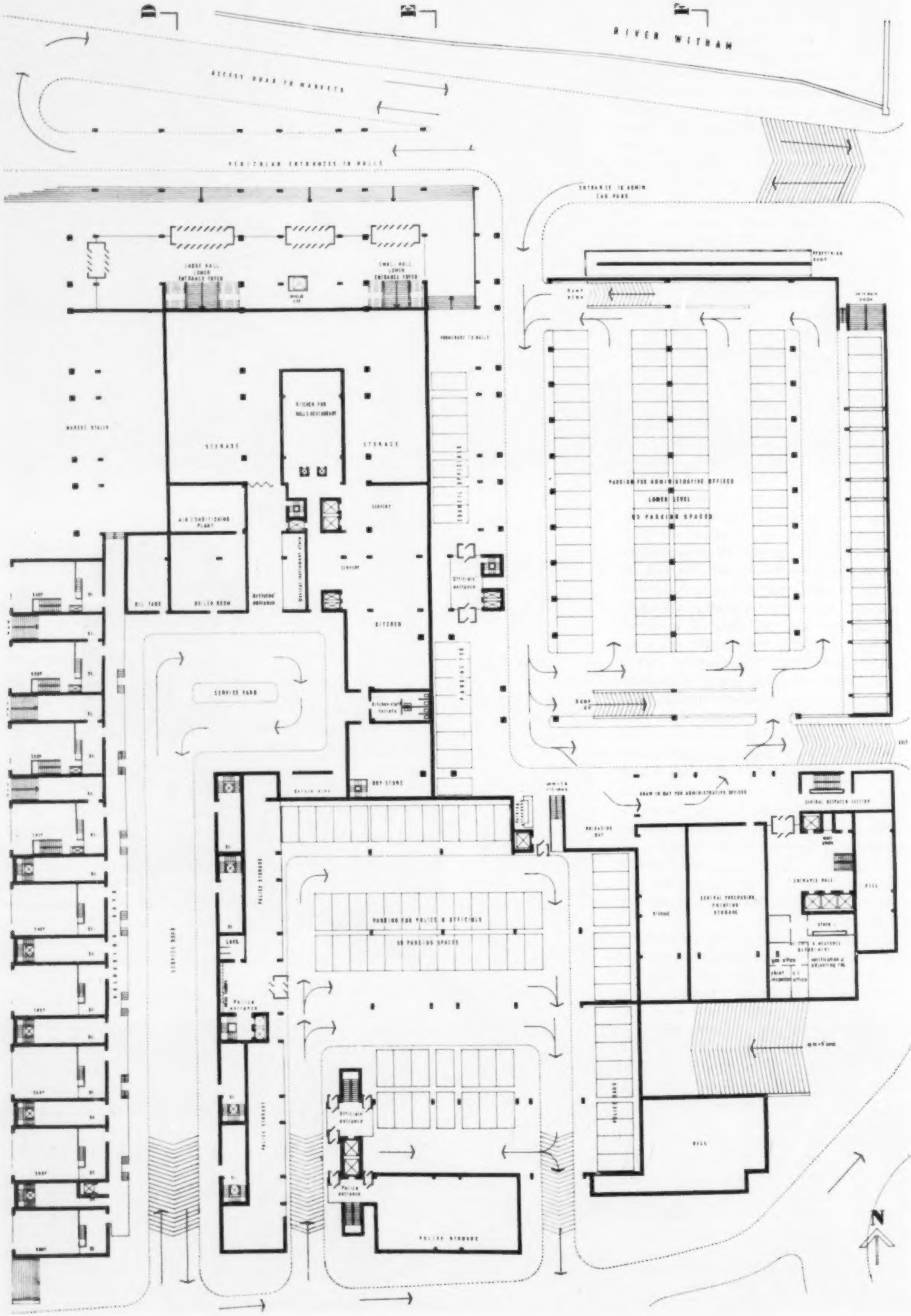
Pedestrians who walk from the stations to the city will ascend a staircase to the podium, where they will pass down an arcade of shops before emerging into the main central spaces. Those who are passing through the centre will go straight on under the main hall and cross the river on a new pedestrian bridge at podium level. Alternatively they can cut across the podium diagonally towards the main road bridge, descending by a broad staircase or a ramp, although the proximity of the staircase to the ramp will surely result in the redundancy of the latter. The buildings on the podium are varied in design to suit their various functions but group together well in general, though the least successful is the office block with its light-well and inset corner columns.

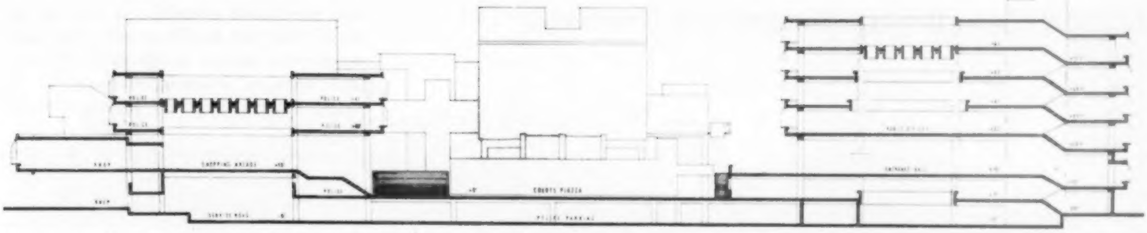
(*continued on p* 498)



Site plan of winning design. North is at top of page

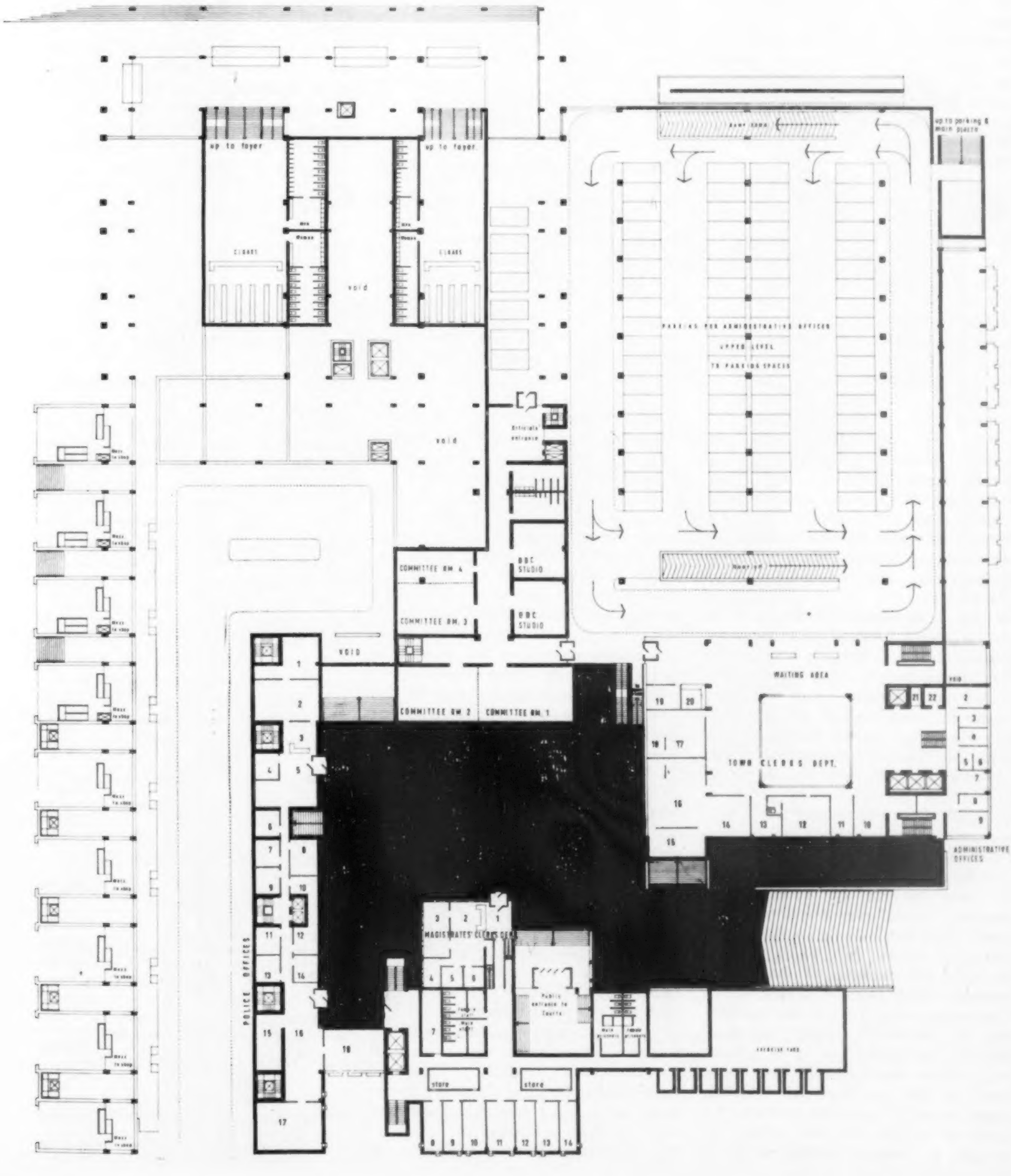
Basement plan —5 level





Above, section looking north, through shopping arcade, police department and public offices

Below, basement and mezzanine plan, +5 level



Lincoln Civic Centre Competition (*continued*)

The scale of the scheme seems admirable for Lincoln and relates well with buildings across the river and up the hill, and will provide a suitable starting point for further development of the south side. The architects say that their buildings will be constructed of in-situ reinforced concrete and are to be faced externally with 18 in × 6 in buff clay semi-glazed tiles used as permanent shuttering. Internally in the civic halls, walls will be natural wood and ceilings precast concrete units with selected aggregate buffed and polished. Foyers will be travertine and hardwood strip.

The other prize winning and commended schemes immediately look less appropriate to the site when compared with the winner. Messrs. Renton, Howard, Kennett and Levin have a long office block down the entire west boundary on their podium, over the Sincil Street shops which shuts off the group from the rest of the area south of the river. Messrs. Bourne, Button, Osgood and Rosenthal's scheme has a 7-storey building across the south side of the site with flanking buildings running north at either side. However, the individual buildings do seem to link awkwardly together and their surface treatments appear unrelated. Messrs. Gollins, Melvin, Ward and Partners' main block is compact, the perimeter columns being placed outside and forming a framework within which the different volumes are expressed. The drawings made the building look very dour, scarcely doing the scheme justice.

Of the commended schemes, that of Messrs. Attenborough, Chalk, Crompton, Herron, Kennedy, Roberts, Teague and Waterhouse had a very metropolitan flavour, their scheme being a faceted "crescent" open towards the cathedral, with the larger masses on the convex south side. This is a dramatic and very interesting scheme, but the assessors' point about the slightly mean character of tunnel access for vehicles seems very relevant.

Thanks to the result of this competition, Lincoln is provided with a project for the redevelopment of a large and important central site, which takes the fullest advantage of the technique of pedestrian access, and which respects the scale and character of the historic buildings which form its setting. There remain two snags. First, as the assessors point out, the winning scheme can probably not be carried out in its present form within the maximum cost stipulated by the conditions of £975,000, despite a rather optimistic estimate. To expect to be able to build offices, for instance, at seventy shillings a square foot in the construction and finishes specified would be very ambitious. But the assessors think that this can be put right by cutting out some of the space provided in the design which was not stipulated in the conditions, and that this can be done without wrecking the scheme.

The second snag is that when the competition was launched, completion was scheduled for 1964, but thanks to the current Treasury squeeze there will, of course, be an indefinite delay in getting the necessary loan sanction.

Prizewinners' report

It is now an established fact that one of the main problems in preparing a design for city centre development is to provide vertical separation of vehicles and pedestrians. This problem was accentuated by the requirements as stated in the Civic Centre programme, in so far as a pedestrian precinct was required which conflicted with other planning requirements and access roads across the site.

A new bridge across the river to a pedestrian deck is suggested as a first step in vertical separation and could be a basis for future development of the area across the river front. In addition, this deck would be extended to the south across Norman Street to connect the Civic Centre directly with the railway station and bus terminal.

Having decided on the necessity of a pedestrian deck, the Civic Centre problem is thus reduced to how best to relate the major volumes to one another in terms of planning and a formal expression, bearing in mind the scale of Lincoln itself and the relationship of the surrounding buildings on the site.

This proposal resolves itself in terms of the main elements being grouped around three varying deck levels, all interconnected and with differing aspects of the town—the most dominant to the north—the cathedral.

Car parking areas occur under the podium and with these are combined the ancillary requirements of the various Centre buildings, so that the major elements themselves may be expressed as pure forms and their functions and relationships to each other made clear. Of these, the council chamber is felt to be dominant, and has been made the nucleus of the Centre, visible from all the spaces within the deck.

Foyer spaces, bars and shops are on the main deck, so that here civic, social and other functions can merge.

The structure proposed is principally in-situ reinforced concrete, as we are advised that this would provide the most economical answer compatible with ease and speed of building, while being the most readily adaptable system for this design.

In certain limited areas to be described individually, we propose the use of pre-cast, and in some cases, pre-cast post-tensioned, concrete.

All buildings are faced with 1 ft 6 in × 6 in × 1½ in buff clay semi-glazed tiles, which are deeply dove-tail keyed on the back and used as permanent shuttering to the in-situ concrete work. The concrete will be vibrated to ensure correct density and to ensure that the keys in the facing tiles are completely filled.

The principal fenestration for all buildings is composed of double glazing, each panel held in a separate aluminium frame, the inner frame openable for internal cleaning. Each glazed unit projects from the main face of the building and the space so formed between faces is used to provide controlled ventilation through aluminium louvres. All aluminium exposed to the weather is to be anodised black.

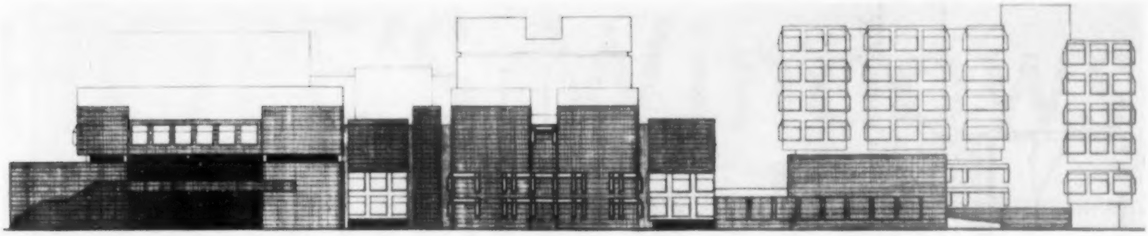
The piazzi are to be laid out with sculpture, water displays, planting and sitting areas, and paved with pre-cast units of varied shapes and colours appropriate to the areas. The river front is to be landscaped.

The principal public accommodation is designed in the first place to meet the requirements of the programme and secondly to meet necessary functional requirements of circulation and purpose. The foyers and bars for the Civic Halls are capable of being easily divided from each other as required by the programme, and additionally can easily be divided and used in part, depending on the nature and requirements of the function.

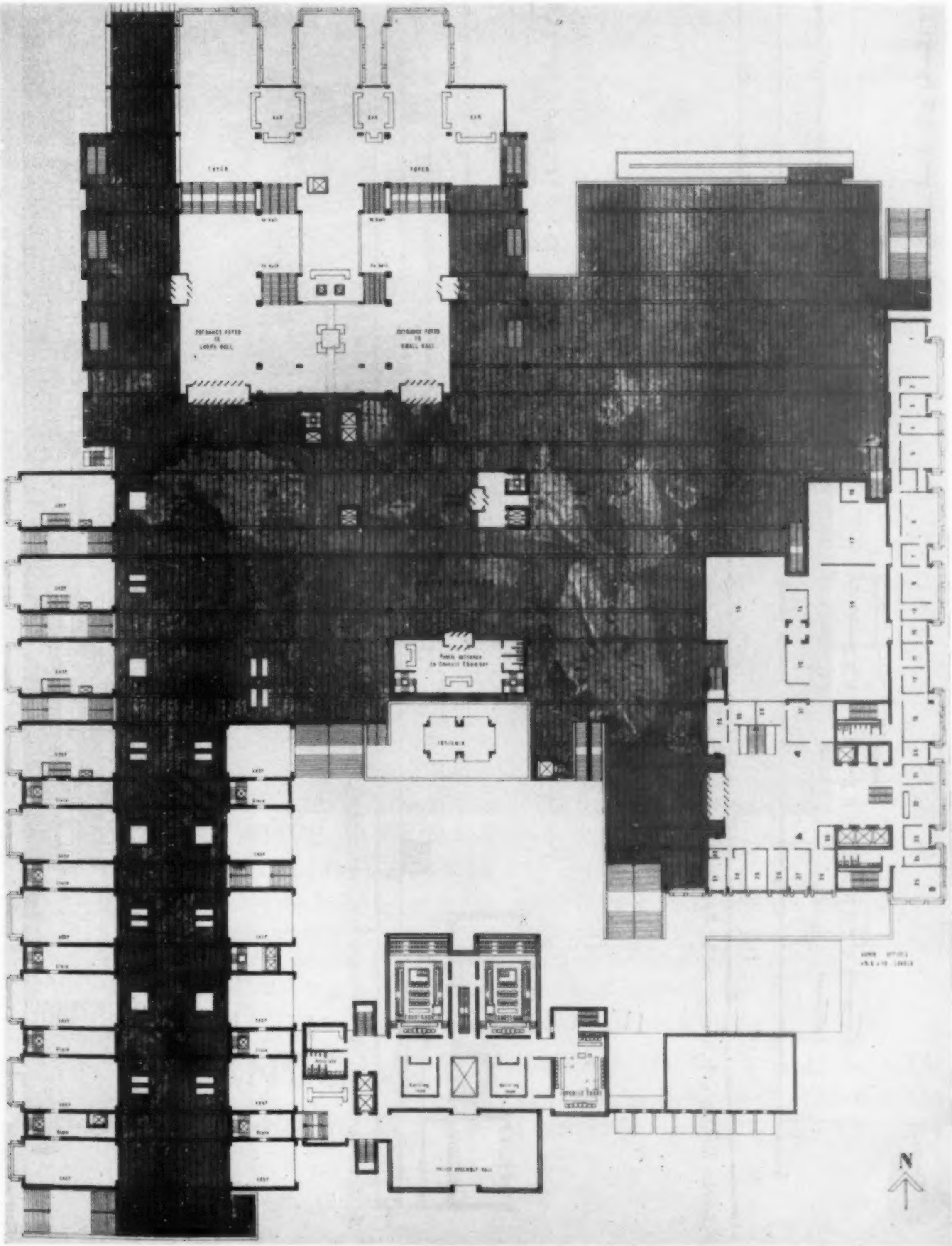
The office accommodation is planned to meet the requirements of the programme but groupings of compatible functions within departments are proposed to provide an economical use of floor space. In practice, the final office layout would be agreed with the Council.

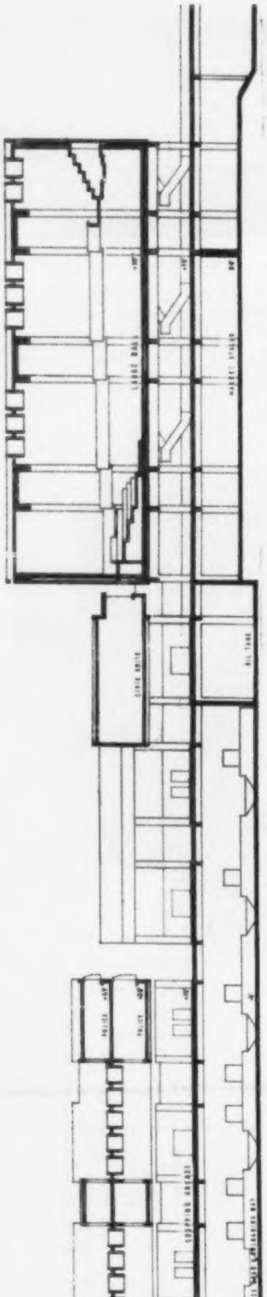
Costs

		£
1.	Civic Suite, Civic Halls, and Courts 74,000 sq ft at £6 0s 0d	444,000
2.	Administrative and Police Offices 83,000 sq ft at £3 10s 0d	293,300
3.	Extra over for car park 28,000 sq ft at 5s 0d	7,000
4.	Extra over for piazzi 126,000 sq ft at 4s 0d	25,000
5.	27 shops at £2,000 each	54,000
	TOTAL	823,300
	Piling, based on programme requirements of 20 ft and 40 ft piles	150,000
	TOTAL	973,300
	Proposed Bridges at, say, £15,000 each	30,000
	TOTAL	1,003,300

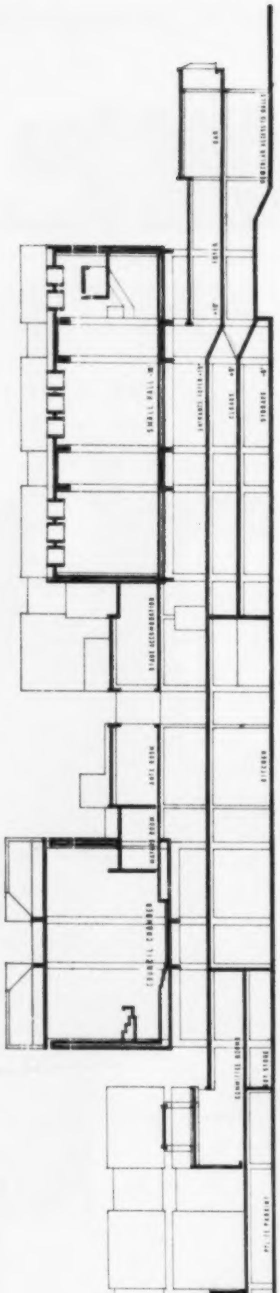


Below, main piazza plan, +15 level *Above, south elevation*

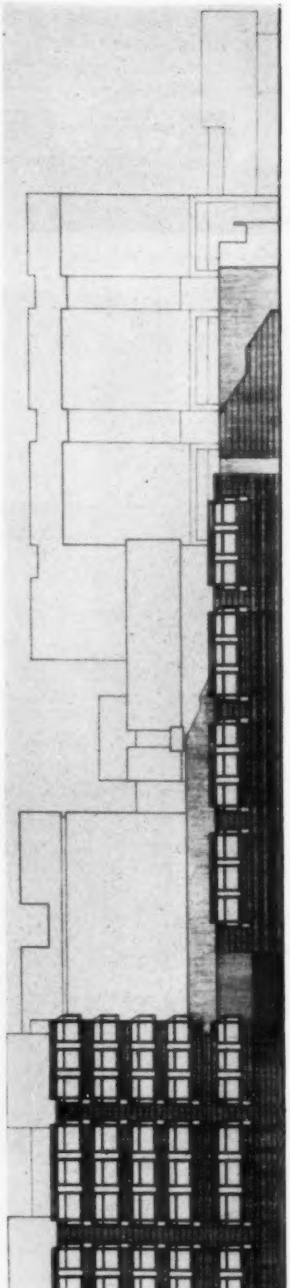




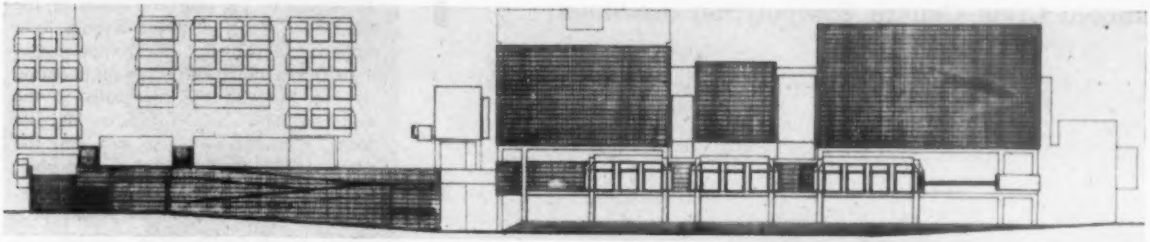
Section looking west through police department and large hall



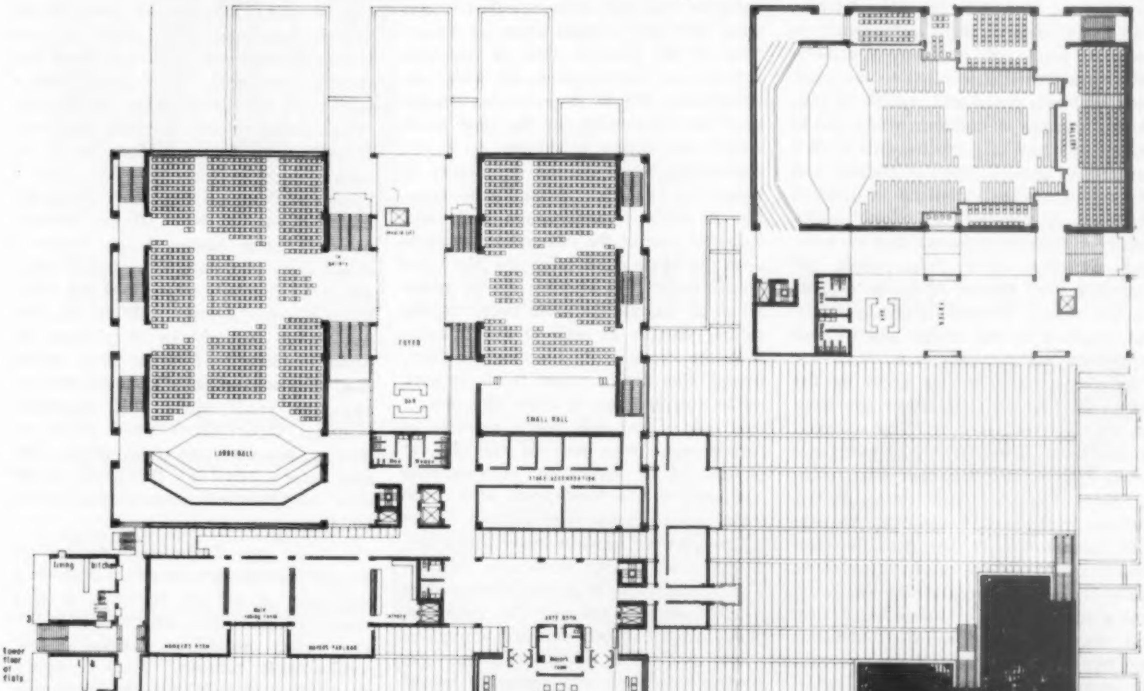
Section looking west through courtroom, council chamber and small hall



East elevation



Above, north elevation. Below, plan at + 30 level, with inset, top right, gallery plan of the large hall, and inset, bottom right, the plan of the administrative offices at + 41 level. At this level a courtyard with pavement lights covers in the central area of the police department, forming a roof to the arcade below at +15 level



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Lincoln Civic Centre Competition (*continued*)

Assessors' report

The competition produced several interesting designs and one of outstanding merit. This, No. 58 (Eldred Evans and Denis Gailey), is in our unanimous view a design of very great quality, offering a masterly solution to the complex problems posed and capable of producing a group of buildings which would endow the city of Lincoln with a civic centre of unusual appropriateness and distinction. When examined in detail it disclosed a number of minor faults, chiefly in internal planning, but we satisfied ourselves that these could be remedied, after further study on the part of the author, without requiring major modifications in the design and without changing its basic conception.

The estimate of the cost given by the author of No 58 was within the limit set, but we were very doubtful whether, in the form shown in the drawings, it could be built for this sum. The design contains, however, certain extravagances, such as two levels of covered car-park, with room for more cars than the conditions called for, a considerable foyer space beneath the area of the two halls and a smaller hall of unnecessary size, and once again we satisfied ourselves that by modifying these the design could be brought within the cost limit without changing it basically or losing any of the qualities that we had found so impressive. This being so, and in view of the outstanding quality of No 58, we felt fully justified in awarding it the first prize and recommending it warmly to the Council.

There were half a dozen other designs deserving serious consideration, each with some very good qualities, but each of these also had some serious defects, and unlike the defects we had found in No 58, they were defects inherent in the basic conception. None of these designs stood out sufficiently above the others to justify awarding it second prize. Three of these runners-up, Nos 7 (Andrew Renton with Peter Howard, John Kennett and Gerald Levin), 19 (Gollins, Melvin, Ward & Partners) and 59 (James Bourne, David Button, Stephen Osgood and H. Werner Rosenthal) seemed to us to be equal in merit and we thought it fairest that they should share the remaining prize-money.

Competitors were set a highly complex problem, which was made both more difficult and more interesting by the opportunities it offered to influence the future layout and architectural development of the lower part of Lincoln. The decision to make Sincil Street pedestrian was clearly one of the many important decisions that will soon be taken in this area. The best designs show an awareness of the possible role of the civic centre as a starting-point for wider developments. No 58 in particular emphasises the relationship of the new levels which this design establishes to future replanning, based on the desirability of separating vehicles from pedestrians. No 53 (John Attenborough and John Roberts) (one of the commended designs) does the same effectively, and No 7 has given constructive thought to the possibility of linking the civic centre in the future, visually as well as functionally, with the rising ground across the river, though this design rather turns its back on its surroundings in other directions.

One role of the civic centre must be to furnish the lower part of the city, at present of a somewhat indeterminate character, with a focal point, and at the same time to bring older Lincoln on the hill and newer Lincoln lower down into a clear relationship with one another. This is where No 58 stands alone among the competition entries. The group of buildings it proposes, compact enough to assert itself as a single entity yet preserving interesting and agreeable spaces within the site, echoes in its proportions and silhouette the buildings on the hill below the cathedral (which forms the background to the scheme), and thus creates for the first time some visual unity between the old and new parts of the city. Although it promises to fall naturally into place in the Lincoln landscape, No 58 has a strong and vigorous architectural character of its own, and the several elements in the group, clearly identifying themselves according to their different functions, are handled with remarkable control, with the council chamber appropriately rising up through the centre.

No other design succeeds so happily in combining a relationship to the setting with the intelligent placing of the buildings on the site from the point of view of access and function. Other competitors have placed their buildings on the most of it, some enclosing courts of site in various ways, some sprawling over various shapes and sizes, some opening up the site as far as possible towards one of the two main streets or to the river and some freeing space on the ground by putting part of the accommodation in a high tower, which we did not however think appropriate to this site, dominated by the cathedral tower on the hill above. Most of these layouts have serious functional or compositional drawbacks, and the arrangement favoured by No 58, with the two halls to the north but easily accessible from Melville Street, the offices on the east and the police group on the south-west corner, seemed to us to be the most satisfactory. In contrast to the squarish blocks proposed by No 58, some competitors employ long horizontal wings, especially for the offices. In the case of No 59, one of the three designs we recommend for prizes, the office wing is nearly 500 ft long, creating difficulties of scale, though as this wing runs from south to north it has not the disadvantages of those that run the other way. These would form a horizontal barrier blocking the interior of the site from the important viewpoint at the foot of Pelham Bridge. One of the commended designs, No 53, runs a barrier of this kind diagonally across the middle of the site, No. 1 (Birkin Haward) places a large square block where it would have the same obstructive effect, and No 7 not only runs a 6-storey office block along the south side of the site, but makes the mistake of placing the police buildings on Melville Street on the east, with sunken parking and other unattractive yards along this important frontage. Apart from these errors of placing, however, and some minor planning defects, No 7 is a thoughtful design with well-handled domestically scaled buildings.

No 7 is one of the few meritorious designs that has not chosen to cover in a large part of the site in the form of a raised piazza from which the buildings rise, providing car-parks and service-roads beneath. Such a raised piazza has obvious advantages, especially in view of the low ground level of the site, it being difficult to create an impressive group of buildings in a dip. Once again No 58 handles a raised platform—or in this case a series of platforms at different levels—particularly well both in relation to the surrounding landscape and to the spatial effects created within the site. This and several other designs make interesting use of these raised platforms to provide shops on two levels; in the case of No 58 the upper level shops form an arcade on the line of the main pedestrian flow across the site, thus avoiding the disadvantage of upper level shops to which the public have to make a special journey.

Apart from the extravagances already mentioned, the defects of No 58 are chiefly defects of detailed internal planning. Some of the entrances and approaches need improving and the allocation of space needs adjusting; there is too much space in some places and too little in others. This is especially so in the office block, where poky, badly shaped rooms are combined with wasteful waiting spaces—in fact the floor-plans of this block need restudying.

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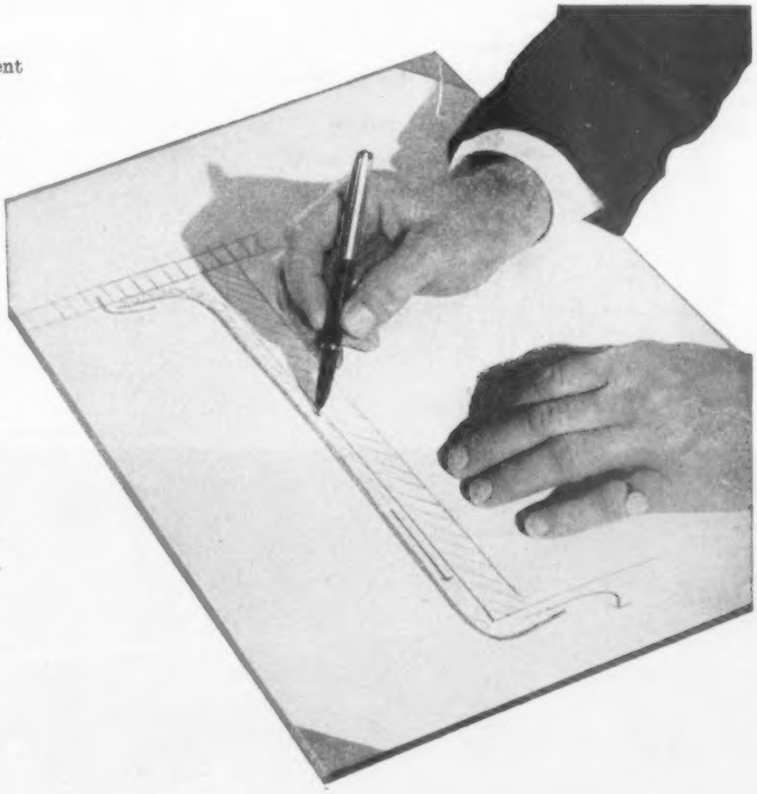

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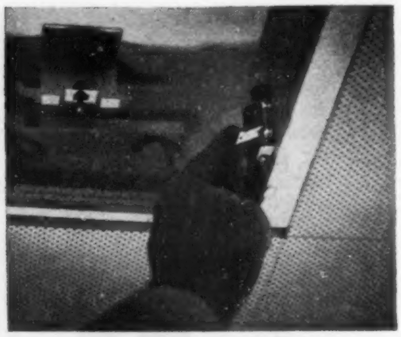

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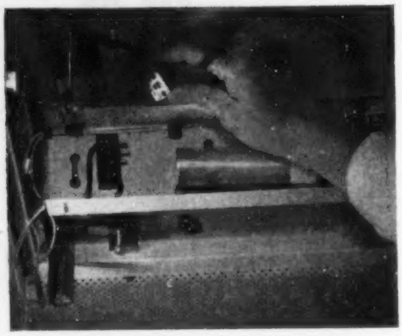

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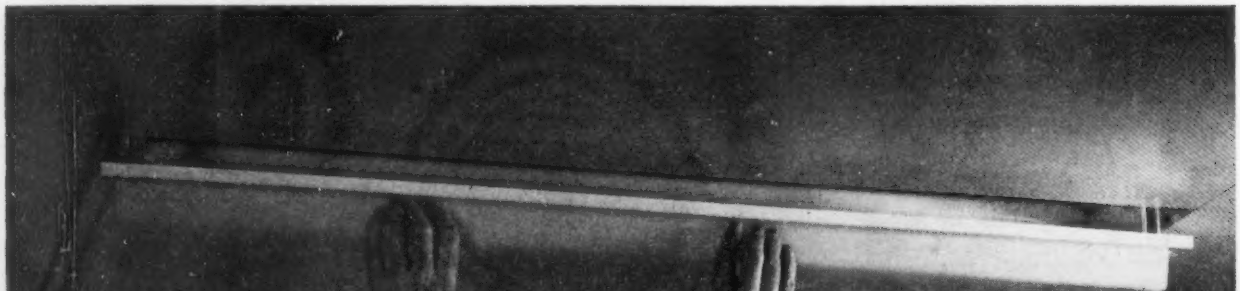

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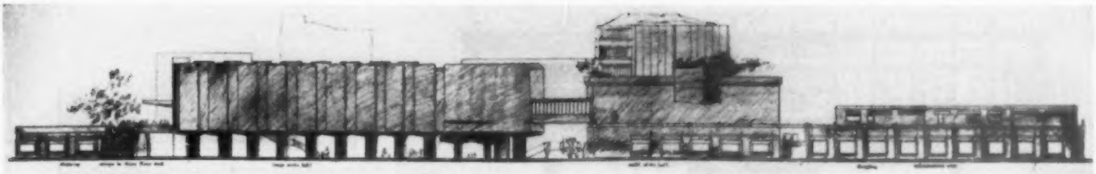
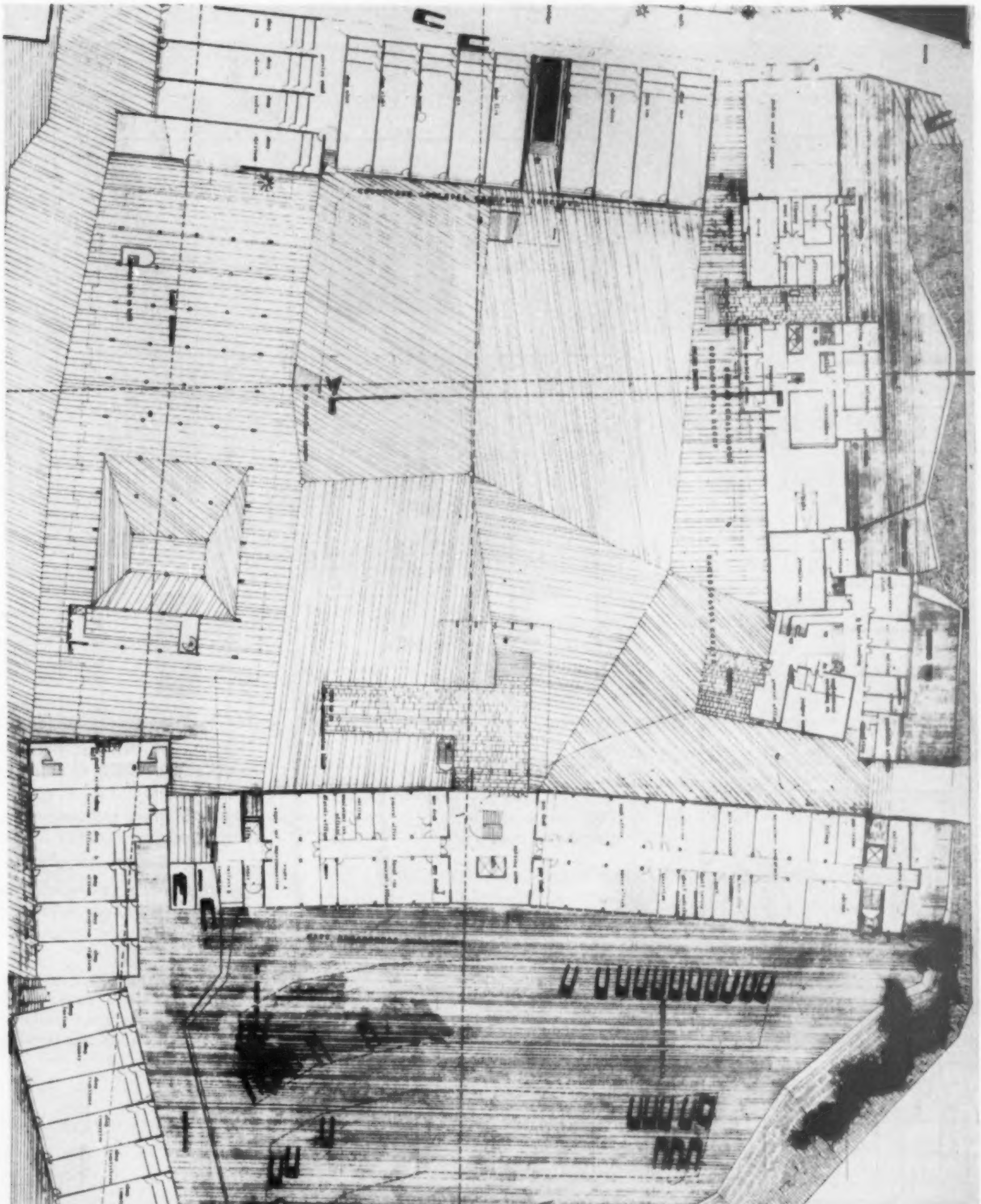
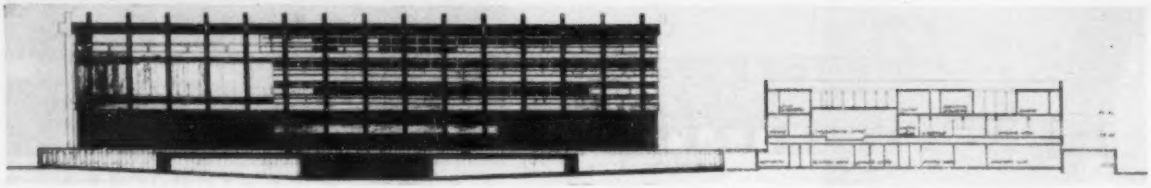
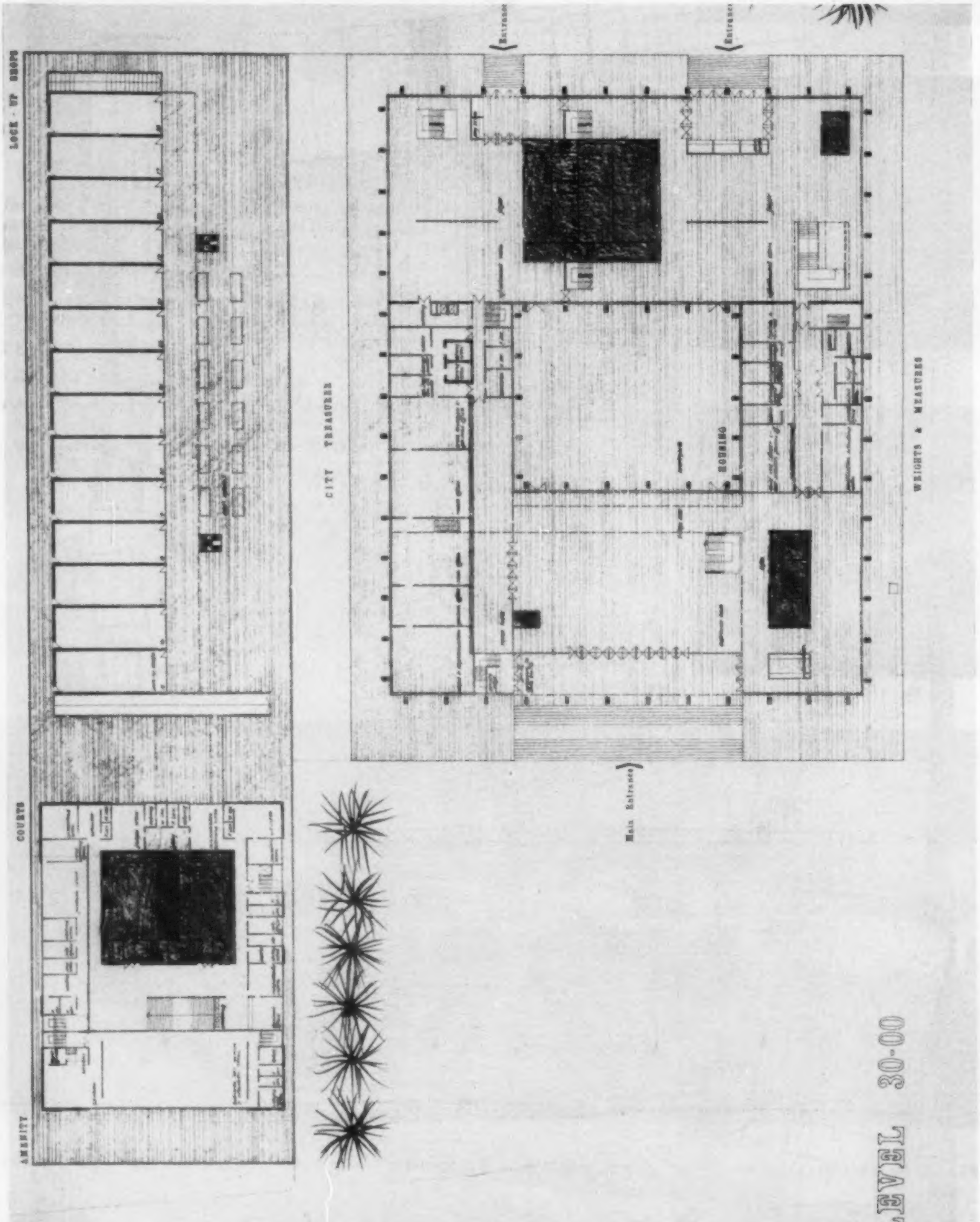


Joint second prize-winning design by Bourne, Button, Osgood and Werner Rosenthal Above, elevation to Sincil Street Below, upper ground floor plan





Joint second prize-winning design by Gollins, Melvin, Ward & Partners. Above, section through court block and elevation of treasurer's offices and halls. Below, plan at podium level from the north, which lies towards top of page



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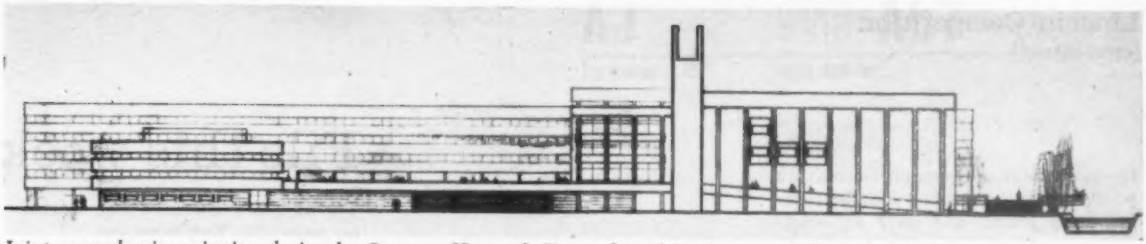
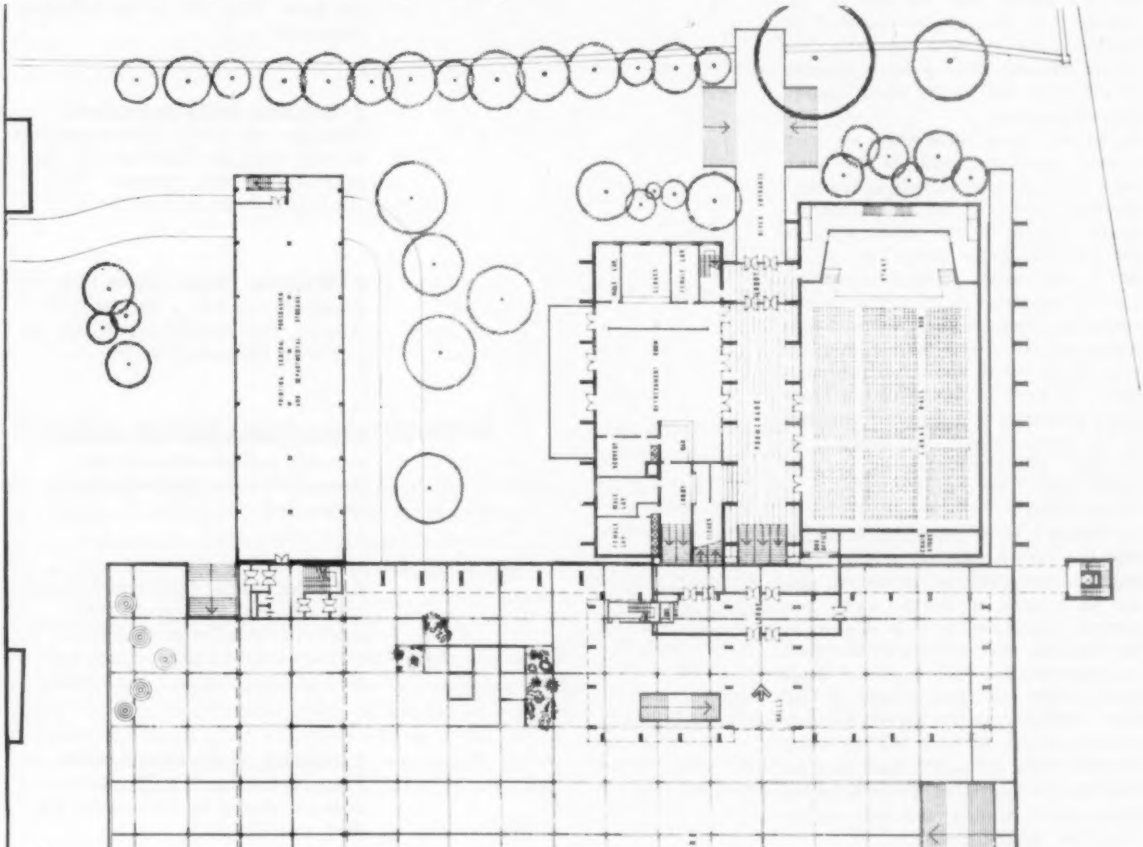


Joint second prize-winning design by Renton, Howard, Kenneth and Levin. Below, plan at civic square level, north is to the right

Above, east elevation.



Lincoln Competition
(continued)

Drawing-offices and committee-rooms are poorly lit and ventilated and the latter are badly placed, and there are weaknesses in vertical circulation. It is necessary to draw attention to these defects, but we repeat that we are of the opinion that they can be remedied by further study without changing the design basically, the general planning of which, as well as the whole conception, is excellent.

As to the three runners-up, we have already mentioned some of the much more basic defects, as well as the considerable merits, of No 7 and the excessive length of the office wing in No 59. This latter design is, on the whole, very cleanly planned. It provides a broad pedestrian piazza across the site, continuing underneath the two long wings to form a roof terrace over the Sincil Street shops. The mayor's entrance takes the form of an isolated staircase tower connected with the other buildings by a bridge, which we thought ineffectual; the approaches by car are rather poor. The architectural effect is disappointing.

No 19 has a more positive architectural character and is laid out in three rectangular blocks well placed on the site, but (in contrast to designs which give separate expression to each element in the scheme) tries to incorporate such disparate elements as ranges of small offices, halls and council suite in one large hollow square, which becomes rather cumbersome and out of scale. The two halls are well related and the detailed planning good. There is an inappropriately large entrance-hall and the shops are poorly placed.

Design No 1 is commended because of the neatness and efficiency of its plan (which again compresses the two halls and the council suite into one cubic envelope, denying itself the opportunity of using the variety of elements in the scheme expressively). The internal spaces and external character could have provided more sense of occasion. No 50 (Alan M. Thompson) also commended has a well-worked-out plan, though the spaces created at piazza level between the buildings are not so satisfactory. The shops are interestingly planned. Finally, No 53, on which some comment has already been made, has unusual interest in itself. Its eight-storey block, which has the effect of opening up the site elsewhere, would be massive in spite of its stepped outline. The access by car involves the use of somewhat tunnel-like approaches. Other designs, however, have this defect, underground access for the motorist, slightly lacking in dignity, being perhaps the price that has to be paid for spacious piazzas for the pedestrian.

File this week

The AJ's new Element File starts on page 525. But from the opposite page onwards, readers should also tear the pages out and file them. They are in the following sequence:

1. Technical Study on Daylight Contours [sfB Ab7]. This should not be filed with the Element File but separately in sfB sequence. (See sfB tables in AJ, September 27.)

2. Working Detail: Roofs [sfB (26)] A monitor roof to a library in St. Austell. This should eventually be put with Element File 26.

3. Publications File: a record of recently published books and pamphlets to be filed separately under Aa2.

4. Products File: this record of new products and services on the market is marked so that it can be torn up into A6 sized sheets and filed in sfB order as a card index.

5. Building Study, second series. Flats in London N1. This cost analysis should be filed under sfB (98), UDC 728.2.

Then follows:

6. Element File sfB (11)

7. Element File sfB (12)

These should be extracted from the AJ and kept intact. Next week you will receive sfB (13), *Retaining Structures*.

AJ SfB Ab7

Technical study UDC 628·92

Simplified daylight contour construction

So far as published sources are concerned, the construction of Daylight Contours is still governed by the provisions of the current Code (CP3) which are known to be inaccurate. This Code is soon to be revised, but in the meanwhile Dr. John W. T. Walsh, O.B.E., gives Journal readers a more satisfactory working tool.

A good idea of the daylight conditions in a room can be obtained from a plan showing lines of equal daylight factor* (analagous to the contours on a map) for a series of values of this ratio. An example is shown in Fig 1.

The "Graded Sky-Factor Tables" reproduced in the British Standard Code of Practice (CP3—Chap 1(A), Daylight) enable the contours for 0·5 per cent, 1 per cent and 2 per cent daylight factors to be drawn approximately, since they give (*a*) the depth of penetration, ie the distance from the outside of the window wall to that point on the contour which is opposite the centre-line of the window, and (*b*) the half-breadth of the contour, both for a wide range of window dimensions and for different angles of external obstruction.

* *Daylight Factor:* Throughout this article the term *daylight factor* is used to denote the ratio of (*a*) the illumination at a point due to light received directly from an overcast sky to (*b*) the illumination of a surface exposed to the whole of the sky. This ratio is properly referred to as the *sky component of daylight factor* but the use of the shorter term seems allowable, provided the meaning temporarily assigned to it is made clear.

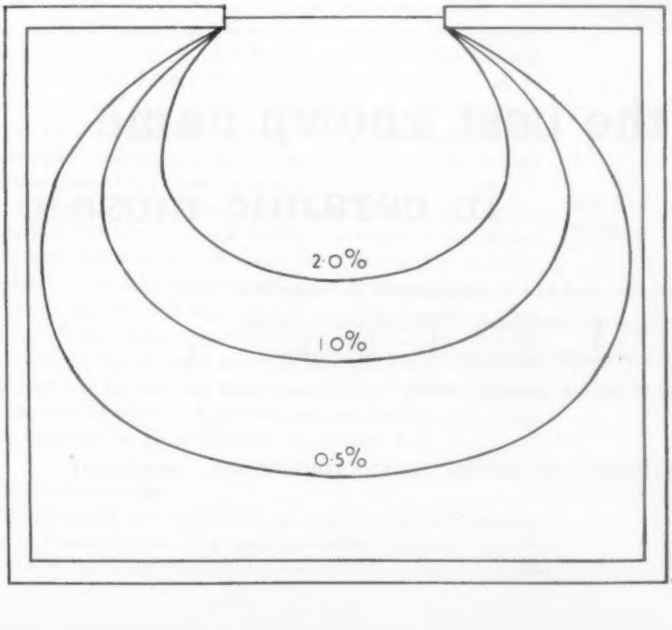


Fig 1 Daylight Factor contours relating to a window

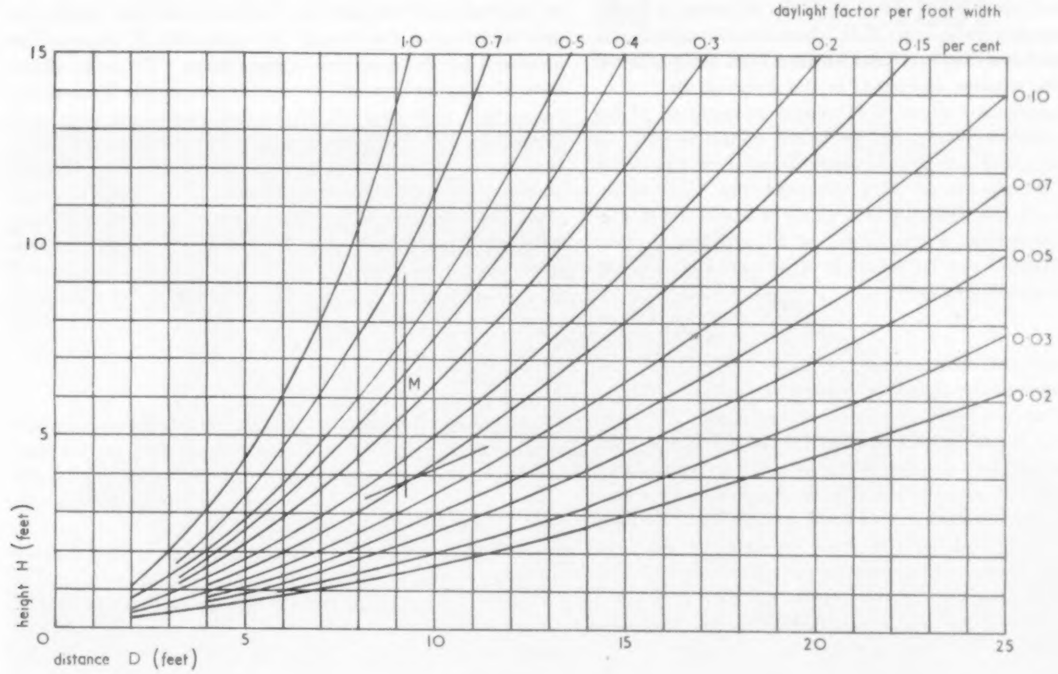


Fig 2 Curves giving daylight factors for each foot of window width

These tables, however, have two limitations. In the first place they were calculated for a sky of uniform brightness and not the brightness distribution now generally taken as typical of overcast skies. In the second place, the external obstruction is assumed to have as its upper edge a horizontal line parallel to the window.

To find the exact form of any particular contour under given conditions is no simple matter, especially if the obstruction is irregular, but on the other hand a useful approximation can be arrived at on the drawing board by the use of a simple graph. The Unit-Width Principle.

The formula for the daylight factor at a given distance from a rectangular window of specified dimensions does not lend itself readily to solving the converse problem of finding the distance at which such a window provides any particular value of daylight factor. If, however, the window is very *narrow* the problem becomes much simpler and, in fact, it is easy to draw a curve giving at once the distance at which some specified daylight factor is obtained *per foot of window width* for a window of any given height. A number of such curves are shown in Fig 2.

For example, if a narrow window is 8 ft high from working plane to window head, the distance at which it provides a daylight factor of 0·1 per cent per foot width is approximately 17 ft 3 in. Consequently, to the approximation to which a window 5 ft wide may be considered narrow when viewed from a point opposite the centre of the sill and about 17 ft away, the daylight factor at that point is 0·5 per cent. To find the distance at which the daylight factor is 1 per cent, the curve for 0·2 per cent per foot width is used and the distance for H = 8 is seen to be 13 ft 6 in.

Contour construction

The principle just described can be applied immediately to the construction of a daylight factor contour, because the curves of Fig 2 are not restricted to points opposite

Fig 3 Application of principle to a point at an oblique angle to the window opening

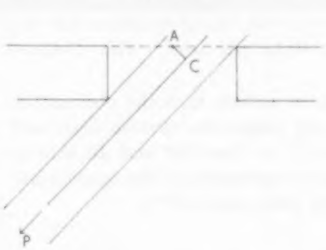


Fig 4 Diagram showing allowance for depth of reveal

the centre of the window. For example, referring to Fig 3, the distance along the line CP at which the daylight factor has a given value can be found at once from the projected width of the window as viewed in the direction PC.

In the example used above, if PC makes an angle of 30 deg with the window plane, the projected width is half the actual width, ie 2·5 ft and a daylight factor of 1 per cent therefore corresponds to 0·4 per cent per foot width. This gives for the distance D a value of about 10 ft 4 in and this, therefore, is the length of PC. As many other points as desired can be found in the same way and the contour is thus determined.

Allowance for wall thickness

In the immediately preceding paragraphs it has been assumed that the window wall is of negligible thickness, but in fact it is not difficult to allow for this thickness when finding the effective window width in any particular direction Fig 4 will show how this is done. Two lines are drawn parallel to the direction considered and passing through those edges which limit the view through the window. The distance between these lines is the effective width and CP is the line mid-way between them. C is the projection on to this line of the centre of the aperture in the outer surface of the window wall (A in Fig 4).

External obstructions

The effect of any external obstruction on the distance CP can be allowed for by drawing on the graph of Fig 2 a sloping line making an angle with the horizontal axis equal to the average angle of elevation of the obstruction (generally measured at the window sill). This line shows the daylight factor lost at any given distance D owing to the presence of the obstruction. Thus if, as in the previous example, a daylight factor of 0·4 per cent per foot width is required, it is necessary to find the vertical line on the graph for which 0·4 is the *difference* between the daylight factor at H = 8 and the daylight factor at the point of intersection with the sloping obstruction line. This vertical line is shown at M in Fig 2, for it will be seen that where M cuts the line H = 8 the daylight factor is about 0·55 per cent while where it cuts the obstruction line the daylight factor is about 0·15 per cent. The distance D is thus 9 ft 3 in.

There is now no necessity to assume that the obstruction has any particular form; its angle of elevation may well change with the position of the line CP and all that is needed is to draw a line on the graph with the appropriate angle of slope when finding each value of CP.

Sky conditions and glazing losses

The Graded Sky-Factor Tables referred to earlier were calculated (*a*) for a sky of uniform brightness (as mentioned earlier) and (*b*) with a uniform allowance of 20 per cent for loss of transmission through the window glass. It is now becoming customary to relate values of daylight factors to overcast sky conditions, with the brightness gradually diminishing from the zenith towards the horizon. The curves in Fig 2 have been drawn for overcast sky conditions and, at the same time, allowance has been made for the loss by reflections at the surfaces of the window glass. This loss is not quite constant, although the variation is small under ordinary conditions. No allowance has been made in Fig 2 for loss due to dirt or for losses brought about by the presence of glazing bars, etc.

If it is desired to include an allowance for dirt, this may be assumed uniform and the values of daylight factor per unit width used for finding the distances CP must all be increased by the appropriate percentage. To make allowance for glazing bars and the like is less simple because the percentage reduction of the overall glass area may well depend on the direction in which the window is viewed. In many cases the best that can be done is to make another uniform percentage allowance appropriate to the type of window construction, eg 20 per cent for all metal windows, 30 to 35 per cent for all wood windows, and so on. This allowance increases the daylight factor per foot width needed for a given contour in exactly the same way as the allowance for dirt on the glass.

Accuracy

The accuracy of any particular value of CP depends mainly on the extent to which the projected width of the window can be regarded as narrow in comparison with the length of CP. In other words it depends on the angle which the window subtends at P.

It will be seen that the greatest error occurs at the point opposite the centre of the window, so a good working rule is to restrict the use of the method to contours for which the depth of penetration is not less than 1½ times the clear width of the window. The error made in estimating the depth is then about 7 per cent. If this is considered too large, the method should be further restricted to drawing contours for which the depth of penetration exceeds twice the window width. The error is then always less than about 2 to 3 per cent, the calculated depth being too great in all cases. It should be noted that the height of the window is quite unrestricted, but if it is exceptionally low the contours are shallower than normal and the application of the rule just given may severely restrict the use of the method.

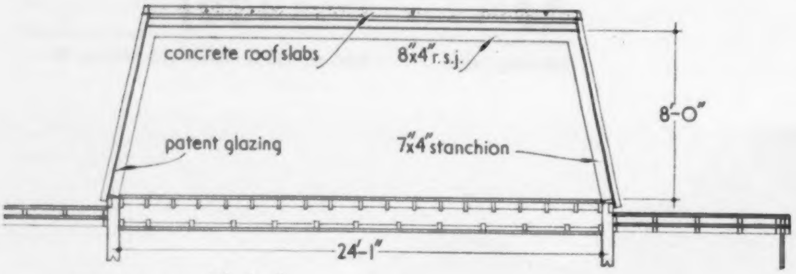
AJ SfB (26)

Working Detail UDC 69·022·3 Roofs and Ceilings 69

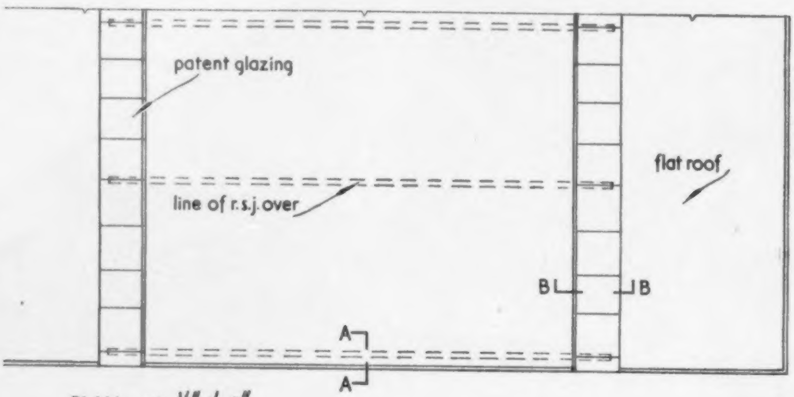
Monitor roof: Library in St. Austell, Cornwall

F. Kenneth Hicklin, architect to the Cornwall County Council

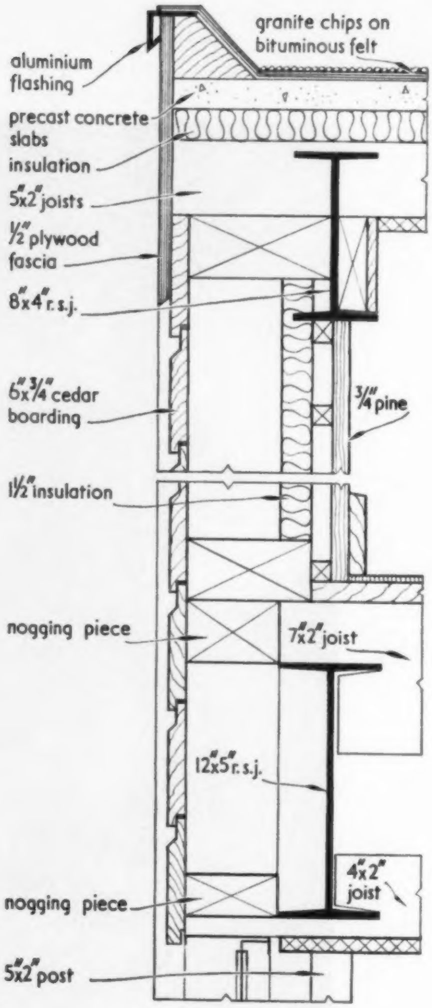
This is a competent solution to the problem of detailing the junctions between a number of different materials, in this case patent glazing, felt roofing and weatherboards.



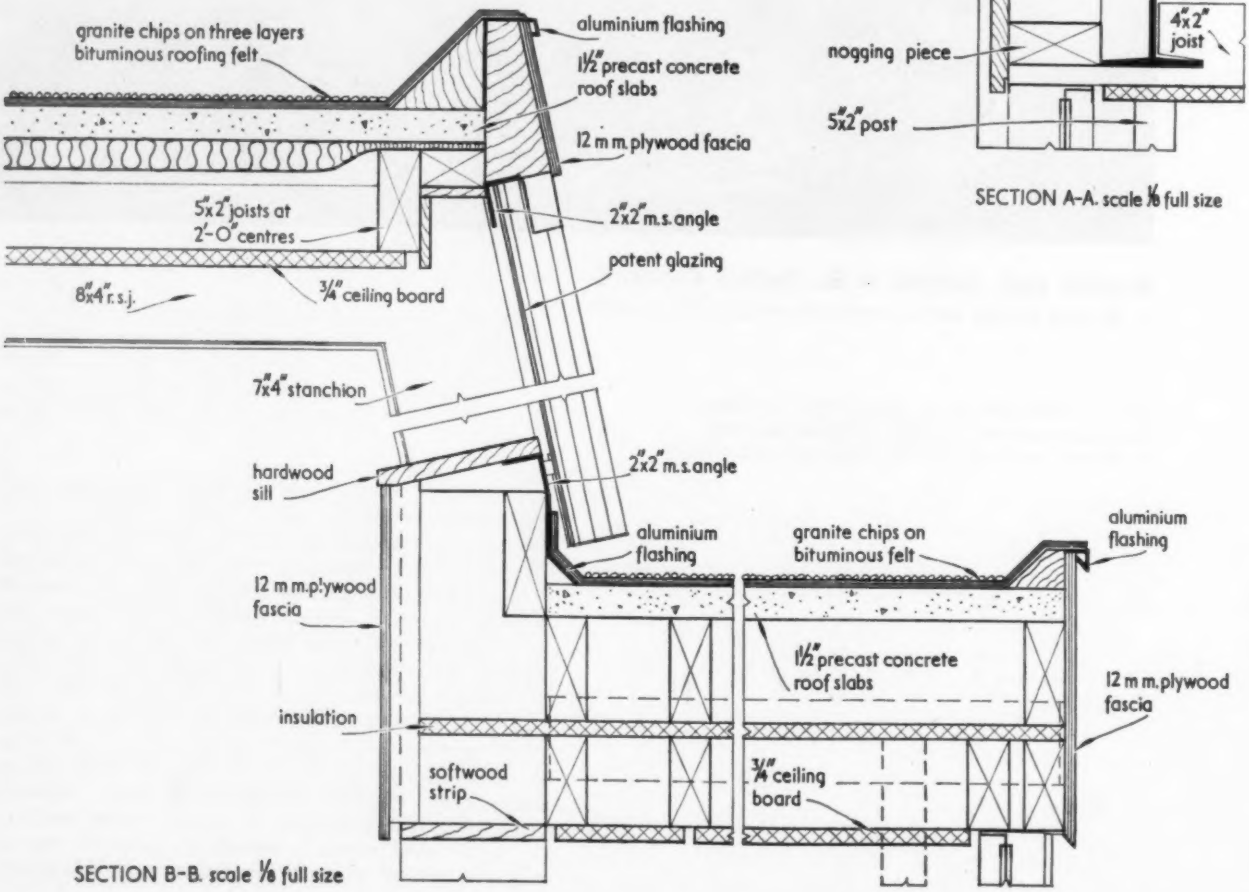
SECTION. scale 1/8"=1'-0"



PLAN. scale 1/8"=1'-0"



SECTION A–A. scale 1/8 full size



SECTION B–B. scale 1/8 full size

Publication File

(15)
Garden: grass, plants, trees

Trees for Town and Country by Brenda Colvin. Lund Humphreys. 30s. An excellent reference, first published in 1947. Much practical advice badly needed by architects.

(63)
Installations, electrical: lighting equipment

Floodlighting Lawn Tennis Courts by W. M. Pierce. Supplement to *Lawn Tennis and Badminton*, the official Journal of the Lawn Tennis Association. Rolls House Publishing Company Limited. 3s. Considers technique and costs. Of specialised interest only.

(84)
Spaces, fixtures: health and welfare buildings.

Hospital Pharmacy Planning. Guild of Public Pharmacists, 18 Sheepcote Road, Harrow, Middlesex. 5s 6d. Second and expanded edition of work first published in 1958. Discusses planning, finishes and services equipment. Intended for hospital pharmacists, architects and hospital administrators. A useful reference.

(84)
Spaces, fixtures: health and welfare buildings

Diagnostic X-ray Departments. Hospital Building Note No 6. HMSO. 1s 6d.
Useful, though rather sketchy information on a part of the hospital which is developing very fast.

(94) 725.5
Health and welfare buildings: General

Hospitals, Clinics and Health Centers. Dodge Corporation. $9.75.
This book is a collection of articles reprinted from Architectural Record and describes a wide spread of American and Canadian buildings. Architects and administrators will find it easy to read and interesting.

(94) 725.511
General hospitals

New Teaching Hospital and Medical School at Ninewells, Dundee. Available from the Secretary, Eastern Regional Hospital Board, Vernonholme, Riverside Drive, Dundee, 3 gns.
Architect's report on the most recent teaching hospital to be designed in this country. A good reference for hospital architects. Reviewed September 6 1961, page 339.

(94) 725.6
Prisons, reformatories

Prison Architecture. A special number of the *British Journal of Criminology*, Vol 1, No 4.
Obtainable from Stevens and Sons Ltd, 11 New Fetter Lane, London EC4. 12s 6d.
An international review of recent prison building including a report of recent work of a development group on prisons set up by the Prison Commission and MOW. Reviewed August 23 1961, page 265.

(97) 727
Educational, scientific and cultural buildings: General

Fire and the Design of Schools. MOE Bulletin No 7, HMSO 4s.
This third edition eases the design criteria very considerably and should be obtained by all school architects.

(97) 727.56
Laboratories

The Design of Research Laboratories. Published for the Nuffield Foundation. OUP. 45s.
Report of work on laboratory design by the Nuffield Foundation's Division of Architectural Studies. A first rate architects' reference on a badly documented subject. Reviewed September 6 1961, page 339.

(98) 728.2
Flats: General

A Study of Space and Water Heating in Local Authority Flats 1956-59. National Building Studies Research Paper 34. HMSO. 6s.
This Building Study is the research worker's version of two articles under the same title published in the Journal on June 1 and June 8, 1961.

Ac1 711.003
Planning economies

The Face of Britain: A Policy for Town and Country Planning. Socialist Commentary, 11 Great Russell Street, London WC1. 1s 6d.
Reprint of a proposal for land nationalisation originally published in Socialist Commentary. Of general interest. Summarised September 13 1961, page 368.

Hd2
Sections and bars: steel.

The Use of Cold Formed Steel Sections in Building. Addendum No 1 (1961) to BS449:1959. Published by British Standards Institution 7s 6d.
A useful addendum, giving structural data on *thin* steel sections, ie plate, sheet and strip steel $\frac{1}{4}$ in thick and under.

AJ Products File October 4 1961

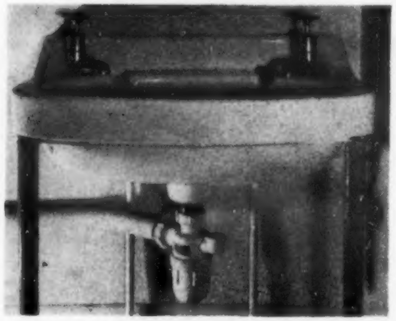
SfB (52)

UDC 696.122

Quieter plumbing

The McAlpine Silentrap is an improved design of bottle waste trap with an anti-siphon valve which prevents air from getting into the system and thus does away with the usual gurgling noises. As the illustration shows, the valve is at the side of the trap and allows the air to escape before it can pass into the waste pipe. The BRS has published a report which concludes that the trap will withstand all pressures likely to occur in the normal system without undue loss of seal and with very little noise. The trap is made from high density polyethylene, which will not corrode and is also resistant to oils, detergents and greases: it will also stand up if boiling water is poured through the trap. There are no joints to solder and the price is about the same as for metal traps.

McAlpine & Co. Ltd., Kelvin Avenue, Hillington, Glasgow SW2



McAlpine Silentrap

AJ Products File October 4 1961

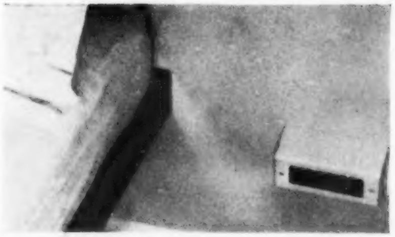
SfB (63)

UDC 696.6

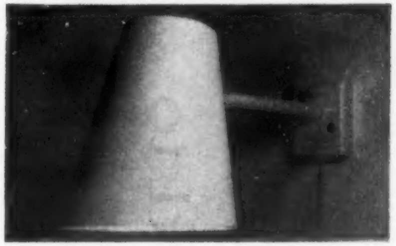
Hospital lighting fittings

Atlas Lighting have several new light fittings for hospital use, and they seem to have been designed with quite a lot of thought and care. One is a low level night light with a 15 watt lamp and a set of louvres giving a lateral spread of 120 deg, all the light being emitted below the horizontal. Mounted between or under beds no light reaches the patients but the floor is well enough lit for the staff to be able to walk about easily. The fitting is made in a flush mounting version so that it will not be wiped off the wall when beds are moved. There is also a good bedhead fitting with a 60 or 100 watt lamp for general use, the shade also incorporating a separately controlled 15 watt lamp for use if patients have to be watched during the night.

Atlas Lighting Ltd, Thorn House, Upper St Martin's Lane, London WC2



Low level night light



Bedhead fitting

AJ Products File October 4 1961

SfB (42)

Dual purpose ceiling

The illustration below shows Marleycell expanded polystyrene in 12 in square panels used as a finished ceiling on the top storey of an office block in Chiswick. The panels, which are ½ in thick, have not been plastered or covered in any way, and provide good insulation as well as looking quite pleasant. The panels were stuck to the underside of the roof with a special oil mastic.

Marleycell is made in sheets with a width of 2 ft and in lengths up to 8 ft and in any thickness from ½ in to 10 in. There are two grades, standard and self-extinguishing.

The Marley Group, Sevenoaks, Kent

Marleycell ceiling panels

Products File by Brian Grant

As readers can see, The Industry has been replaced by Products File. Each item occupies a quarter page (ie A6 size) and is given an SfB number so that readers may cut the page up and file each under its right number if they so wish. Alternatively, they may tear out the whole page and file all Products File pages together. In either event they will be relieved to know that Products File pages will never back on to editorial matter

AJ Products File October 4 1961

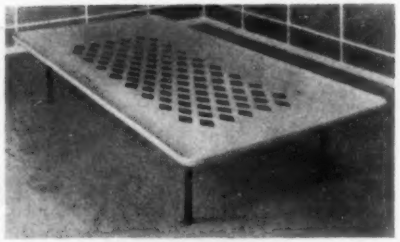
SfB (72)

UDC 643·4/5

Glass fibre furniture

Vitafoam, makers of latex foam mattresses, have now set up a subsidiary company called Vitesta for moulding various types of furniture in reinforced glass fibre and other plastics. The moulding service can be used by any designer, and advice is available on technical problems. The firm already produces several designs of chair, including a double shell easy chair, and has recently standardised the divan base illustrated here, which is claimed to give a high degree of comfort when used with a 6 in foam mattress. Retail price of this is £28, or £36 10s with a built in storage cabinet.

Vitesta Ltd, 12a George St, Hanover Square, London W1



Vitesta divan

AJ Products File October 4 1961

SfB Uj3

Furnishing fabrics

A Nottingham firm is now producing an all nylon fabric in a range of 12 plain colours, though corded and striped designs will be developed later. The main advantage is that it can be sponged clean, and the heavier grades can be scrubbed. The plain unbacked grade is suitable for compound curves, and costs about 12s 6d a yard 48 in wide. With a backing of pvc it is suitable for kitchen chairs or office furniture, as it can be scrubbed: price is 15s 6d. There is also a cotton twill backed grade for extra heavy duty, which is also waterproof and costs 21s. All grades are, of course, mothproof. Some of the colours have a slight surface shine which I find a bit unattractive, but there is a particularly good olive green and one or two other colours which architects will find useful. The fabric is known as Sprusalon.

Jersey-Kapwood Ltd, Nottingham

AJ Products File October 4 1961

SfB (64)

UDC 621·39

Telephone economies

When everyone is on the subscriber trunk dialling system with charges based on 3 minutes for local calls and on 12 second units for trunks I suspect that most people's bills will take a pretty sharp jump, for there are no pips on local calls and it always seems to take three or four times as long to get through to the right person as it does to get an answer to a question. A possible discouragement for long cosy chats is the Time-o-Phone, a watch that fits in the centre of the telephone dial and has a pointer to indicate the time of the call. I am not quite sure what this is supposed to do beyond horrifying people at the length of time they spend talking, but if it encourages them to be brief then it may be worth its price of 7 guineas.

Inter-Continental Office Equipment Ltd, Vivian Rd, Harborne, Birmingham 17

Time-o-Phone telephone watch

AJ Products File October 4 1961

SfB (56)

UDC 697·2/.8

Ceiling heating panels

Most architects will be familiar with the Frenger ceiling, and the same firm is now producing Frengerstrip heating panels for overhead use in factory buildings of all kinds. The panels have heating tubes of ¾ in steel pipe connected to 1 in cross headers, forming a grid under which are panels formed of aluminium sheet to provide a radiating surface. Above the pipes is 1½ in of insulation. The panels are made in five widths from 16 to 48 in and in lengths which are multiples of 10 ft, the maximum recommended length of panel being 100 ft for low pressure hot water, or 60 ft for high pressure. The approximate weight of the panels, including the water in the pipes, is about 4½ lb per sq ft.

Frenger Ceilings Ltd, 7-12 Tavistock Sq, London WC1

Frengerstrip heating panel

AJ SfB (98)
Building study, 2nd series UDC 728.2 Flats: General

General view from the north-west

Flats

at	BRECKNOCK ROAD, LONDON N1
for	ST. PANCRAS BOROUGH COUNCIL
architects	J. M. AUSTIN-SMITH AND PARTNERS
	P. J. LORD, PARTNER
assisted by	P. C. WALLER
	J. LASCELLES
quantity surveyors	DAVIS, BEFIELD AND EVEREST who prepared the cost analysis
in conjunction with	A. W. DAVEY, HOUSING MANAGER, ST. PANCRAS BOROUGH COUNCIL

The architects have turned to advantage the awkward features of a small site, and the restrictions placed upon its development, in filling in with four-storey housing

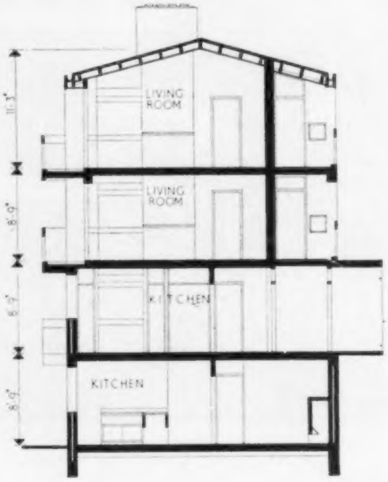
APPRAISAL

The problem facing the architects was to fill in with housing an awkwardly-shaped and sloping corner site, surrounded by Victorian terraces. They were required by the LCC to keep to a maximum density of a hundred persons per acre, and to pay due respect to the massing of the adjacent houses. With the enormous pressure for building land in the London boroughs, it is inevitable that this type of infilling should be taking place, even on the smallest or most difficult of sites. Superficially at least, it also seems perfectly reasonable that such infilling should be controlled by the planners to ensure that as far as possible it fits in happily with the existing surroundings. But in a case such as this, such demands on the architect can only be based on the assumption that the existing housing still has a relatively long and useful life. Houses of this size tend, of course, to have multiple occupancy. Even with the most skilful use of improvement grants, such accommodation cannot usually be brought up to current standards, especially in terms of access and satisfactory sound insulation, timber floors being quite obviously inadequate. The major long-term problem for many local authorities in future years inevitably will be the redevelopment of such areas, which can best be tackled comprehensively. Such infilling as this may well prove to be an embarrassment in the future, because of the limits it places on an entirely fresh layout and road pattern.

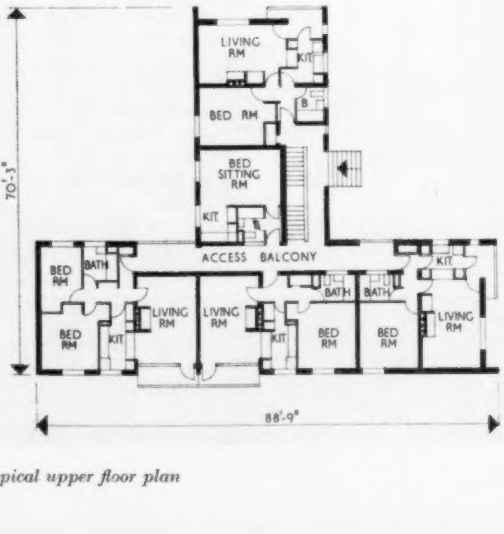
But accepting these restrictions, the architects have fully exploited the possibilities of the site. Their recognition of the surrounding housing is almost exclusively in terms of massing, with approximately the same roofline along Brecknock Road being carried through. Beyond this, by the very exercise of approaching a low-cost solution, they have created a scale and pattern which are totally different from the adjacent existing houses. This is not merely the change of relationship between solid and void, the smaller windows being the result of a relatively narrow width of block, but the use of bitumen felt on a lower-pitched roof. At the same time, by having the entrance at a higher level off Lupton Street, it has been possible to develop the main frontage along Brecknock Road to four storeys without an excessive climb to the top floor.

The block is planned in T form, set out so that a definite punctuation is created at the corner, one of the problems for which the clients were particularly interested in seeing a satisfactory solution. At the same time, this layout has made possible the provision of balconies to a number of the flats facing outwards from the two exposed ends of the block roughly south and west. The detailing externally is generally robust and economical, with an obvious eye on low maintenance costs, and with such features as the robust, woodsy handrails to the access stairs and balconies. There is also a sense of refinement in such details as the rendering of the reveals to the bedroom windows, which is the continuation of a well-established tradition of domestic architecture in London. Slightly less successful is the design of the eaves fascia. This, from a distance, looks as if it were the expression of a structural concrete roof slab, but is revealed as something quite different when the joints in the sheeting become visible close to. But much of the visual character of the block depends upon the use of this design of clipped eaves. Another detail which is not, perhaps, in line with the high quality of the remainder, is the design of the balcony fronts. These are already weathering unevenly, due to the absence of anything to throw off the water along the top edge of the concrete.

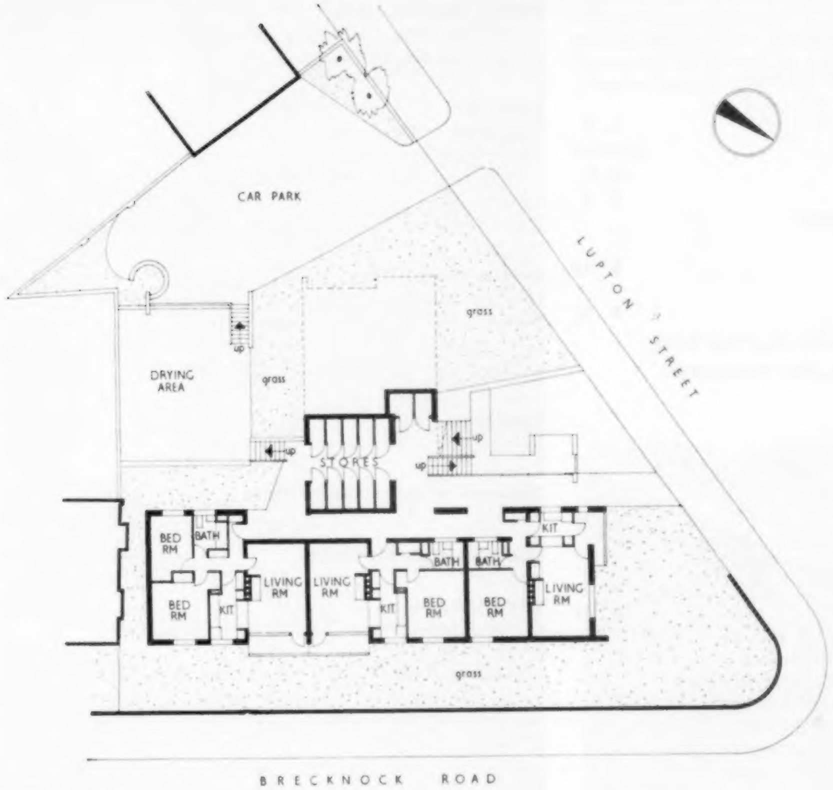
But in many respects the block reflects careful consideration of all aspects of design, rather than the rather hurried adoption of stock solutions. It is, indeed, a good example of the type of stimulus that the private office can contribute to local authority housing; which, as Elizabeth Layton pointed out in *Building by Local Authorities*, is a major factor in favour of such commissions. This consistency appears internally in such features as the neatly and tightly planned storage in the kitchens, with their successful open counter top links with the living rooms. Equally in the landscaping there has been close attention to floorscape, and to the siting of such amenities as a drying yard and tenants' stores, all neatly integrated and discreetly hidden from the road frontages.



Section [Scale: $\frac{1}{16}$" = 1' 0"]



Typical upper floor plan



Ground floor plan, showing site layout [Scale: 1/32" = 1' 0"]

CLIENT'S REQUIREMENTS

Maximum number of small units, bedsitting room (1 person), single bedroom (2 persons), two bedroom (3 persons) to local authority standards. In all, three bedsitting rooms, eleven one-bedroom flats and four two-bedroom flats were required. The Committee were concerned to have a scheme which "fitted the site and solved the corner relationship."

SITE

An " infill " site left by bomb damage. A slope of 12 ft. 6 in. from the western extremity to the Brecknock Road frontage, and a further drop of 4 ft. to the pavement.
There were semi-basements left from the houses formerly occupying the site; elsewhere the ground was made up.

PLANNING AIMS

The planning department of the LCC was adamant that the site density of 100 per acre was not exceeded, and that the height of surrounding buildings was recognised.
The " T " form adopted closed the corner, provided interest from the main road, and with the 4-3 storey arrangement, carries on the lines of the roofs of the existing properties.

SUMMARY

Floor areas: 9,310 sq. ft. (net floor area of all dwellings); 12,090 sq. ft. (gross floor area of building).
Type of contract: Competitive tender.
Tender date: October 1958.
Work began: March 1959.
Work finished: February 1960.
Tender price of foundation, superstructure, installation and finishes including drainage to collecting manhole: £29,640 1s. 6d.
Tender price of external works and ancillary buildings including drainage beyond collecting manhole: £2,521 18s. 6d.
Total tender price: £32,162 0s. 0d.

COST ANALYSIS

Based on tender.
(AJ revised elemental breakdown in use from November 10, 1960.)

	s	d
	Cost per sq. ft.	

Preliminaries and insurances 6 3

9·95 per cent of remainder of contract.

Contingencies 2 1¾

Work below lowest floor finish 4 9½

Cross walls to firm bed (8 ft. average below ground level), ground beams to take lateral walls, 6-in. waterproofed concrete slab on 6-in. hardcore.

STRUCTURAL ELEMENTS

Upper floors 5 2¼

6-in. to 7½-in. precast concrete floors with in situ balconies; 973 sq. yds., 49s. 7½d. per sq. yd.

Roof 3 3¾

15 degree pitched roof with purlins up to 11 in. × 3 in. spanning between cross walls at 2-ft. centres. Compressed straw boarding covered with three layers of felt roofing, secret gutters lined with heavy duty roofing felt, asbestos cement sheeting to fascias, barge boards and verge soffits, lead flashings and cast iron rainwater pipes; 357 sq. yds., 86s. 5½d. per sq. yd.

Staircases 1 0

One 26 ft. 9 in. high × 3 ft. 6½ in. wide. Precast concrete cantilever treads with non-slip inserts. Balustrades in 2-in. galvanised tube standards with 9 in. × 2 in. varnished softwood handrails.

External walls 10 3¾

9-in. fletton brick walls faced with purple Uxbridge facings; 322 sq. yds., 62s. 2d. per sq. yd.
13½-in. fletton brick walls faced with purple Uxbridge facings; 336 sq. yds., 81s. 1½d. per sq. yd.
11-in. cavity walls in purple Uxbridge facings and 4½-in. partition blocks; 471 sq. yds., 54s. 9½d. per sq. yd.
Timber framed screens with painted asbestos cement sheeting and plasterboard infill panels with 1-in. glass-fibre quilt and metal opening lights and glazed doors (the cost of these is included with windows and external doors); 132 sq. yds., 68s. 5d. per sq. yd.
Glazed balcony fronts with galvanised steel frames, ¼-in. Georgian wired cast glass, 9 in. × 2 in. varnished softwood handrails; 90 sq. yds., 155s. 0½d. per sq. yd.
(At points of high stress engineering bricks were used sometimes with vertical reinforcement in cavity (not shown in costs).)

Windows 2 1

Steel (Z range except bathroom lights), painted softwood frames, cement rendered reveals, quarry tile sills; 899 sq. ft., 19s. 7d. per sq. ft.
Steel (Z range) to balconies set in timber screens (cost of frame in external walls); 231 sq. ft., 7s. 9d. per sq. ft.

External doors 10¾

22 softwood glazed (cost of frame included with external walls), 358 sq. ft., 6s. 6½d. per sq. ft.
30 1¾-in. plywood faced flush including softwood frames; 688 sq. ft., 8s. 3½d. per sq. ft.
2 pairs double 1¾-in. flush plywood faced to tank room including softwood frames; 23 sq. ft., 11s. 6d. per sq. ft.

Internal structural walls 2 9¼

9-in. fletton brick walls incorporating chimney stacks; 440 sq. yds., 59s. 9d. per sq. yd.

Partitions 1 3½

9-in. partition block walls; 57 sq. yds., 13s. 8½d. per sq. yd.
3-in. partition block walls; 660 sq. yds., 14s. 7d. per sq. yd.
Half brick fletton walls; 89 sq. yds., 18s. 2¾d. per sq. yd.

Internal doors 1 5¼

144 1⅜-in. hardboard faced flush including softwood frames; 1,840 sq. ft., 5s. 9½d. per sq. ft.
36 pairs double 1⅜-in. hardboard faced flush including softwood frames; 468 sq. ft., 5s. 11½d. per sq. ft.

Ironmongery 8

Aluminium generally.

Total of structural elements: 29s 0d

FINISHES AND FITTINGS

Wall finishes 2 3½

2 coats gypsum plaster; 2,463 sq. yds., 5s. 8½d. per sq. yd.
2 coats vermiculite plaster; 303 sq. yds., 8s. 3d. per sq. yd.
Cement render to fuel stores; 77 sq. yds., 7s. 3d. per sq. yd.
Glazed wall tiling; 71 sq. yds., 58s. 3½d. per sq. yd.

Floor finishes 3 1¾

1-in. cement/sand pavings; 23 sq. yds., 8s. 6½d. per sq. yd.
1-in. granolithic pavings; 33 sq. yds., 32s. 9d. per sq. yd.
1-in. waterproofed granolithic pavings; 243 sq. yds., 24s. 11½d. per sq. yd.
Thermoplastic tile pavings on screed; 895 sq. yds., 24s. 6¼d. per sq. yd.

Ceiling finishes 9¾

¼-in. asbestos cement sheeting; 54 sq. yds., 9s. 9d. per sq. yd.
2 coats gypsum plaster; 695 sq. yds., 5s. 3½d. per sq. yd.
Plasterboard and skim-coat; 294 sq. yds., 8s. 6d. per sq. yd.
Cement rendering; 181 sq. yds., 6s. 6½d. per sq. yd.

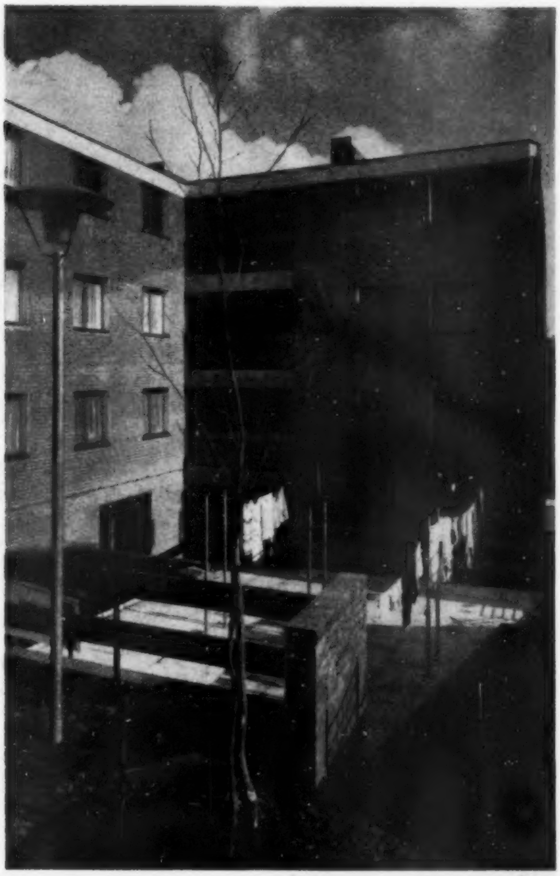
Decorations 1 10¾

Plastered surfaces, 2 coats washable distemper; woodwork, hardboard, metalwork and asbestos, 2 coats oil paint; timber handrails, 3 coats varnish.

Fittings 1 11¾

Type of fitting	*No. of each type*
Linen cupboards	18
Broom cupboards	22
Larders	18
Servery counters	18
Fuel hoppers and stores	15
Shelving and worktops, 661 sq. ft.	

Total of finishes and fittings: 10s. 1½d



Left, drying yard, neatly tucked away from public view
Below, entrance forecourt
Bottom, frontage on to Brecknock Road, showing how admirably the infilling ties in with the existing houses, despite a strong change in scale

SERVICES

Sanitary fittings — 2 2¼

Type of fitting	*No of each type*
Kitchen sinks	18
Lavatory basins	18
Baths	18
Low level w.c. suites	18

Waste, soil and overflow pipes — 1 8½

Galvanised steel wastes, etc., cast iron stack pipes

Cold water services — 11¾

450-gallon storage tanks in roof. Galvanised steel rising main, down services.
No. of draw-off points: 72
Includes builder's work, 2¾d.

Hot water services — 2 2½

15 combined hot and cold water cylinders.
15 closed free-standing stoves with backboilers.
Copper distribution services.
No. of draw-off points: 54.
Includes builder's work, 2d.

Gas services — 5½

Normal subsidised domestic installation.
No. of outlets: 108.
Includes builder's work, 1d.

Electrical services — 2 7½

	No of points
Lighting installation to access balconies, staircase and stores	14
Lighting installation in flats	91
Power installation	70
Cooker control units	18
Water heaters in bed-sitting room flats	3
Panel fires in bed-sitting room flats	3

Includes builder's work, 2½d.

Drainage — 1 2¼

Salt-glazed ware, rendered brick manholes.

Total of services: 11s 4¼d

External works — 5 5

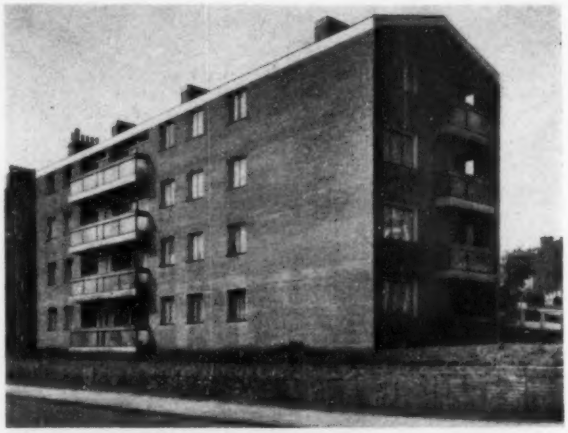
	s	d
Site preparation		0½
Water connection		7¾
Drainage connection		1¾
Car park and drying area, including retaining walls, steps and balustrading	2	4¼
Paved forecourt, including retaining walls, balustrading and bollards	1	4
Site layout, planting and grassing		10¾

Total cost per sq. ft. based on net dwelling area

$$\frac{\text{£29,640 (net cost excluding external works)}}{\text{9,310 sq. ft. (net dwelling area)}} = 63\ 8$$

Total cost per sq. ft. based on gross floor area

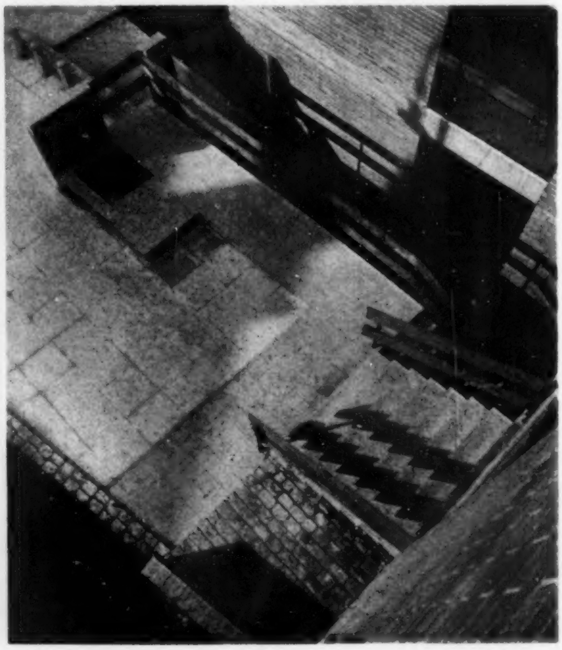
$$\frac{\text{£29,640 (net cost excluding external works)}}{\text{12,090 sq. ft. (measured inside external walls)}} = 49\ 0\tfrac{1}{2}$$



Top, block from the north

Centre, generous balconies are provided for the larger flats

Bottom, carefully detailed floorscape of the entrance forecourt, seen from above



COST COMMENT

A certain number of points should be noted in examining this analysis.

Preliminaries: these are relatively high, being just under 10 per cent of the rest of the contract; this may well represent the relatively higher cost of building in this particular area.

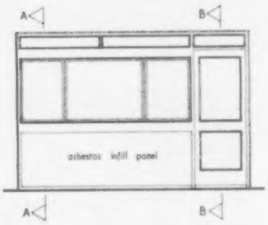
Work below lowest floor finish: due to the nature of the site, previously the ruins of houses, it was necessary to take the foundations about 8 ft. down.

External walls: the block has a relatively high ratio of wall to floor area of 0·90 : 1. This was the inevitable result of the brief from the client, and of the form of the site.

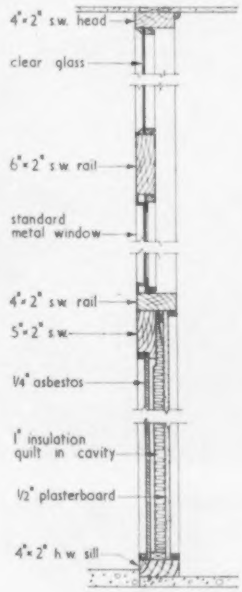
Sanitary fittings and plumbing: due to the high number of bed-sitting rooms and single-bedroom flats, the cost of these items is abnormally high.

CONTRACTORS

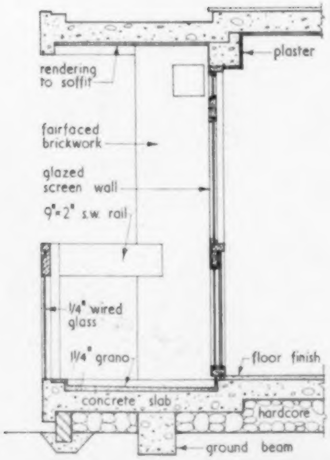
General: Percy Bilton Ltd. *Sub-contractors and suppliers—Electrical:* Buchanan & Curwen Ltd. *Precast concrete floors and staircases:* Cawood Wharton & Co. Ltd. *Tarmacadam paving:* The General Asphalte Co. Ltd. *Thermoplastic flooring:* The Marley Tile Co. Ltd. *Gas:* North Thames Gas Board. *Felt roofing:* Permanite Ltd. *Sanitary fittings:* Ashley Brandon (Kensington) Ltd. *Metal windows:* The Crittall Manufacturing Co. Ltd. *Fuel hoppers:* B. Finch & Co. Ltd. *Ironmongery:* W. N. Froy & Sons Ltd. *Combined hot and cold water cylinders:* The Economic Hot Water Supply Co.



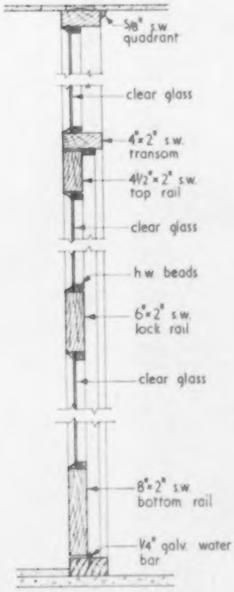
Details of living room fenestration to balcony. Above, key elevation [Scale: ⅛" = 1' 0"]



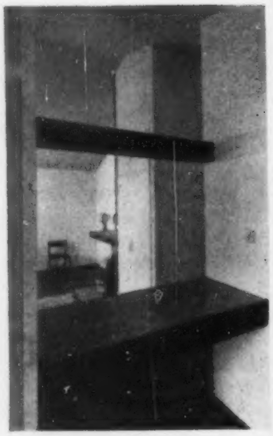
Section A through infill panel

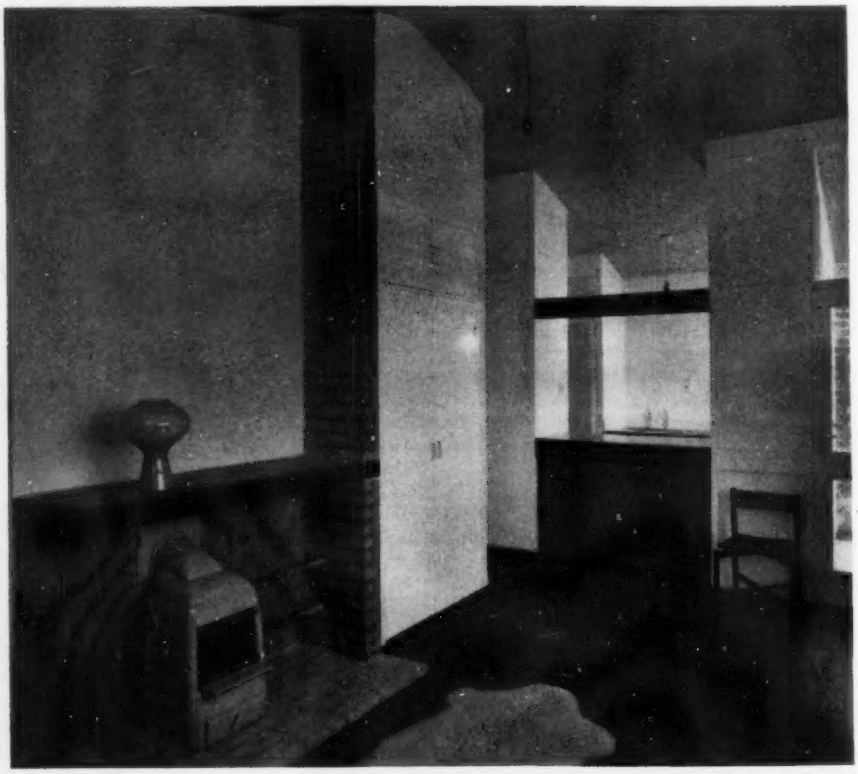


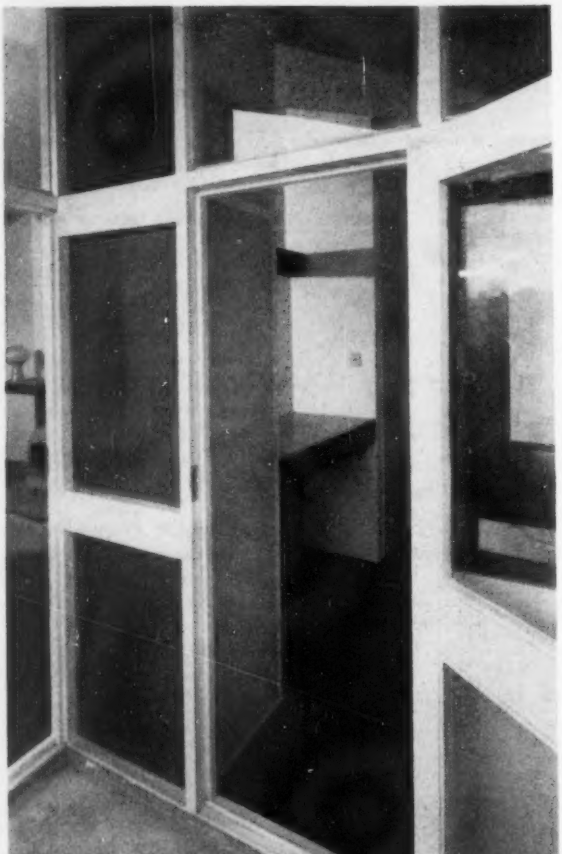
Section through balcony on ground floor [Scale: ⅛" = 1' 0"]



Section B through glazed door [Scale: ⅛" = 1' 0"]







Above left, living room seen from kitchen
Above, living room
Left, glazed screen to kitchen

AJ SfB (II)

Ground: General

Roy A. Nicholls, the author of the Elemental Design Guide for this section and of the special article, is a civil engineer on the staff of Holland & Hannen & Cubitts specialising in soil mechanics

(11) *Ground: General*

This Functional Elemental File contains three items: an Elemental Design Guide, a special article entitled Soil Investigation for the Smaller Project, and two information sheets. In addition, the file includes some specialised advertisements, prepared for inclusion in it.

The Elemental Design Guide (EDG) was first described in the AJ for September 13 and is in the form of a design procedure arranged in chronological order in three columns. The first column is basically a check list of principal steps in design, the second column lists the considerations to be borne in mind at each step and the third column gives the essential references and notes on each step or consideration.

In the case of (11) *Ground: General*, however, the principal purpose is not one of design but the provision of information about the site on which a design may be based.

This EDG is in two main parts:

LAND SURVEY This gives details of the information required to provide the positions, sizes and character of physical features, services, ownerships and restrictions on the use of the site.

SOIL MECHANICS: SITE INVESTIGATION This deals with an investigation of the physical features below the surface, to enable the economic design of permanent and temporary works. The considerations involved in the design of embankments are included in this section, but the use of the results of a soil investigation in relation to other elements, *e.g.* (14) *Roads and Pavings: General*, will be found in the appropriate Design Guide.

In this section the object has been to provide an outline of the design process giving clear indication when specialist advice should be sought, how to brief the adviser and make intelligent use of his results.

AJ SfB (11)

Elemental Design Guide Ground: General

(11) Ground: General

Bibliographic references (third column) are graded as follows:
* General reference of value to every architect and which he may wish to possess
** Specialised reference normally used by consultant or architects with special knowledge of particular aspects of building
*** Highly specialised references and research papers which would not be of value to the architect unless working with a consultant
Figures in square brackets are SfB references to the publications refered to

Land survey

1 **Check with Ordnance Survey**	For general information Most useful scales 6in. to 1 mile 1 in 2500 1 in 1250 All surveys are copyright	H.M. ORDNANCE SURVEY *A Description of the Ordnance Survey Large Scale Plans, 1954, HMSO [Aa9] *A Description of the Ordnance Survey Medium Scale Maps, 1955, HMSO [Aa9] *Licence for copying obtainable*
2 **Check** OWNERSHIP AUTHORITIES	Name and address of and obtain permission if necessary from: OWNER ADJOINING OWNERS TENANTS AGENTS SOLICITORS Names and addresses and responsible officers as necessary LOCAL AUTHORITIES PUBLIC UTILITIES TRANSPORT TELEPHONE CONSERVANCY (e.g. River Board, National Trust)	*Kelly's Directory [Aa2]
3 **Initiate survey**	Own survey Local surveyor Surveying firm by contract Aerial survey by contract	*CLARK, D. Plane and geodetic surveying Vol 1, London, 1958 Constable & Co. Ltd. Chapter III, p. 177. Chain survey Chapter IV, p. 202. Theodolite and compass traversing Chapter VI, p. 303. Levelling Chapter VII, p. 333. Plane table surveying ROYAL INSTITUTE OF CHARTERED SURVEYORS, 12 Great George Street, London, SW1 for scale of fees and suggested surveyors
4 **Survey must obtain**		
ORIENTATIONS	OS grid north Magnetic north	
SITE BOUNDARIES	Type, condition	
ADJACENT ROADS	Type, condition, access	
LEVELS	Decide datum, key levels and suitable grid	
LARGE FEATURES	Buildings, trees, depressions, mounds, rivers, streams, fences, woods, marshes, roads, railways canals, bridges, culverts	
SERVICES IN USE ABOVE AND BELOW GROUND	PO, gas, water, electricity, hydraulic mains, district heating, oil or other pipelines, underground railways Valve and inspection pits	*Drawings and/or information often available from local government engineers or public utility engineers at their respective offices*
DRAINAGE	Land drainage, rivers, streams, ditches Subsoil drains, catchpits and outfalls	

	Sewers, separate or combined system Private drains Manholes, cess pits Check depth and condition, sizes and inverts of all pipes Check flow direction if possible	
SERVICES NOT IN USE	As above where applicable	*Drawings and/or information often available from local government engineers or public utility engineers at their respective offices. Deeds, leases, old maps, etc.*
DISUSED WELLS AND SHAFTS	Position, diameter, depth, whether filled or not, condition	
OLD OR EXISTING MINEWORKINGS	Depth, type, date of working, seam height	NCB *local offices, mineral valuer and sometimes geological survey*
BURIED FOUNDATIONS	Type, size, depth	
5 **Check own and adjacent property**		LONDON BUILDING ACT [Aa5] MODEL BYELAWS [Aa6] RAILWAYS ACTS [Aa5] LTE ACTS [Aa5] PARTY WALL LAW (London only) [Aa5] 1957 SUBSIDENCE ACTS [Aa5]
CONDITION	If necessary, initiate a joint survey of adjacent property, including photographic and physical records where possible	
RIGHT OF SUPPORT	Check with local authority the relevant acts relating to right of support	
RIGHTS OF LIGHT AIR WAY		
POSSIBILITY OF DAMAGE	Due to demolition or construction	
WAYLEAVES		Public utilities and others by Act of Parliament
RESTRICTIVE COVENANTS		Deeds, leases, contract for sale
6 **Planning requirements**	ZONING DENSITY	HEAP, DESMOND. Encyclopaedia of Planning Law. Sweet & Maxwell London, 1960 [Aa5]
	PLOT RATIO BUILDING AND IMPROVEMENT LINES	TOWN AND COUNTRY PLANNING ACT [Aa5] *administered by planning officers of county boroughs and of county councils*
	AESTHETIC AMENITY FUTURE DEVELOPMENT	TREE PRESERVATION ORDERS BUILDING PRESERVATION ORDERS SMOKELESS ZONES
7 **Note environment**	CLIMATE rainfall prevailing winds temperature range location *industrial* *urban* *coastal* *rural*	BRITISH STANDARDS INSTITUTION *CP. 3 : 1950. Chap IX. Durability, Appendix VI [Bc7]
	PHYSICAL sources of nuisance noise fumes dirt odour vibration	
	EXISTING USES agricultural industrial commercial domestic scholastic	

Soil mechanics site exploration

	This work, and the interpretation of results and foundation design should normally be supervised by a specialist engineer	THE INSTITUTION OF CIVIL ENGINEERS, Great George Street, London, SW1, *with the British Society of the International Society of Soil Mechanics and Foundation Engineering will advise on the names of suitable engineers*

8 **Soil investigation required**	If applied load on soil exceeds ¼ ton/sq. ft. If site is PEAT MARSH FILL SUBJECT TO FLOODING RECENTLY RECLAIMED Or adjacent to MARINE, ESTUARINE OR RIVER EXISTING BUILDINGS If an existing structure is in need of remedial work or is to be extended	*A site investigation may not be necessary if sufficient is known about the site from the local authority, adjacent site investigations or other local knowledge* WILLIAMS, G. Surveying and specification: site investigation. Architects' Journal, 1960, 132 (October 27 and November 3) Pages 610-613, 649-655 [c]
9 **Refer to existing geological records**	Geological records show either or both of Upper drift deposits Underlying rocks	*And are obtainable or viewable at* GEOLOGICAL MUSEUM, Exhibition Road, South Kensington, London, SW7, Regional Offices of the Geological Survey, and Local Libraries Also published are regional geology books by Geological Survey. [Aa9] Local Geological Society records
10 **Decide type of soil investigation**	TRIAL PITS — usually sufficient for small areas and loads (typically two storey houses) TRIAL BORINGS — for larger areas and loads sometimes with trial pits. This should be checked with the soil mechanics engineer for full requirements	NICHOLLS, R. A., Soil investigation for the smaller project. Architects' Journal, 1961, 134 (14), (October 4) [(11)]
11 **Initiate contract**	For a small number of shallow trial pits employ local resources with technical supervision and visiting For larger investigations employ a specialist firm(s) undertaking BORINGS IN-SITU TESTS LABORATORY TESTS (preferably the same firm)	THE FEDERATION OF CIVIL ENGINEERING CONTRACTORS, Romney House, Tufton Street, London, SW1, or THE INSTITUTION OF CIVIL ENGINEERS, Great George Street, London, SW1, *will advise on firms undertaking site investigations* [Aa2]
FORM OF CONTRACT		BRITISH STANDARDS INSTITUTION *CP.2001. Site investigation. [Ca] **TERZHAGHI & PECK: Soil mechanics in engineering practice. pp. 255–285. New York, 1948, John Wiley & Sons. London, 1948, Chapman Hall. [Ca] **HOUGH, B. K.: Basic soils engineering. Chapter 15 & Appendix VII, para. 2. New York, 1957, The Ronald Press Co. [Ca]
12 **The specification, bills of quantities**	To be drawn up by a specialist engineer, and the contract to go out to tender either as an advertised tender or on a selected list. Contract form for boring usually lump sum items for MOVING ON AND OFF SITE MOVING BETWEEN BOREHOLES ERECTING AND DISMANTLING ON EACH BOREHOLE REINSTATEMENT WATCHING AND LIGHTING INSURANCE SITE SERVICES, e.g. water, electricity The carrying out of site exploration work to be specified as either by approved 'soft' boring methods, SHELL AND AUGER PERCUSSION or 'hard' boring methods ROTARY CORING METHODS in rocks and boulders (diamond, shot, or hard metal coring) Boring method detailed by type 'SOFT' OR ROCK MINIMUM DIAMETER OR CORE SIZE TYPE OF TOOLS TO BE USED USE OF WATER OR WASH WATER LINING OR BORING MUD TO KEEP HOLE OPEN UNACCEPTABLE METHODS (e.g. wash boring) Trial pits detailed by AREA	

	DEPTH TIMBERING PUMPING (if required) TIME TO BE LEFT OPEN	
13 **Size and numbers of boreholes**	Depend upon TYPE OF BUILDING PRELIMINARY APPRECIATION OF STRATA from geological records and local knowledge	*At least one bore or pit should penetrate to a depth equal to the greatest width of the building* *The existence of possibly troublesome thin layers of strata is best investigated by trial pits if possible* *The larger the individual particle size of strata the larger the bore, e.g. 5 in. diameter gravel is best penetrated by an 8 in. nominal diameter bore* *The numbers of holes or pits will depend upon the area of the building and the complexity of strata*
14 **In-situ tests**	Numbers and types depend upon: Bearing capacity problems PLATE BEARING TESTS STANDARD PENETRATION TESTS VANE TESTS (clays and silts only) CONE OR PENETROMETER TESTS (continuous penetration tests) PORE-PRESSURE MEASUREMENTS PRESSURE METER TESTS	See Appendix 'A' for definitions of types of tests HOUGH, p. 382 TERZHAGHI & PECK, p. 265 *Ibid*, p. 277 ***R. E. GIBSON: In-situ measurement of soil properties with the pressure meter *Civil Engineering and Public Works Rev.*, 1961, 56 (658), (May), 615–618 [*Ca*3]
	Settlement problems CONE OR PENETROMETER TESTS PLATE BEARING TESTS IN-SITU DENSITY TESTS PORE PRESSURE MEASUREMENTS PRESSURE METER TESTS	HOUGH, p. 408
	Permeability and drainage PUMPING TESTS PERMEABILITY TESTS (require at least 4 observation boreholes) deep well shallow well well point falling head	**BS722: 1937. Borehole and well pump tests [Ca3] TERZHAGHI & PECK, pp. 259, 283, 297, 298, 329 *See special article* Soil investigation for the smaller project. Architects' Journal, October 4, 1961
	Roadworks IN-SITU CBR OR SIMILAR TESTS MEASUREMENT OF SOIL MOISTURE MOVEMENT	**SfB (14) Roads and Pavings: General** See Appendix A, page 537, for laboratory tests
15 **Sampling**	Samples are specified by type, frequency, number and position in strata and may be any or all of the following: small disturbed samples approx. 1 lb. large disturbed samples approx. 56 lb. undisturbed samples 4 in. diameter by 18 in. long for cohesive soils only	TERZHAGHI & PECK, pp. 255–285 HOUGH, Chap. 15 and Appendix VII, para. 2
	CBR samples (trial pits only) 6 in. × 7 in. diameter other non-standard undisturbed samples, e.g. Bishop sand sampler for fine grained non-cohesive soils extra long 4-in. diameter samples samples using thin wall piston samplers (normally for sensitive clays) other recommended by engineer or specialist contractor water samples cores obtained from rotary borings	***BISHOP, A. W. A new sampling tool for use in cohesionless sands below ground water level: *Geotechnique*, 1948/49, 1, (2), 125–131 [Bb9]
16 **Timing of water samples**	Typical conditions which affect water samples are state of tidal conditions period of standing after boreholes or pit completed	

	whether borehole lining in position or not, or if partially withdrawn surface water to be excluded from the borehole or trial pit	
17 **Disposal of samples**	Sealing and care and transport of containers to engineer and/or laboratory All samples billed per sample including transport	
18 **Records**	The submission of boring and trial pit records to be specified	*Check with soils engineer continuously throughout and at end of the site exploration work, on need for further bores or pits*
STRATA	Full description of engineering type, i.e. sands, gravels, clays, chalk, peat, mixtures, etc. (Possibly) Full description of geological type THICKNESS—check especially mention of thin layers in the middle of predominant strata types DEPTH REDUCED LEVEL	
SIZE	Diameter or area	
DEPTH	Depth of boring or trial pit	
SUPPORT	Lining, depth and size, timbering, mud-flush or other	
SAMPLES	Depth, type	
WATER	Depth at which struck RISE OR FALL STANDING CONDITIONS Other relevant data including dates of level observations	
TESTS	Type Description of procedure or reference to description	
TIME DATA	Date Reference to whereabouts of results Daily penetration or excavation rate Dates borehole STARTED FINISHED (*Borehole records included in boring rates*)	
19 **Particular project requirements**	The need for further tests arises on a site where the comparatively small-scale tests completed in boreholes and trial pits, combined with laboratory tests are insufficient to give design information due to site conditions requiring full-scale testing to overcome extrapolating errors, e.g. the presence of many small random lenses of soft material embedded in firm strata will require full-scale tests to provide bearing capacity and settlement data	See Appendix A p. 537
BEARING CAPACITY	May need larger trial pits and plate bearing tests for full-scale bearing tests	
PILING	Full-scale pile tests giving any or all of DRIVING DATA LOADING DATA EXTRACTION DATA (*Refer to specialist engineer*)	
SETTLEMENT	Full-scale bearing tests Modified scale bearing tests (*say half size*)	
WATER	Full-scale pumping tests, e.g. WELL POINTING DEEP WELLS SHALLOW WELLS	
EXCAVATION	Actual excavation on site, including measurement of loads on excavation supports of a trial length actual trials of excavating machinery or explosives	
EMBANKMENT AND COMPACTION	Trial compaction on site using site and materials and various types of compaction machinery and in-situ measurements	
ROAD CONSTRUCTION	Numbers of in-situ CBR tests Trial lengths of types of bases and sub-bases including trials of soil stabilised materials	**SfB (14) Roads and Pavings: General**
OTHER PROBLEMS	Services of specialist contractor for site tests: DE-WATERING PILING	For names of specialist contractors contact FEDERATION OF CIVIL ENGINEERING CONTRACTORS [Aa2]

	GEOTECHNICAL PROCESSES such as grouting, chemical injection, vibroflotation — for strengthening ground permanently electro–osomosis, freezing — for strengthening ground temporarily EXPLOSIVES for blasting and removal by displacement	*GLOSSOP, R., Classification of geotechnical processes : *Geotechnique*, 1950, 2 (June), 3–12 [Cb5]
	GEOPHYSICAL SURVEY seismic resistivity vibration	TERZHAGHI & PECK, pp. 281–283 BS CP.2001:1957. Site investigation, p. 121 [Ca]
	magnetic	*These geotechnical tests are of greatest use when differentiating greatly between different strata, e.g. bedrock surveys, and in surveys of large areas covered by water* *All need the use of boreholes as calibration data* *All undertaken only by specialists* *For names of specialists, contact* INSTITUTION OF CIVIL ENGINEERS
20 **Initiate laboratory testing**	Work to proceed concurrently with site work to enable further samples from bores or pits to be obtained if laboratory testing shows need Check need for further testing in conjunction with specialist engineer and/or contractor	HOUGH, p. 454 et seq. **AKROYD, T. N. W.: Laboratory testing in soil engineering. London, 1957, Soil Mechanics Ltd. [Ca3]
21 **SOIL INVESTIGATION REPORT** **Exploration**	Check submission of soil mechanics site investigation report Including site exploration work in-situ testing laboratory testing These should be presented in the form of a descriptive report with results attached, including interpretation of the three first items This should be written as an appreciation of the type of problem presented by the site, e.g. typically are the results in any way suspect owing to unusual conditions? are the types of soil revealed good bearing materials? are water conditions hampering to construction? geological considerations (*e.g. soundness of rock*)	
22 **Recommendations**	This part of the report should be submitted by either or both the engineer and specialist contractor on any of the following required: TYPES OF FOUNDATIONS DEPTH OF FOUNDATIONS ALLOWABLE BEARING LOADS ESTIMATED SETTLEMENTS TIME OF SETTLEMENTS CONSTRUCTION PROCEDURES CHEMICAL ATTACK SPECIAL OR OTHER FACTORS AREAS OF IGNORANCE Without the following information this part of the report cannot be written: AREA OF BUILDING HEIGHT OF BUILDING PROPOSED FORM OF CONSTRUCTION LOADINGS TRANSMITTED TO THE GROUND AN ESTIMATE OF ALLOWABLE SETTLEMENTS	
23 **Copies**	Check that copies of the report are available to all tenderers for the foundation and building works The information used in the design of the permanent works is the same as that required for the design of temporary works	

Basic design

24 **PROJECT INFORMATION**	The use of the data supplied in the land survey and soil mechanics site exploration will provide information for:	
Foundations	design of type, size and depth of required foundations	**SfB (16) Foundations: General**
Retaining walls	design of type and size of required retaining walls	**SfB (13) Retaining Structures: General**
Earthworks	design of embankments, slopes, cuts and other permanent excavations	See 25, Embankments, slopes and cuts, below
Roads	design of roads, runways, both permanent and temporary	**SfB (14) Roads and Pavings: General**
Temporary works	design of temporary works for construction purposes TEMPORARY RETAINING WALLS STRUTTING TEMPORARY CUTS TEMPORARY EMBANKMENTS QUANTITIES OF GROUND WATER to be disposed of during construction FOUNDATIONS of cranes, derricks, tower cranes TEMPORARY BRIDGES OR RAMPS	*Although the design of these is not the normal responsibility of the architect he should be able to satisfy himself that such designs are sound. Such designs may however be subject to approval by the engineer*
Waterproofing	design of precautions against WATER PRESSURE UPLIFT CHEMICAL ATTACK FLOODING	
Drainage	design of drainage PERMANENT TEMPORARY (*normally during construction*) well point deep wells shallow wells cut off walls	**SfB (12) Drainage: General** *The point of disposal should be chosen with care, so that the stability of the permanent works and adjacent buildings and services is not impaired*
25 **Embankments, slopes and cuts**	Check use of embankments for: AESTHETIC PURPOSES IN LIEU OF STEEL OR CONCRETE STRUCTURES, e.g. footways, light bridges ACOUSTICS	*Screening effect of obstacles* *PARKIN, P. H., & HUMPHREYS, H. R.: Acoustics, noise and buildings. [Ab9] London, 1958, Faber and Faber, pp. 172, 252 *BS CP.3:1960. Chap. III, p. 83. Sound insulation and noise reduction [Ab9]
	The types of failure to be investigated in design are: SLIP FAILURES toe base slope SLIDING SETTLEMENT	TERZHAGHI & PECK, pp. 354–406 HOUGH, pp. 199–230 **TAYLOR, DONALD W.: Fundamentals of soil mechanics. New York, 1948, John Wiley & Sons Inc. London, Chapman & Hall, Ltd. [Ca]
	This depends upon the type of soil given by: ENGINEERING CLASSIFICATION (*from classification tests*) SHEAR STRENGTH (*from suitable shearing test, chosen with regard to type of soil and length of life*) DENSITY (*from density and compaction tests*) DRAINAGE PROPERTIES (*from permeability tests*)	
	On the basis of	
	HEIGHT	*The height is normally specified by use*
	DESIGN LIFE	*The length of life determines the relevant strength characteristics*
	DRAINAGE	*The drainage affects the relevant shear strength*
	SUPERIMPOSED LOADS	*Superimposed loads can either reduce or increase stability*
	USE, e.g. roadway reservoir	*The use determines the most likely causes of failure*
	Check use of grass or other vegetation to stabilise wind-blown soils prevent gullying	INSTITUTION OF CIVIL ENGINEERS. *Biology and civil engineering. Proceedings of the conference held at the Institution, September 1948. London, 1948, The Institution

	These factors together are combined to give the safe angle of slope or calculate the applied pressure to be retained, and govern the method of construction	*Note: The long term stability of slopes, especially in clay materials, is very complicated and needs the most thorough investigation by a qualified engineer*
26 **Earthworks and earth moving**	" Cut and fill " operations influenced by: TYPE OF MATERIAL QUANTITY OF CUT QUANTITY OF FILL BALANCE OF CUT TO FILL DIFFICULTY IN EXCAVATING	*The larger the operation the cheaper (generally) the unit rate* *A large unbalance of cut to fill or vice versa increases the cost due either to the necessity of finding tips for excess material or importing fill and in each case the additional haulage required*
	Source of material for filling purposes TYPE OF MATERIAL QUANTITY USE WHEN IN PLACE COMPACTED OR NOT COMPACTED METHODS OF COMPACTION	
	Areas for dumping of surplus soil ACCESS SURFACE AREA DEPTH OF AND SURPLUS ALLOWED DISTANCE OF LAND PRECAUTIONS ON SITE DEPENDING UPON TYPE OF SOIL PREVENT DAMAGE TO NEIGHBOURING PROPERTY PREVENT SPREADING PREVENT CHEMICAL ACTION POSSIBLE NEED FOR REVETMENT, TRIMMING COMPACTION TO INCREASE CAPACITY OF TIP	*Note: Laboratory tests required for bulking and compaction of soil*
	Area of cut or fill and depth of cut or fill	*In general a small area and large depth reduce costs in large scale operations due to reduction in haul distances. In smaller operations (typically building operations) the ratio of area to depth has an influence on cost through its influence on selection of suitable excavating and transporting plant*
	selection of plant to suit individual site specified methods of fill treatment, i.e. compaction. Selection depends on: TYPES OF SOIL SPECIFIED COMPACTION RESULTS SIZE OF COMPACTED AREA RATE OF COMPACTION	*Plant available:* *Steel rollers — not suitable for clays or wet sands* *Rubber tyred rollers — suitable for most soils — towed* *— self-propelled* *Vibratory rollers—suitable for sands and gravels* *Sheepsfoot rollers — clays only, normally in large quantities* *Grid rollers — for crushing rock material only* *Impact compactors large — for confined spaces, e.g. behind abutments* *Impact compactors small — trenches, spaces around manholes* *Note: Rock fill material best placed and compacted hydraulically*
	Specified methods of cut. From this, and type of site, the decision as to what plant is to be used is made	
27 **SETTLEMENTS, HEAVES AND OTHER MOVEMENTS**		TERZHAGHI & PECK, *various* HOUGH, *various*
28 **Types of movement**	TOTAL SETTLEMENT DIFFERENTIAL SETTLEMENT TOTAL HEAVE DIFFERENTIAL HEAVE	*Settlement in the form of movement caused by overloading the ground is not included here* *Normally differential settlements (or heave, e.g. negative settlement) is more important than total settlement, as differential ground movement causes differential movement in structural members while quite large total movements can be accommodated if the*

		structure moves as a whole (but these may cause damage to adjacent buildings or services)
	SOIL CREEP SOIL FLOW	*Flow and creep are normally of importance only over very long periods, except in cases of sudden catastrophic flow failures, e.g. landslides* *Creep normally occurs only in certain clays* *Flow normally occurs only in certain types of "natural" grounds, e.g. screes, marsh on slopes, and is normally associated with sudden changes in ground water conditions, or (occasionally) vibration*
	EARTHQUAKE MOVEMENT MINING SUBSIDENCE	*These are both subjects for consulting engineers experienced in local conditions causing such movements. Such engineers can be contacted through the* INSTITUTION OF STRUCTURAL ENGINEERS, 11, Upper Belgrave Street, London, SW1, or INSTITUTION OF CIVIL ENGINEERS [Aa2]
CAUSES 29 **soils**	These types of movement are affected by SOIL TYPE	*The type of soil is specified by:* *engineering classification tests* *consolidation characteristics from consolidation test* *density characteristics from density tests* *permeability from permeability tests* *shrinkage characteristics from shrinkage test* *pore pressure, moisture movement and capillary characteristics from relevant tests* *The total settlement in a soil depends essentially upon the amount of easily available density increase that can be caused by the applied load. Therefore any type of soil in a 'loose' (or 'light') state can be caused to produce large settlements. It is only 'rate of settlements' that depends mainly upon soil type. In general, clays produce slow movements, and sands and gravels fast movements. (This ignores elastic movements, essentially instantaneous.)* *These are general statements and should be treated with caution. They do not apply to peat or other organic material, for which each case needs special attention*
30 **loads**	CHECK SETTLEMENT due to loads during construction amount and duration after construction TYPE OF LOADING TYPE OF UNLOADING	*The type of loading (or unloading) affects movement inasmuch as the volume of soil affected by a foundation load depends upon* *value of load* *area of load* *depth of load* *It is particularly emphasised that, for a given area and depth of load, an increase in load increases the area and depth of affected soil. Similarly for a given load per unit area at a certain depth, an increased total area of load stresses (and therefore causes movement) in an increased depth of soil*

	VIBRATION	***CROCKETT, J. H. A. Vibration control in machine foundations. *Insulation*, 1961 (March, May and July) [Ab9] TERZHAGHI & PECK, pp. 111 and 528 *Prolonged vibration loads, though small in value, cause settlements in the same way as vibration compacts concrete They may cause extremely large movements, mainly in sands. Vibration loads of small duration may cause soil flows in certain soils, e.g. screes*
31 environmental	Moisture movement may cause: SHRINKAGE SWELLING and subsequent (*sometimes reversible*) ground movements Such moisture movement can be caused by: LARGE NEW PAVED AREAS, e.g. roads, carparks, runways TREES REMOVAL OR PLANTING OF VEGETATION NEW DRAINAGE CHARACTERISTICS, possibly caused by new construction, e.g. blocking of an underground river	*Biology and Civil Engineering
	VEGETATION	*Vegetation affects movement by altering the moisture conditions. It can also be used to check some movements, such as wind and water erosion*
	HEAT	*Large quantities of heat can cause combustion or shrinkage in soils and coal seams (e.g. the presence of boilers sited over coal seams at shallow depths)* **LITTLE, A. L.: Foundations, p. 99 London, 1961, Edward Arnold Ltd. [16]
	COLD	*Large volume changes are caused in soils by frost action. This can be natural or man made, e.g. frost induced in soils under cold storage buildings* LITTLE, p. 103
	Climate affects movements by: WIND causing erosion, especially in sands RAIN causing swelling, or in the case of screes, a soil flow, or erosion DROUGHT causing shrinkage FROST causing expansion EARTHQUAKES causing vibration loads and movements	TERZAGHI & PECK, pp. 528-9
32 other structures	Both permanent and temporary structures can cause movement of adjacent structures by the influence of their load on the strata beneath or above an existing structure, e.g. SURFACE LOADS may cause tunnels and shafts to settle HEAVY STRUCTURES may cause nearby light structures to tilt ANY STRUCTURE may cause damage to buried services by differential movement DEEP EXCAVATIONS may cause movement in nearby roads, buildings and services	
	It may be difficult or impossible to avoid some such movements. Reference should be made to the relevant Right of Support data	LONDON BUILDING ACT [Aa5] MODEL BYELAWS [Aa6] RAILWAYS ACTS [Aa5] LTE ACTS [Aa5] PARTY WALL LAW [Aa5]
33 subsidence	SHAFTS WELLS MINES The presence of old shafts, seams and other signs of mining activity, however old, indicates the possibility of past, present or future mining subsidence. If such a possibility exists the mineral valuer's report should be obtained and the services of a qualified mining subsidence engineer may be necessary to estimate the extent of future subsidence and collaborate with the structural engineer on the structural and foundation design	*This is a subject for consulting engineers experienced in local conditions causing such movements. Such engineers can be contacted through the* INSTITUTION OF STRUCTURAL ENGINEERS *or* INSTITUTION OF CIVIL ENGINEERS [Aa2] Nottingham County Architect's Dept. Design for mining subsidence. Architects' Journal, 1957, 126 (October 10), pp. 557–570 [(2) Hd]

Appendix A

DEFINITIONS

Engineering classification of soils

This mainly depends upon the size of the constituent material:

Size in mm.		
over 200 – 60	BOULDERS	*It is extremely difficult to obtain undisturbed samples of these soils*
60 – 20	COARSE GRAVEL	
20 – 6	MEDIUM GRAVEL	
6 – 2	FINE GRAVEL	
2 – 0·6	COARSE SAND	*These may sometimes be sampled in undisturbed form*
0·6 – 0·2	MEDIUM SAND	
0·2 – 0·06	FINE SAND	
0·06 – 0·02	COARSE SILT	*These may be sampled in undisturbed form by using various sample tubes*
0·02 – 0·006	MEDIUM SILT	
0·006– 0·002	FINE SILT	
0·002– 0·0006	CLAY	

The engineering classification of peats and other organic soils, and chalks, depends mainly upon geological and chemical tests

The behaviour of all soils depends upon:

CLASSIFICATION
PROPORTIONS OF ONE CLASSIFICATION TO ANOTHER
PARTICLE SHAPE
IN-SITU DENSITY
GROUND WATER CONDITIONS

IN-SITU TESTS

Plate bearing tests — A test done to find the settlement of the strata at various loads, and to indicate the ultimate bearing capacity

Standard penetration test — A test of an empirical nature to indicate the allowable bearing capacity of the soil

Vane test — A test to find the in-situ shear strength

Cone or penetrometer tests — These are of various types, but all are designed to give a record of the position of changes of strata, the resistance to driving of piles, the allowable bearing capacity of piles and the allowable bearing capacity of the strata

Pore pressure measurements — Are designed to measure those internal stresses in the strata which are likely to affect bearing capacity and slope stability, especially on a long term stability analysis

Californian bearing ratio (CBR) — An empirical test designed to give an indication of the capacity of the strata to withstand loads transmitted by pavings. Based on a comparison with a " perfect " soil

LABORATORY TESTS

Soil classification	*Information given and types of soil to which tests apply*	
LIQUID AND PLASTIC LIMIT	Classification into silts, clays (and possibly fine sand) only	**AKROYD, p. 17 et seq. *B.S. 1377 : 1948. Methods of test for soil classification and compaction [Ca3]
SIEVE TESTS	Classification into gravels, sands, silts	
PARTICLE SIZE DISTRIBUTION	Classification into silts, clays	
	Mechanical analysis	
SPECIFIC GRAVITY TESTS	For comparison in other tests	
MOISTURE CONTENT	For comparison in other tests	
ORGANIC CONTENT	For liability of soil to large volume changes	
CHEMICAL ANALYSIS FOR		
free sulphates		
free chlorides		
PH value	Degree of activity against buried structures	
full chemical	For special cases, e.g. very active chemicals in soils, special structures, special effluents	

FULL PHYSICAL, SPECTROSCOPIC OR MICROSCOPIC ANALYSIS	For specialist applications, mainly with sensitive clays	
	All these tests give valuable preliminary information on bearing capacity, settlement, compaction, road and water problems, to be amplified by further tests	
OTHER TESTS mainly chemical	For classification of peats and chalks	
Shearing tests		
SHEAR BOX—SMALL	For sands	
SHEAR BOX—LARGE	For gravels	AKROYD, Chapter VI
EITHER—DRAINED UNDRAINED	Information as below, but normally not so accurate or as full. However, large shear box is only convenient means of testing large gravels in the laboratory	
TRIAXIAL TESTS on samples 1½ in. dia., or 4 in. dia.	For clays, silts, sands to give information on: BEARING CAPACITY; PILE BEARING CAPACITY; SETTLEMENT; DESIGN OF SLOPES AND EMBANKMENTS; RETAINING WALLS, temporary and permanent	AKROYD, p. 80 ***BISHOP, ALAN W., & HENKEL, D. J. The measurement of soil properties in the triaxial test. London, 1954, William Clowes & Sons, pp. 74–81 both give details of test equipment *Tests carried out either drained or undrained, either consolidated or unconsolidated, either with measurement of pore-pressures or without, either on undisturbed or remoulded samples of soils, either with measurement of volume change or without or any suitable combination of these*
Consolidation or odeometer tests		
ONE DIMENSIONAL long term short term	For clays, silts and possibly peats. These give information on settlements and rates of settlements, and heave or expansion	AKROYD, Chapter VII
TRIAXIAL	In conjunction with shearing test	
Compaction tests	In conjunction with density tests, for all soils, but larger particles removed and allowance made in results	AKROYD, Chapter IX
AASHO MODIFIED AASHO DIETERT	These give information on: EMBANKMENTS; ROAD BASES AND SUB-BASES; FILL	*American Association of State Highway Officials* (AASHO)
OTHER NON-STANDARD TESTS	Including vibration compaction tests mainly for sands and gravels; these are used to give information on: SETTLEMENTS; VIBRATION SETTLEMENTS; LARGE SCALE EMBANKMENT TRIALS with very heavy compaction machinery (*including clays*)	*For these tests, arbitrary standards are chosen and must be stated*
CBR tests	For all soils. This and other similar tests, e.g. North Dakota Cone Tests, are used to give information for the design of road slabs and pavements, and aerodrome runways. All are empirical tests and were based firstly upon American practice. Normally used in conjunction with CBR tests on site	*Californian bearing ratio* (CBR) AKROYD, Chapter X
Permeability tests		
FALLING HEAD	For clay and silts	
CONSTANT HEAD	For sands and gravels (must be done at in-situ density of stratum)	AKROYD, Chap. VIII
	These provide information for: PUMPING CALCULATIONS; COFFER DAMS; PRECAUTIONS AGAINST "PIPING"; DESIGN OF SOAKAWAYS	*These tests are nearly always done in conjunction with in-situ permeability tests, and the resulting calculations, including the necessary flow nets, are done by a specialist engineer*
Shrinkage limit tests	For information on shrinkage and swelling movements in clays only	AKROYD, p. 28
Puddle clay tests	Empirical tests for clay only For information on use of clays as waterproof layers	AKROYD, p. 39
Stabilised soil tests	For all soils	AKROYD, Chap. XI
CEMENT BITUMEN CHEMICAL	These give information for the design of stabilised soil roads, runways and bases	*BS 1924 : 1957. Methods of test for stabilised soils [Ca3]

Chemical analysis tests PH VALUE SULPHATES CHLORIDES OTHER	All soils and ground water	AKROYD, p. 17 *These give information on possibility of aggressive attack on buried structures including pipes*
Other special tests	All such tests devised as special tests for a particular site in conjunction with specialist engineer and contractor	
SOIL CREEP	Related to long term stability	
PLASTIC FLOW		
EXPANSION	Related to long term stability	
SPECIAL PERMEABILITY TESTS	Often related to change of biological cover and to climate	
FROST TESTS		
CAPILLARY ACTION TESTS	Related to directional flow through laminated strata	
Submission of laboratory testing results	Related to climate Related to climate and mainly for large paved areas	*Other such tests may be advised by the specialist engineer as a result of the site exploration and laboratory testing*
	These must include: NUMBER OF SAMPLE related to site exploration record DEPTH OF SAMPLE TESTED DESCRIPTION OF SAMPLE TESTED REFERENCE TO PROCEDURE OF TEST e.g. British Standard or description of procedure READINGS TAKEN DURING TEST CALCULATIONS RESULTS UNITS OF RESULTS	*Results should preferably be supplied as testing proceeds* *Similar test results should be tabulated or plotted to a suitable scale*

SfB (11)

"The traditional practice of basing the design of foundations upon local site information amplified by the result of a few trial holes can be unsatisfactory.

Simple scientific investigation on the lines described in the following notes frequently saves many times its own cost. Specifically, it ensures that (a) where there is a stratum of high load-bearing quality upon which the building might be founded, this exists in all areas concerned and in ample thickness; (b) where the sub-soils are of poor or variable bearing value, enough working data are obtained; (c) where piled foundations are necessary the type of pile and probable length can be decided.

The structural engineer who has the detailed results of this kind of investigation can design with greater economy and confidence. There is less risk of the extra cost which may arise if the design has to be changed when excavation for the proposed foundation provides the first detailed information about the nature of the soil.

ECONOMICAL SITE INVESTIGATION

by F. D. Green

A.M.I.C.E., F.G.S., A.M.I.STRUCT.E., A.M.I.W.

Engineering Manager

Truscon Limited are willing to undertake this service (subject to the availability of the teams and their equipment) as a preliminary to designing a structure, basing charges simply on recovery of costs incurred. Site investigation is, in fact, best done at the earliest stage of building planning, for the information gained may well affect the design of the superstructure, or even the choice of the site itself.

The practice of scientifically investigating the sub-strata of building sites has become more general during the last twenty years, but owing to the cost has been confined mainly to larger buildings.

A method has been developed which gives as complete a picture as possible of the sub-strata, yet keeps costs within reasonable bounds. Two series of operations are involved: first the site is explored with a penetrometer, and then a few representative boreholes are made to establish the composition of the soils encountered . . ."

The opening paragraphs of the second edition of Truscon Review No.17, which are reproduced above, set out the general basis on which we provide a comprehensive site investigation service. The remainder of the Review, for which you are invited to write if you do not already possess a copy, sets out in detail our methods of operation.

Truscon Limited

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AJ SfB (11)

Technical study Ground: General

Soil investigation for the smaller project

Roy A. Nicholls describes the scope of site investigation and suggests a number of site tests which may be used on small projects

Greater use of soil mechanics and site investigation, and a growing body of knowledge of the theory behind them, has resulted in the last decade from the increasing use of sites hitherto discarded resulting both from the great increase in building generally and of larger and taller structures in particular.

Foundations present no new or very difficult design problem in the majority of structures, but a knowledge of soil mechanics makes it possible to reduce the cost of a design without loss of safety, and gives the designer greater certainty of how the completed structure will " behave."

Large and complicated investigations for a small project are rarely justifiable or indeed economically possible, but use of the general body of foundation theory available, plus a small scale site investigation, can increase the efficiency of the foundations.

A perfect example of this is the increasing use of short bored piles for houses on clay soils. Here, the basic research and design principles have been investigated, mainly in the Building Research Station, and are freely available. The only point to be decided is the need to use such piles, and this can quickly be determined by a few trial pits or auger holes on the particular site.

A site investigation adding only 1·2 per cent to the total project price will normally suffice to give adequate information, eg, for a project costing £10,000 approximately £150 would be required for site investigation. For this amount it should be possible to sink two boreholes to about 20 ft. below surface, sample the soil, and obtain test figures for use in design. This is only an example, and the depth and number of bores, or the use of trial pits, must be chosen to suit the site conditions.

This cost is well within the normal amount allowed for contingencies, and in all but a very few cases the cost will be covered by savings in construction, for the use of test figures in the calculation of allowable bearing pressures will give margins of saving over rule-of-thumb methods which can be misleading and are frequently over-conservative.

If the site investigation information is available to the contractor, uncertainties (and possibly later claims—most often encountered for work in the foundation stage) can be reduced at the tender stage. Obviously if no information is available on the materials in which the foundation is to be executed, then every circumstance in the construction is unforeseen. Information on ground water conditions alone will be well worth the small cost involved in exploring the site strata.

Appreciation of scope

Need it be said that the selection of the investigation work to be carried out, and its actual execution must be done by experienced persons? Unnecessarily elaborate investigations are nearly as bad as none at all. A clear idea of the proposed project and of the information needed to ensure suitable workmanlike foundations are required. Some of this appreciation is within the scope of the architect's office.

The scope of site investigations work

The majority of site investigations with which architects deal are required to give information on the following points only:

(*a*) allowable bearing pressures
(*b*) settlement problems
(*c*) ground water problems
(*d*) precautions against chemical attack.

Points (*a*) and (*b*) are very often inter-dependent. The allowable bearing pressure for a soil, may, if actually applied, produce settlements which exceed those tolerable to the structural designer. This emphasises the fact that the site investigation report must be written with a knowledge of the proposed structure. It is extremely difficult to give all-embracing figures of allowable bearing pressures, or estimated settlements, because different sizes and shapes of foundations have different allowable pressures on the same soil, and therefore produce different settlements. Further, for the same allowable pressure, different foundation types behave dissimilarly. Hence for a well-balanced and efficient foundation design knowledge of the structural details is also essential.

Bearing pressures

Dealing with point (*a*) above, the design of allowable bearing pressures has received a great deal of attention in soil mechanics research, as a result of which it is now possible, after tests, to give allowable bearing loads with considerable precision. This load depends upon :

(i) strength of the soil
(ii) type of soil and ground conditions
(iii) type of foundation

(Considerations of settlement, and the inter-action of (*a*) and (*b*) above are ignored here.)

For (i) the strength of the soil is measured by tests either in the laboratory or in situ. Most of these tests obtain the ultimate strength of the soil by means of some form of shearing or compression. From this the allowable pressures are obtained by means of a suitable factor of safety, which is most frequently some function of (ii) and (iii).

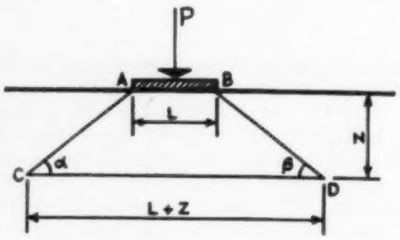
As the greater part of any site investigation is taken up in gaining information on the strength properties and the greater the information, the greater the cost, for a small project, economy is often achieved by cutting down on these data. In view of the basic need of having reliable figures for the soil strength, this is a hazardous proceeding. It is possible, however, to gain reliable strength information for small projects with only a limited expenditure by using the simpler types of site investigation technique, and these can often be carried out as part of the site appreciation mentioned earlier as being within the scope of the architect's office.

Definition of small sites projects

Here it may be well to define a small project in terms of a soil investigation. The most reliable concept here is to consider the depth to which the site strata will be stressed or altered by the new structure. The depth of stress change is a function of the numerical value of the loads applied, and the plan area of the applied load. Therefore large rafts, even though lightly loaded, can affect relatively deep levels. However, large areas of small isolated foundations (eg large single-storey sheds) only shallowly affect the sub-strata. Residential 2-storey development can be treated as a "small project," and areas of large extent can be treated as a series of "small projects." It is wise to consider 3-storey development with rather more care, and at least one bore-hole as deep as the height of the proposed building may be required on such a site.

Significant stress change method

The numerical calculation of stress changes and depth is complex. The following empirical method may, however, be used in helping to define the small site.



AB represents a footing carrying total load P.

The stress on the ground at AB is assumed to be $\dfrac{P}{\text{area at AB}}$

If the trapezium ABDC is drawn where $\alpha = \beta = 63\frac{1}{2}°$ then at any depth Z below AB

Length CD = L + Z, where AB = L.

The stress induced at depth Z may then be approximated by the expression $\dfrac{P}{\text{area at CD}}$

Thus for a square footing:

Stress in soil at AB $= \dfrac{P}{L^2}$

and stress in soil at CD $= \dfrac{P}{(L+Z)^2}$

At the level CD, before construction of the footing, the existing soil is already stressed by the ground above. This load is equal to $(Z.\gamma)$ per unit area where γ = density of soil in situ. For first approximations γ can be taken as 100 lb./cu. ft. in most cases. It can be safely assumed on most sites that when the stress on CD calculated by the above method is 10 per cent or less of the stress existing due to over-burden load, then no significant change will occur in the soils.

An example:—

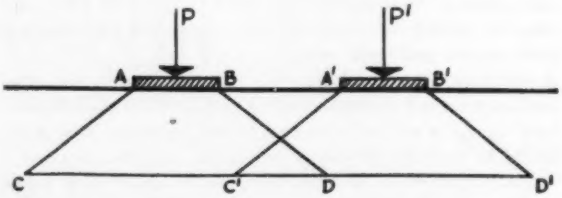
Assume a footing 5 ft. square with a total load of 50 tons.

The soil stress directly under the footing is $\dfrac{50}{5 \times 5} = 2$ tons per sq. ft.

At a depth of 20 ft. below the footing the soil stress is reduced to $\dfrac{50}{25 \times 25} = 0{\cdot}08$ ton per sq. ft.

The pre-existing soil stress at this depth is given by $\dfrac{20 \times 100}{2240}$ $= 0{\cdot}89$ ton per sq. ft.

Therefore no significant change in soil stress takes place below 20 ft. If two separate footings are close enough for the trapezium construction to overlap, as below,



then the soil in the area C'D is being stressed twice, and the significant stress change will occur much deeper. If overlap is more than 20 per cent this method should not be used, and a more accurate computation made.

It is emphasised that this is an approximate method of determining stress change. It applies to shallow foundations only, and can be used for square, round or strip footings. It is completely inapplicable to large loaded areas, and on sites where the ground water table is above the level of significant stress change, eg above the level of 20 ft. under the footing in the example above.

So a " small project " can be defined as one where from a preliminary appreciation of the site structure, and using the above type of calculation, it appears that no significant stress change will occur at depths greater than 10-15 ft.

This would normally include houses, and single-storey and two-storey structures where the floor loads are either applied through the footings or, if applied directly, are less than ½ ton per sq. ft. If the plan area of such a building or buildings is large, this should be treated as a series of " small projects," mainly to take account of possible changes of type of strata. It should be remembered that deep excavations for drainage may produce effects on strata below the foundations.

The site investigation can be planned from this preliminary appreciation. In a very few cases this type of approach is useless, eg very poor ground such as peat or marsh. Such sites should be obvious on first inspection. In the majority of small projects the two major difficulties which invalidate the significant stress change calculation are high ground water, and a stratum which is weaker than those above it. Both such snags will become obvious in the procedure detailed later.

If difficulties arise other than those already mentioned, it is obviously wise to increase the site investigation.

Scope of site work

In some cases (eg single houses) no investigation is needed other than reference to the relevant local authority, a geological map, and a survey of existing similar buildings in the area. Even so, this is best supplemented by a trial pit on the site. If examination of the site shows that the new building is to be taller than the existing structures in the area, further investigation is imperative. The heightening of existing buildings also calls for a thorough investigation of the sub-strata beneath the existing foundations.

Trial pits

For small projects the best information obtainable about the sub-strata is to be had from trial pits. These not only allow time for the strata to be studied, and give information concerning ground water, but, to depths of up to 8 ft., are cheaper than machine-executed trial bores. They may be supplemented by hand auger holes, either in other positions, or through the bottom of an incomplete trial hole, where ground water is troublesome.

To obtain soil strengths, undisturbed samples are required and these can be taken as easily from trial pits as from borings. Caution must be used, however, in pits where ground water conditions are troublesome. Allowable pressures are directly affected by ground water, and difficult conditions while digging the pits can mean difficult problems in designing the foundations (and during the construction). Pits can be dug by unskilled labour and should be kept timbered where necessary, and as clean as possible. The recording of strata and taking of samples should be supervised and recorded in an orderly manner, similar to that illustrated (see page 546), and once a site investigation has been embarked upon no information should be overlooked. One pit or bore should be sunk on every site. For the smaller project, one pit or bore per 10,000 sq. ft. of site area is advisable. For taller structures many other considerations arise, and the formulation of the numbers of trial holes or boreholes required is too lengthy to be dealt with here.

Classification of soil types

One of the principal results obtained from such a trial pit is a description of the strata penetrated. A major development of soil mechanics theory is a strict engineering classification of soil types. This relatively simple process of sampling and classification can yield, by itself, a great deal of data upon which a design can be based.

The process of classification divides soils into eighteen types, including many mixtures. From these, it can be seen at once what bearing and settlement problems will be encountered. This process of carrying out trial bores and pits, with classification by geology and simple tests is one essential feature of all investigations.

If the information from the trial pit, or boreholes, is properly obtained and set out, much other information is automatically given. This includes data on ground water problems and very nearly all the necessary information for an engineering appreciation of muck-shifting and excavation.

Difficulties and sources of error

One of the most common complaints heard concerning site investigations is that the conditions revealed during construction differ from those revealed in the borehole and trial pit records, and to avoid this great care and experience is required in interpreting these first findings, and an appreciation of what borehole findings can or cannot do. Firstly, the actual area of strata uncovered, even in a very large investigation, is minute compared with the area later to be exposed during construction and, secondly, the process of boring and sampling sometimes changes in varying degrees the properties of the strata. It is often only luck that results in a borehole revealing a small underground stream or a disused well, or a layer of very soft material between firm layers. These are small scale effects but may well have an effect on the construction of the building. In such cases as streams, wells, shafts, etc., there can be no substitute for reliable, intimate local knowledge. It is possible that geophysical methods, allied with the boreholes, may reveal some hidden snags, but no guarantee can be given.

As for sampling disturbances, in general it may be said that these cause the soil properties to appear worse than they are. In certain marginal cases it is imperative to check the soil properties by certain in-situ tests which can give more reliable results. But these are not available in all cases or for all soil types, and in situations where the ground conditions are marginally bad it may be worthwhile to open a quite large area of ground to examine the site on a scale more nearly full size. If construction proceeds on such a site, preparations should be made for modifications in design as the job proceeds. This may well apply more generally, for in foundation design the margin of possible variation in strata on a site is much larger than that in building materials.

The natural moisture content of a London clay can vary 4 per cent between two samples taken from within only 2 in. of each other. How much greater is the chance of missing a troublesome layer of silt on a two-acre site with four boreholes set at the corners! Obviously for the small project much help is gained by using the classification of soils as fully as possible.

Two types of sample for use in this way are obtainable from trial pits and shallow boreholes. First are disturbed samples, for visual description and classification tests if required. These should be about 1 lb. in weight, and kept in airtight sealed containers, adequately labelled, with identifica-

tion as to position, depth, etc. One such sample of each type of soil found in each pit or bore should be taken and kept, preferably until construction is well commenced.
Undisturbed samples can also be taken. These nearly all rely upon the driving of thin-wall sample tubes of varying diameters into the strata. Special driving tools are readily obtainable for use in trial pits, sometimes with auger tools Sampling needs considerable care and experience, the samples must be sealed after being taken and transported carefully. Such samples cannot be taken in gravels, and are very difficult to obtain in sands. They can be used for classification, but are mainly to obtain strength and density characteristics.
Suitable containers for undisturbed samples, such as Kilner jars, cost only one shilling each. A simple undisturbed sample apparatus capable of taking 1½ in. dia. samples need cost only £15 to £20.
From these samples, the soil classification can be commenced.
Firstly, the soil should be described visually. For most sites this means dividing the soil into four main types (clays, silts, sands and gravels) and mixtures of these. Local and personal descriptions should not be used.
In particular, clays should be described according to their firmness, on the general scale below:—

Test	*Classification*
Easily moulded in fingers	Soft
Can be moulded by strong pressure in the fingers	Firm
Cannot be moulded by fingers	Stiff
Brittle or very tough	Hard

Sand and gravel descriptions must give some indication of the proportions of particle sizes, and mixtures of soil types should be broken down as completely as possible.

Laboratory tests

In cases of difficulty, especially where silts and silty clays occur, it is advisable to classify the soil by means of the British Standard Classification Tests, eg liquid and plastic limit, particle size analysis and sieve test, which give exact answers.
These tests require a certain amount of laboratory equipment, some of which is quite expensive. However, many commercial soil mechanics laboratories exist, and small samples despatched to them can be tested cheaply. The cost of despatch will in most cases be small.
For example, the exact classification of a clay and sand mixture sample into its relative proportions should cost only £4 to £5. The grading of a sand gravel mixture will cost about £2. For a trial pit containing two or three types of strata an exact engineering classification of the soils will involve an outlay which is very unlikely to exceed £12. Even on sites containing organic materials, the amount will not exceed £20.

Sands and gravels

From the pits and classification test results the bearing value problem can then be studied. Often the simplest case is one in which non-cohesive soils (eg sands and gravels) occur. The major difficulty here is with ground water conditions and if ground water is near the surface or flows into the trial pit with rapidity, the bearing capacity of the soil should be regarded much more conservatively. The actual testing for strength of non-cohesive soils is more difficult than for cohesive materials (eg clays and similar soils). As already mentioned, undisturbed samples are impossible to obtain in gravels, and difficult in sands. One of the most reliable tests for these soils is to measure the actual density of the soil in its natural state in the pit. This is known as an in-situ density test, and suitable methods are given in British Standard 1377. This is a cheap, reliable, simple test, the cost of which should not exceed £2, excluding getting the operator and test equipment to the site. For fuller information, this in-situ density can be compared with laboratory tests on the material, where the maximum and minimum densities obtainable are investigated.
From these results, the soil can be described as loose, medium dense, or dense. Medium dense and dense soils will withstand the pressures transmitted by the types of structures under discussion. Loose soils may also withstand the loads, but will probably settle excessively, and will be affected by ground water to a greater extent than the denser soils.

Cohesive soils

The cohesive materials in the ground will require rather more study. In the case of sand and gravel strata mixed with clay, it is advisable to treat all strata with more than 20 per cent clay proportion as a cohesive soil. The taking of undisturbed samples in these soils is relatively easy, and is accomplished by driving the thin-walled sample tubes (normally 1½ in. or 4 in. dia.) into the soil. For clays containing stones the larger size is more suitable. These samples are then tested in the laboratory to obtain the compressive and shear strengths. The vast majority of such tests are carried out under triaxial compression conditions, in which the sample is surrounded by an enveloping pressure, and then compressed by means of a vertically applied load.
For a small project it is often sufficient to test the sample by means of the unconfined compression test, which is in fact a triaxial compression test in which the enveloping pressure is zero. This test is simple, reliable and cheap and can be carried out directly on the site. It gives all the information required to design for light loads, including the design of short bored piles. Unfortunately, the test is not suitable for samples larger than 1½ in. dia., and therefore cannot be used on stony clays. It is also unreliable on partially dried out clays, as the theory of the test assumes the soils to be fully saturated. It cannot be used in arid zones or on soils subjected to moisture changes due to heat or vegetation.
The cost of carrying out an unconfined compression test should be about £1, plus sampling costs and transport where applicable. The undisturbed sample gives the in-situ density of the soil directly.

Summary of procedure

The table opposite summarises the procedures required.
This table gives a simplified procedure for a site investigation suitable for small projects and light structures on certain soils. It is emphasised that many conditions on a site may invalidate this procedure. In particular, the existence at depth of a weaker stratum means that the relevant strength required is the strength of the weaker. Therefore, some information on the soil type underlying the loaded strata must be obtained to check the design.
If peat or similar organic soils are found, special precautions will be needed, unless it can be removed. The existence of chalk also calls for very thorough examination of the design, especially where fissures and ground water exist. Where rock exists at depths suitable for foundations

Operation No	Operation	Procedure in: Clays	Sands and Gravels	Mixtures
1	Dig trial pit to depth 6-8 ft. or to ground water level	Timber pit especially in soft clays	Timber or batter sides Timber essential where ground water enters	Timber
2	Probe through bottom of pit to a depth of at least 10-12 ft.	Use hand auger	Use hand auger or probe	Use hand auger or probe
3	Obtain samples	Use sample tubes to obtain undisturbed samples	Take disturbed samples for sieving analysis	Take undisturbed or disturbed samples as suitable to soil
4	Carry out soil classification	By inspection, liquid and plastic limit tests and particle size mechanical analysis	By inspection and sieving tests	By a suitable combination of tests and visual inspection
5	Carry out in-situ tests		In-situ density	Possible in-situ density
6	Carry out laboratory tests	Unconfined compression test (can be carried out on site) Triaxial compression tests Density tests	Maximum and minimum density tests (and possibly shear box or triaxial compression tests)	Any suitable combination of these tests depending upon type of mixture

Table giving a simplified procedure for site investigation

it must be proved to exist in thicknesses sufficient to withstand the higher loads it is normally expected to bear; finally, it is essential to investigate carefully sites where geologically recent alluvial materials exist, eg estuarine silts.

All the foregoing, of course, is sometimes applicable to heavier structures.

Plate bearing test

The plate bearing test is eminently suitable for the small project. Its inherent defect is that during the tests it stresses only a shallow depth of soil—this defect is not so important when considering sites defined as "small" in this article. The test is one in which a circular or square plate on the surface of the soil is loaded by means of a jack. The jack must be provided with kentledge and the plate deflection is measured accurately by means of four dial gauges. The test should preferably be carried out at two or three depths and can be combined with the trial pit excavation.

On most sites the most difficult part of the test is the provision of suitable kentledge, for loads of 20 to 30 tons are often needed as the test should reach the ultimate load of the soil. The test will however give very reliable results, and may also provide some information on the settlement of the completed structure. The load should be applied in small increments, and to obtain as much information as possible on the time-load relationship, the loads should be kept constant for as long as possible. Several days may therefore be required for each test. This test cannot be carried out below ground water level without dewatering the site. The cost will vary from site to site.

Settlement

The allowable bearing pressure with respect to soil strength having been found, the question of settlement must be investigated. All new structures settle to some extent, many structures settle all their life. It is *not* total settlement, however, that mainly affects a structure, but the differential settlement between various points.

Many faults in completed structures are due to settlement. Total failures of foundations are extremely rare, but expensive maintenance of buildings due to differential movement is common. Investigation of this point at the design stage is imperative, and need not be elaborate or costly. The foundations can then be designed with allowable settlement as the criterion, rather than allowable bearing pressure. This approach is becoming more general and offers a more logical approach to economic design.

Calculations of settlement can only be done as the result of laboratory testing on the soil to be stressed by the structure. The majority of settlement problems occur on clay soils, and therefore the most common test is the oedometer test which is now fairly standardised throughout the laboratories carrying out practical site investigations. The test is used to predict total settlement and rates of settlement in clay soils and is usually done over a wide range of loads. For certain soils and for lighter structures, however, the range can be decreased. As the experiment is a lengthy one, this could result in a saving of cost and time. Conversely, it may be necessary to increase the information coming from these tests, and vary the normal practice.

From these tests, and the design of the foundations, the settlement analysis can be carried out, but a complete analysis can only be made with a very good idea of the size and type of structure required. For instance, knowledge of the number, spacing and loads of columns is essential, and also of any points where allowable movement can be increased. The calculation of total settlement can then be made, and such computations are rapidly gaining in accuracy as the amount of information published in which calculated settlement is compared with measured settlement increases. The calculation of rate of settlement is liable to larger errors, especially over long periods, but normally errors in both total and rate are on the safe side. Reliable estimates can be made of settlement during construction and where necessary the computation of heave of ground, for very long periods after.

Reversals in movement, such as occur under roads, paved areas, etc., and those due to seasonal changes in the ground and vegetation cover can also now be predicted with considerable accuracy.

The question of settlement due to vibration, which occurs mainly in sand sub-strata, is very complicated but the work so far done is sufficient to take adequate precautions. Here one of the main problems is the lack of realisation that a problem exists. With many more buildings containing more and larger mechanical and electrical services this type of settlement will increase.

Design considerations

The settlement analysis may then lead to changes in the structure under examination to accommodate or reduce the movements calculated. These changes, more often than not, result from considerations of differential settlement. The

HOLLAND & HANNEN AND CUBITTS (Great Britain) LTD.

Soil Mechanics Section

BOREHOLE LOG

PROJECT St. Helens BORE No. 3

DATE BORING STARTED 9.2.61. TYPE OF BORE Hand auger

DATE BORING FINISHED 9.2.61. GROUND LEVEL

DIAMETER OF BORE 8" LINING None

WATER TABLE & DATE No water encountered

Daily Depth	Description of Strata	Sample No.	Sample Depth	Sample Type	B.H.	Depth B.S.	O.D. Level	Remarks
	Fill material					4'-0"		N.B. Levels relate to existing floor level
	SAND		5'-0"	D		5'-0"		
	Grey silty SAND		7'-0"	D		7'-0"		
	Brown SAND with small pebbles					10'-0"		
	Brown CLAY with pebbles (1½")			D		15'-0"		
	COAL (poor quality)		16'-6"	D		16'-6"		
	END OF BOREHOLE							

KEY: U—Undisturbed Sample. D—Disturbed Sample. B—Bulk Sample. W—Water Sample. S—Standard Penetration Test.

DATE ON 9.2.61. DATE OFF 9.2.61.	CONTRACT No. 5018	INVESTIGATION No. 2	SCALE 1"=4'	FIG. No. 3

A typical method of recording information about strata and samples computation of these is extremely complex, stemming as they do, not only from variations in soil properties, types and distribution, but from variations in load types. The most promising approach to this problem is to limit the bearing load to that fraction of the ultimate bearing capacity which it is known from empirical research will limit the differential movement to what is permissible. Here again, co-operation between designer and soil mechanics engineer will give the best answer to the problem.

If consideration of (*a*) bearing capacity and (*b*) settlement, shows that ordinary foundations cannot suffice at depths within reasonable excavating distance below ground, there are two alternatives. One is to provide a basement (or extra basement), to give buoyancy, and the other is piling. The decision whether or not to utilise the basement solution is normally decided on economic grounds. The soil mechanics engineer can give figures for the allowable increase in load for this solution together with settlement and heave computations.

Settlement in small projects

For the small project the calculation of settlements is often regarded as a luxury. This, however, does not prevent light structures from settling.

On sites where clays occur it is quite simple to obtain undisturbed samples from the trial pits of a type suitable for an oedometer test. Even one such test will provide a guide to potential settlement. The test is more expensive than most of the other tests previously mentioned, but but is still well worth while.

For sands and gravels the problem tends not to be so critical, and may be partly studied from the density results used in the bearing calculations. In any case the settlement occurs much more quickly than in clays and may be complete when construction is finished.

However, light structures are not liable to great trouble from settlement. Flexible framed single-storey buildings will rarely suffer, unless movement approaching foundation failure is experienced.

More rigid structures, including houses, are liable to damage from differential movement. Here the problem can be approached by so limiting the bearing loads that total settlement, and therefore differential settlement, is very small. If seasonal or alternate movements are expected the foundations should be taken down below the affected depth, eg by the use of short bored piles.

General rules cannot be framed for settlement problems for small projects. A study of them, however, can be made without greatly increasing the cost of the site investigation. The classification tests will indicate if a problem exists. A test on one sample for settlement properties should not exceed £10, plus sampling and transport costs. Computation, for more complex structures, will add to this amount.

Ground water

Ground water conditions on a site should be studied over as long a period as possible. In most cases information is collected only during the period of borehole drilling or trial pit excavation. However, wherever possible, longer term observations should be made to help in waterproofing and chemical action problems. The risks due to the presence of potentially destructive chemical elements in the ground may be very much reduced by the absence of ground water. If, however, ground water is assumed to be absent, but does in fact appear for limited periods only, then damage to buried foundations may well result. The cost of observing water levels for a few months is small, and well worth while.

If the use of soakaways on a site is under scrutiny, simple tests on the site can be carried out during the trial pit or boring programme, which will enable these to be designed with precision. The two simplest forms of test are:—

(i) to investigate the flow of water into the pit or bore,
(ii) to investigate the flow out of the pit or bore.

For (i), useful mainly where ground water already exists, the water table is reduced by baling or pumping. The rate of return is then measured. For the second type of test, an extra head of water is applied to the pit or bore, and the rate of dissipation recorded.

Both these tests can only measure water flow problems within a very small distance of the test position; for larger problems full scale pumping tests, with recorder boreholes, are necessary.

For the purpose of investigating chemical attack on buried structures, samples of soil and ground water are easily obtainable and can be simply and cheaply tested. The sampling and testing should be done on all sites, large or small. The cost of completely testing one sample should be about £2. In questions of electrolytic action, or other corrosive action, specialist advice should be sought, especially where large numbers of services exist underground.

Precautions against chemical attack on foundations usually take the form of using special cements. Advice on this problem is obtainable in literature published by the Building Research Station. It is noteworthy that clays in general, are more likely to give trouble in this respect. Direct contact with untreated water is of course potentially very dangerous, but the examination of this is outside the scope of this article.

Investigation for larger buildings and piling

Here the problem is mainly to penetrate deep enough to sample all the strata which will be affected by the new structure. Therefore machine boring and more complicated sampling methods are required. The basic procedure is the same—the soil is sampled, classified and tested for strength. In all cases there are occasions when this procedure still leaves doubt as to the safe value of load which can be applied, and frequently this occurs when the use of piles is being considered. The most suitable line of action in such conditions is to provide a test on site, to as near full scale as possible. Full scale pile tests and loaded area tests are examples. However, there are a number of other smaller tests also suitable for use in-situ. These include plate bearing tests and penetrometer tests of various kinds. It is safe to say that a site which requires penetrometer tests or full scale pile or loading tests to evaluate its strength is beyond the scope of the " small project."

Full scale pile tests

The computation of piled foundations presents a more complex problem. The values of the soil tests results obtained for (*a*) and (*b*) are used in the calculations, but the values may have to be varied owing to several factors, principally the type of pile used. Piles get their bearing capacity from a combination of end bearing and friction. The division between these two values varies from stratum to stratum, from pile to pile and from type to type. The allocation of the correct distribution is a matter of great complexity, and is by no means clear in a large number of cases. It should be regarded as mandatory to carry out a number of in-situ tests, preferably full scale, on any site where it is proposed to use piled foundations. These tests will yield very valuable detailed information which will enable a more economic design to be used than that based purely on theory.

The tests must be carefully planned and properly executed and one of their great merits is that they will lead to a much better understanding of the settlement characteristics of the site in question.

In the present state of knowledge, theoretical settlement calculations for piled foundations are liable to large errors and if test figures are available a much more accurate design can be made. The use of piles constructed on a guaranteed load basis must be subjected to rigid checks. While there are only a very few cases of such piles being found incapable of withstanding their guaranteed load, in far too many instances these loads are unrelated to any given settlement. This settlement can only be arrived at, before construction, by adequate site testing, and a knowledge of the soil strata to a depth below the piles equal to the length of the piles.

Temporary work design

The information gained from a full and accurate site investigation having been used to design the foundations, the selected contractors should study the report, as the information in it is essential to the design of temporary works and the planning of construction methods, as well as the design of the building.

Other uses of site investigation

Site investigations can of course be carried out for purposes other than the design of new structures. An increasing number are undertaken for remedial works, change of use, and heightening existing structures. In such cases the site investigation report will probably vary from the general run, and collaboration between designer and soil mechanics engineer is even more essential. It sometimes happens that the previous history of the structure is available providing accurate information of design purposes, but this is rare. This applies particularly to settlement. A wise precaution for the future would be to file a copy of the site investigation report with the as-built drawings.

Conclusion

To sum up, soil mechanics and site investigation enable us to predict the behaviour of structural foundations with a greater precision than ever before, owing to a growing body of theory, new techniques and case histories. But each site investigation is unique, and very few rules can be generally applied. The best use of this new technology is obtained by close collaboration between designer and soil mechanics engineer and in some cases the design of the foundation is best done by a specialist foundation engineer, skilled in soil mechanics.

AJ SfB (11)
Information Sheet No. 1001 UDC624·13 Ground: General

CLASSIFICATION OF GEOTECHNICAL PROCESSES: 1

This Sheet is the first of two summarising a number of known processes which will alter the properties of weak rocks and soils in situ to increase their load-bearing capacity and/or reduce their permeability to water. All these processes are founded on four fundamental principles—dewatering, compaction, artificial cementing and base exchange. The tables on this and the following pages set out the various processes under these main headings, briefly describe the nature of each process, the soil types to which each is applicable, the properties modified by the process and the field of use. Design work involved in any of these processes should normally be undertaken by a consulting engineer. The purpose of the tables is to enable the architect to recognise the problem and determine the method most likely to overcome it. He will then be in a position to take the next step: to call in and brief either a consultant or a specialist contractor.

There are, in fact, a number of patented techniques for carrying out some of these processes. The Federation of Civil Engineering Contractors will supply the names of members specialising in these patented techniques.

Needless to say, the use of any geotechnical process depends upon the soils concerned having been analysed and for this purpose a full site investigation will be necessary.

(Tables reproduced from "Classification of Geotechnical Processes" by Rudolph Glossop B.Sc. published in "Géotechnique," June 1950.)

FUNDAMENTAL PRINCIPLE	BASE EXCHANGE	
	Electro-chemical Hardening	Treatment with Concentrated Solutions
Nature of process	Direct current passed between aluminium electrodes inserted in the ground	(1) Clay mixed with solutions mechanically (2) Clay inundated with sea water
Soil types to which applicable	Clays with capacity for base exchange	Clay
Properties modified by the process	Moisture content reduced; cohesion much increased; swelling prevented: liquid limit decreased	Swelling properties increased; thixotropy developed; permeability decreased; liquid limit increased
Field of use	Excavation; prevention of frost-heave	Preparation of thixotropic slurries for injection fluids; improvement of clay puddle
Remarks	This process is still in the experimental stage but has been used on a large scale in Germany and Russia	Research needed, since clay is a valuable constructional material

DEWATERING				
DESICCATION				DISPLACEMENT
Capillary Forces				Compressed Air
Superficial	In Depth			
Vegetation	High temperature		Low temperature, natural ventilation	
	Permanent	Temporary		
Surface planted with suitable grasses, shrubs, willows, etc.	Surface of clay heated by portable furnace	Hot air circulated through adits	Circulation of air on surface or through deep rubble drains	Air pressure in working chamber of excavation is adjusted to hydrostatic head
All soils with a high moisture content	Clay	Clay	Clay	Sand, fine sand, and silt; clay at or near the liquid limit
Moisture content reduced; surface erosion decreased; stability increased	Moisture content much reduced; clay is hardened	Moisture content reduced; cohesion increased	Moisture content reduced; cohesion increased	Free ground-water expelled; sands acquire some cohesion; plastic flow of clay checked
Stabilisation of slopes, airfields, road verges	Improvement of clay roads	Stabilisation of slopes	Cuttings, etc.	Tunnels and caissons
Moisture content near the surface is decreased and controlled; surface slips prevented	Used in Australia	Only one instance recorded	A secondary effect of counterfort drains	Use limited to tunnels and vertical excavations of limited area owing to uplift; depth is limited to 100 ft. for physiological reasons; range of soils wide

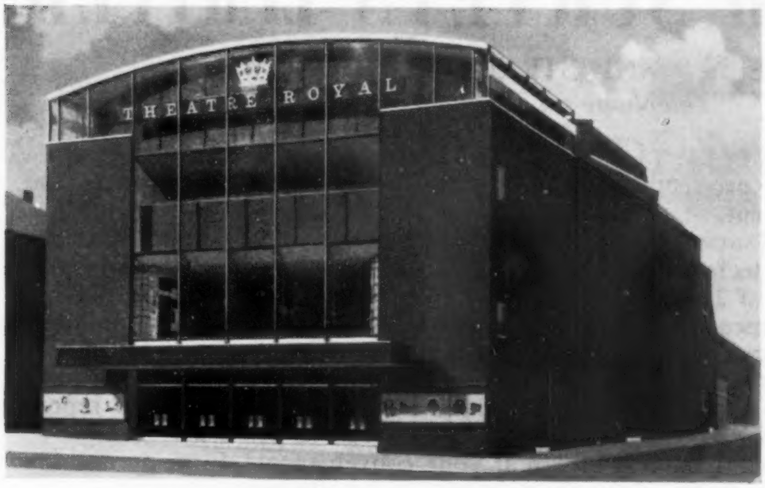
FUNDAMENTAL PRINCIPLE	DEWATERING									
	DRAINAGE									
	Gravitational Forces									Electrical Forces
	Flow Set Up by Pumping					Natural Gradient			Pressure Gradient	
	Groundwater lowering by wells			Sumps						
	Deep wells	Shallow wells	Well points	Simple	Filter	Land drains, French drains, mole drains	Adits and tunnels	Counterfort drains	Vertical drains	Electro-osmosis
Nature of process	Filter wells (20 in. dia.) with submersible pumps	Filter wells (12 in. dia.) at about 50-ft. centres	Well points (2 in. dia.) at 3–6-ft. centres	Sunk ahead of main excavation. Large enough for pump. Timber runners, sheet piles	Double sheeted sump with a gravel filling	Shallow trenches with or without pipes, filled with gravel, etc. Mole drains	Horizontal galleries sometimes back-filled with permeable filling round a pipe	Deep trenches backfilled with suitably graded material. Pipe drain at bottom	(1) Boreholes filled with graded gravel (2) Artesian filter wells	Potential-difference set up between wells and electrodes in soil reverses natural flow
Soil Types to which applicable	All non-cohesive soils coarser than silt (e.g. sand, gravel)					All types of soil	All types of soil if fissured or permeable	Silty sands, clay; particularly stiff fissured clay	(1) Clay and sand (2) Sand	Silt
Properties modified by the process	Water table lowered; artesian pressure relieved; piping prevented; lateral pressure decreased; sand after drainage will have some cohesion			Inflowing water collected and controlled if necessary by filter media		Moisture content decreased: cracks drained: standing water removed	Moisture content of non-cohesive soils reduced; internal erosion checked. In rock and stiff clay, drains fissures	Moisture content reduced; fissures drained; swelling of clay checked	(1) Voids ratio decreased, shear strength increased (2) Free water removed; artesian pressure relieved	Moisture content reduced; cohesion increased; slopes are stabilised by the reversal of natural drainage
Field of use	Drainage of excavations and relief of artesian pressure	Drainage of excavations		Drainage of excavations		To drain the subgrade of roads, run-ways, and railways; land drainage	To stabilise high natural slopes, prevent landslides	To stabilise small slopes, sides of cuttings, etc.	(1) To hasten natural consolidation (2) To relieve artesian pressure or uplift under dams	Excavation in saturated silts
Remarks	Submersible bore-hole pumps used	Average reduction in water-level by shallow wells and well points is 15 ft.	Unsuitable where headroom is limited, and where clay and sand alternate	Both the sinking and sealing of sumps are far more difficult than in the case of bored wells		Essentially suited to draining large areas to a very shallow depth	To drain large areas to a great depth; where topography permits, often used in conjunction with vertical drains	Chief use is to stabilise slopes in clay soils	To drain small areas to a great depth; to control seepage beneath dams and prevent piping	Still in the experimental stage, but has been used on a large scale in Germany
	Generally suited to excavations of large area and moderate depth; installation faster than sinking sumps; safer since flow is from the excavation; prevents piping and internal erosion									

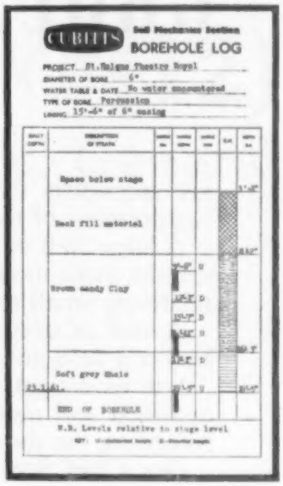
CLASSIFICATION OF GEOTECHNICAL PROCESSES : 2

FUNDAMENTAL PRINCIPLE	COMPACTION								
	IN DEPTH					SUPERFICIAL			
	Piling			Vibration	Explosives	Pressure	Impact	Vibration	Inundation
	Driven Timber or Concrete	In-Situ Sand Piles				Rolling	Rammers and Punners	Vibrators	Ponding
		Lined hole	Unlined hole						
Nature of Process	Short piles driven at close centres	Damp sand tamped into hole formed by withdrawn pile tube	Concrete or sand tamped into hole formed by conical monkey	Use of specialist plant	Detonation of buried charges	Sheepsfoot; pneumatic; smooth; construction traffic; also man and animal power	Hand or mechanical rammers; dropping weights	Heavy static vibrators; vibrating rollers	Loose fills, flooded with water, with or without well points
Soil Types to which Applicable	Sandy silts and loams (loess) unsaturated with water, with numerous air voids. Lined holes used in permeable sands, saturated with water			Sandy and silty soils	Well sorted sands below critical density; saturated	All soils except peat		Mainly sandy soils	Sand
Properties Modified by the Process	Angle of internal friction increased; density increased; porosity decreased; permeability decreased; shear strength and hence bearing capacity, increased			Density increased	Density increased above the critical value; horizontal permeability much decreased	Angle of internal friction increased; cohesion also increased if moisture content controlled; density increased			Angle of internal friction and density increased
Field of Use	Beneath raft foundations of buildings; moderate loading can be used in soil above or below groundwater-level		Buildings, bridge piers; heavy loading	Compaction of fills	Foundations for earth dams	Compaction of subgrade of roads and runways; embankments and earth dams	Compaction of small areas, such as backfill, and trenches; embankments	Compaction of embankments; subgrades; earthworks	Compaction of sand fills
Remarks	A method long known and used on compressible soils	Chiefly used in Germany; Franki system	Chiefly used in France; Compressol system; appears to be obsolete	Developed in Germany before the war; said to be highly efficient	Used on a number of dams in the U.S.A.	Thorough compaction effected by repeated passes of sheepsfoot, pneumatic, and smooth rollers; soil should be slightly below optimum moisture content; effect checked by Proctor tests and full-scale field tests; peat below embankments may be removed by bog blasting			

FUNDAMENTAL PRINCIPLE	ARTIFICIAL CEMENTING								
	PERMANENT						TEMPORARY		
	Injection Processes						Freezing		
	Single Fluid					Two Fluids	Liquid Refrigerant	Gaseous Refrigerant	Solid Refrigerant
	Cement grouting	Asphalt grouting	Bentonite and clay grouts	Bituminous emulsions	Soluble silicate solution	Soluble silicates	Poetsch	De Hottay	Dricold
Nature of process	Cement grout pumped in through pipes or drill holes	Liquid asphalt pumped into drill holes through pipes electrically heated	Grout of thixotropic clay-suspension; a dispersing agent may be added	Bitumen dispersed in water with the addition of a flocculating agent	Solution of sodium silicate with addition of an agent to cause delayed flocculation	Alternate injections of sodium silicate and calcium chloride	Chilled calcium-chloride brine circulated in bore holes	Expansion of carbon dioxide into freezing circuit	Application of solid carbon dioxide and alcohol
Soil types to which applicable	Rock fissures, very coarse sand, gravel	Wide fissures in rock (e.g., limestone)	Coarse, medium, and moderately fine sands: effective size 0·1 millimetre				Water-bearing sands and silts; clays with moisture content at or exceeding the liquid limit		
Properties modified by the process	Cavities and fissures blocked; in granular material, permeability decreased and strength increased		Cohesion very slightly increased; permeability reduced			Cohesion greatly increased; permeability reduced	Cohesion temporarily greatly increased; permeability reduced to zero		
Field of use	Shaft sinking and tunnelling in rock	Sealing of fissures and cavities below dams	Checking the flow of water in sand beneath dams and into cofferdams, etc.; prevention of piping			Under-pinning; tunnels; excavation	Shaft sinking, underpinning, and excavation		
	Reduces compressed air losses in tunnels and caissons								
Remarks	A cheap and effective method of sealing water-bearing fissures more than 0·1 millimetre in width	The only injection method by which large cavities with fast-flowing water can be sealed	In all these processes the suspension or emulsion coagulates after injection. They are preferable to the two-solution processes where a very large volume of ground is to be treated, but only if no increase in strength is required			Reaction instantaneous after the addition of the second solution; mechanical strength is much increased	A construction expedient chiefly used in shaft sinking where depth precludes compressed air; in underpinning in silt and mud where other methods are inapplicable, costly, and slow		

SITE INVESTIGATIONS FOR ARCHITECTS





This is the actual log of the borehole driven from the stage of the Theatre Royal, St. Helens. It shows the type strata and the positions of the various samples.

A CASE HISTORY FROM CUBITTS

The old Theatre Royal, St Helens is being converted into a modern theatre by Pilkington Brothers Ltd., for the use of their staff and the townspeople. Bryan and Norman Westwood & Partners are the architects.

The old theatre will be rebuilt entirely. Originally it had load bearing walls, but in the new theatre structural columns will transmit greater loads to the ground. This also involves new types of loading, and deeper layers of ground strata will be stressed.

Cubitts' Soil Mechanics Section was called in to investigate the strength of the ground below that already loaded by the old theatre. Site investigation was planned and carried out with the old building still standing. Trial pits were used to investigate the existing footings and the ground stressed by them.

It was necessary to penetrate deeper. This was done by a combination of hand auger holes and holes drilled with a shell and auger rig. The hand auger holes were sunk through the bottom of the trial pits, and in the stalls directly under the circle where headroom was insufficient to allow the use of a shell and auger rig.

The shell and auger rig was brought into the theatre through the stage door and erected on the stage.

Undisturbed and disturbed samples were taken from this hole and from other pits. Laboratory investigations of these samples led to the test results which were used to give the allowable bearing loads.

Laboratory investigations of clay samples leads to the evaluation of allowable bearing pressures.

A shell and auger rig at work on a soil investigation. Cubitts employ a number of site investigation teams able to carry out complete surveys in all parts of the country for the design and construction of foundations.

Cubitts' Soil Mechanics Section is equipped to drill in all materials, to take all types of samples and to carry out all soil mechanics tests. The Section can also advise on foundation design.

CUBITTS

Holland & Hannen and Cubitts Ltd.,
1 Queen Anne's Gate, London, S.W.1

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AJ SfB (12)

Drainage: General

Peter Burberry, author of the Elemental Design Guide and the special article, Recent Developments in Drainage, is an architect in private practice and a lecturer on Services at the AA. He has a longstanding special interest in all matters to do with drainage and has already published a number of check lists on services in the Journal.

(12) *Drainage: General*
The subject matter of this element file has been confined to drainage below ground, that is, up to and including the junction with the lowest fitting. Drainage above this point will be treated in (52) *Installations, Sanitation: General.*
The element file contains a main Elemental Design Guide on the design of drainage schemes in general and two minor design guides as appendices on sub-soil drainage and sewage disposal. It contains an article on Recent Developments in Drainage and four Information Sheets. These last give a comparison of materials for drain pipes and describe the current range of stoneware gulleys, brick manholes and manhole covers.
The references chosen for this Design Guide are all readily available with the exception of the US Department of Commerce, National Bureau of Standards Report BMS65 on the estimation of the flows produced by plumbing systems. This will, in any case, be superseded in Britain by a new design method shortly to be published by the Building Research Station.

(12) Drainage : General

Bibliographic references in the third column are graded as follows:—

* General reference of value to every architect and which he may wish to possess.

** Specialised reference normally used by consultant or architects with special knowledge of particular aspects of building.

*** Highly specialised references and research papers which would not be of value to the architect unless working with a consultant.

Figures in square brackets are SfB references to the publications mentioned.

General

1 **REGULATIONS**	ENGLAND outside London	**Public health act 1936 [Aa5] MOHLG Model byelaws. Series IV. Buildings 79-102. [Aa6]
	inside London	**Public health (London) act. 1936. [Aa5] LCC drainage byelaws [Aa6]
	SCOTLAND	Department of Health for Scotland Model building byelaws for burghs. 1954: reprinted 1957. [Aa6] Model building byelaws for counties 1954 : reprinted 1957. Part VIII. [Aa6] *BRITISH STANDARDS INSTITUTION CP 301: 1950. Building drainage. [12]
2 **Information required by local authorities**	Plans and information required by byelaws (part of general PHA submission) Usual information: Plans and sections showing: positions, levels and types of sanitary appliances, paved areas and RWP's lines, sizes and levels of drain and means of access and ventilation position and details of sewers or means of sewage disposal	LCC Drainage byelaws, Section 14 [Aa6] *CP 301: 1950. clause 103 (e) Model byelaws. Series IV. First schedule. [Aa6]
	Notice of intention to discharge trade effluent to sewer	**Public health act, 1936. Section 27. [Aa5] **MOHLG Final report of the Trade Effluents Sub-committee of the Central Advisory Water Committee. 1960. (*review of effluent types and law*) [Ab6]
	If required by local authority estimate of peak flows and character of sewage	
3 **Definitions**		*CP 301: 1950, clause 102. [12] **Public health act, 1936. Section 343. [Aa5]

Data required

4 **Land: Establish the following**	SURFACE LEVELS, existing and proposed VEGETATION and other special features SUBSOIL: mechanical and chemical properties (*e.g. sulphates*) WATER TABLE EARTH MOVEMENT: likelihood and extent TRAFFIC to be expected EXCESS EXCAVATION: areas for disposal BEARING CAPACITY OF SOIL if deep manholes are required	**SfB (11) Ground: General, paras. 1-7**

5 **Rights and obligations**	PRIVATE SEWERS DRAINAGE TO AND FROM ADJOINING SITES (*check with deeds of property and local authority*)	**Public health act, 1936, Section 38. [Aa5] *GOODIN, F. G., & DOWNING, J.: Domestic sanitation. p. 230. London, 1959, Estates Gazette Ltd. [12]
6 **Other services on site existing and proposed**	Lines, levels, sizes and any special requirements or limitations Types: FOUL SW COMBINED Special requirements by local authorities: separate drains on site for future separate sewers no more SW accepted in existing combined sewer Lines Diameters Levels Material Level at which connection can be made Will local authority make connection? Is interceptor required? Likelihood and consequence of surcharges *particularly in relation to basement sanitary appliances*	**Public health act, 1936, Section 32. [Aa5] *Note: local authorities have duty under PHA, 1936, to maintain sewer plans for public inspection* *CP 301: 1950. clause 103 (b) Drainage to a sewer [12] *GOODIN & DOWNING, p. 224 [12] **Public health act, 1936, Sections 34 and 36 [Aa5] *Consult local authority*
7 **Sewage disposal** (if public sewers are not available)		See Appendix " B." Sewage disposal
BUILDING 8 **Proposed work**	Position on site (new and existing buildings) Levels of ground floor and foundations Construction of foundations and ground floor Extent, material and levels of paved areas Foul inlets: position, material and diameter STACKS VENT WASTE SOIL GULLIES GROUND FLOOR W.C.S SW inlets: position, material and diameter, RWP'S GULLIES Volume and nature of flows to be anticipated: volume of surface water run-off at each entry peak flows for foul drains special effluents	*Economy and the practical limitations of drainage will normally be taken into account when deciding these points at the design stage* *When the drain designer has to deal with an already completed plan, the information will be taken from the drawings* *BUILDING RESEARCH STATION Digest No. 6 (2nd series). Drainage for housing [12] *CP 301 Clause 103 (d) [12] *CP 303: 1952. Surface water and subsoil drainage. Section 3 (*Design considerations for SW*) [12] *BURBERRY, P. Recent development in drainage. Architects' J., 1961, 134 (14) (October 4) p. 565 [**12**] **PHA, 1936, Section 27 [Aa5] Report of Trade Effluent Sub-committee. [Ab6] Model byelaws 85 [Aa6]
9 **Existing drains**	Establish as far as possible on site: POSITIONS LEVELS MATERIALS CONDITIONS	*Refer to deeds and local authority* *GOODIN & DOWNING, p. 347–358. Testing [12]

Basic design decisions

10 **SELECT PIPE MATERIALS AND JOINTS** **Considerations**	EXTERNAL OR INTERNAL SOIL OR SURFACE WATER STRENGTH FLEXIBILITY AND EXTENSIBILITY (to resist ground movement)	Model byelaws 82 [Aa6] *BRS Digest No. 124. Small underground drains and sewers: 1. 1959 [12]

		No. 125. Small underground drains and sewers: 2. 1959. [12] No. 134. Questions and answers on underground drainage. 1960. [12]
	SKILL OF LAYERS NATURE OF EFFLUENT NATURE OF SUBSOIL (chemical) RANGE OF FITTINGS AVAILABLE RELATIVE DISCHARGE CAPACITY SPECIAL LAYING PROBLEMS: maintenance of flow waterlogged trenches frost rapid testing COST	
11 **Materials: General Comparison**		*GOODIN & DOWNING, p. 184–190. Pipe Materials [12] *CP 301 Section 3 clause 306. Choice of material [12] *BURBERRY, AJ 4th Oct., 1961 [**12**]
Detailed Properties	STONEWARE—spigot and socket joint self centring joint bituminous joints 9 in.–18 in. dia. neoprene ring joint 4 in. and 6 in. dia. " seconds " BS BS tested	*BS 65: 1952. Salt-glazed ware pipes including taper pipes, bends and junctions [Ig4] *BS 539: 1951. Dimensions of drain fittings. [Ig4] *BS 540: 1952. Glass (vitreous) enamelled salt-glazed fireclay pipes [Ig4] *BRS Digest no. 85, p. 2. Fracturing of drain pipe sockets. [Aa2]
	CAST IRON—caulked lead joint rubber ring joint	*BS 437: 1933. Cast iron spigot and socket drain pipes. [Id1] *BS 1130: 1943. Schedule of cast iron drain fittings, spigot and socket types. [Id1] *BS 1211: 1958. Centrifugally cast (spun) iron pressure pipes for water, gas and sewage. [Id1]
	CONCRETE—spigot and socket joint rubber ring joint	*BS 556: 1955. Concrete cylindrical pipes and fittings including manholes; inspection chambers and street gullies. [If2]
	PITCH FIBRE	*BS 2760: 1956. Pitch impregnated fibre drain and sewer pipes [In2] *BRS digest 67, page 2. Pitch-fibre drain pipes 1954 [Aa2] *BRS digest 97, page 1. Pitch fibre pipes 1957 [Aa2] *BRS digest 120, page 1. Pitch-fibre pipes for house drainage 1959 [Aa2]
	ASBESTOS CEMENT—pressure pipe	*BS 486: 1956. Asbestos cement pressure pipes [Ih1]
	drain pipe	Manufacturers' literature
	Note that relative levels of building site and sewer or sewage disposal plant must be taken into account when designing the building, and that positions of sanitary fittings and the plan of the building should also be considered if economical drainage is to result	AJ Information Sheet No. 1003, Drainpipes: materials, joints and sizes [**12**]
PREPARE DRAIN LAYOUT		
12 **Take into account**	EXISTING DRAINS—decide whether to repair in situ or relay	Consult specialist drain repair firms See new drain generally
	ECONOMICAL PIPE RUNS	*CP 301, clause 302. Layout of drains [12] *BRS digest 6 (2nd series) [12]
	ECONOMICAL FALLS in relation to ground level sewer connection or sewage disposal arrangement	Model byelaw 82 [Aa6]
	MINIMUM COVER—under gardens and fields under roads	*BRS digest 6 (2nd series). Drainage for housing [12]
	MAXIMUM AND MINIMUM DESIRABLE FALLS	*Institution of Sanitary Engineers. Report of the joint committee on field research into drainage problems (satisfactory falls). London, 1957, The Institution [**12**]

	DRAIN SIZES in relation to available fall and discharge required	*CP 301, clause 304 Gradients [12] *GOODIN & DOWNING, p. 225–228 (*Chezy's Formula inaccurate but simple and widely used*) [12] *Tables of drain discharges. Arch J. 1961, 134 (Oct. 4) [**12**] *BRS digest 6 (2nd series) [12] ***MANUS, V. T.: National plumbing code handbook. New York, 1957, McGraw Hill Publishing Co. Ltd. [Ab8] ***US Department of Commerce, National Bureau of Standards Report BMS 65 (16.12.40) Estimating loads in plumbing systems [Ab8] ***DSIR Hydraulics Research Station. Hydraulics research papers no. 1. Resistance to fluids flowing in channels and pipes. P. Ackers. 1959. [Ab8] ***no. 2. Charts for the hydraulic design of channels and pipes. P. Ackers 1959. [Ab8] ***ACKERS, P.: Hydraulic resistance of drainage conduits. Institution of Civil Engineers Proceedings. 1961, 19 (July), 307–336 [Ab8]
13 **Provide access**	Access for cleaning: MANHOLES— at intervals along drain at bends at changes of gradients at junction against direction of flow ACCESS GULLIES RODDING EYES	*CP 301, clause 308 Access [12] Model building byelaws for burghs 105, counties 106 (Scotland) [Aa6]
14 **Provide ventilation**	3 in. vent stacks at head of drain FAI if interceptor is used Unvented branches not longer than 20 ft.	*CP 301, clause 301 Ventilation [12] *GOODIN & DOWNING, p. 197 [12] Model byelaws 89 [Aa6] Model building byelaws for burghs 107, counties 108 (Scotland) [Aa6]
15 **Check falls**	Expedients for inadequate falls: making up ground flushing cistern All inlets to foul drains other than waste, soil or vent stacks to be trapped	Model byelaws 84 [Aa6] Model building byelaws for burghs 108, counties 109 (Scotland) [Aa6] *GOODIN & DOWNING, p. 201 [12]
16 **Select drain fittings** GULLIES	MATERIALS—salt glazed cast iron concrete TYPES—standard back inlet—*vertical* *horizontal* access yard road ACCESSORIES—raising pieces dishes waste receivers gratings kerbs type DATA—inlet—*shape* *size* outgo—*diameter* *angle* accessories	*CP301, clause 312 Gullies [12] AJ Information Sheet No. 1004, Stoneware gullies Manufacturers' literature *BS 539 [Ig4] *BS 1130 [Id1] *BS 556 [If2]

DRAIN SHOES RODDING EYES JUNCTIONS		Manufacturers' literature
17 **Decide manhole construction**		
CONSIDERATIONS	Internal or external Size of chamber Size and alignment of cover Cost	
TYPES	CI in brick chamber Brick and stoneware fittings Precast concrete	Manufacturers' literature
18 **Decide on special fittings or installations required**	Grease traps	*GOODIN & DOWNING, p. 203 [12] CP 301, clause 313 Grease traps [12]
	Petrol interceptors	*Institution of Municipal Engineers civil engineering code of practice no. 5 Drainage (sewerage). London, 1950, IME [12] *GOODIN & DOWNING, p. 221–223 [12] *CP 301, clause 314 Petrol and oil traps [12]
	Automatic flushing cisterns	
	Anti-flood valves or gullies	*GOODIN & DOWNING, p. 203 [12]

Detail design

19 **GENERAL**	Conventions, working drawing and specification information	*BS 1192: 1953, Drawing office practice for architects and builders [Ba5] *BURBERRY, P., Check lists 2: drainage installations. Arch. J., 1961, 133 (3449) (May 25), 781–2 [52]
20 **Gullies**	BEDDING SURROUND CHANNELS KERBS BEDDING FOR ROAD GULLEY GRATINGS	
21 **Manholes** BRICK	APPROPRIATE SIZES FOR WORKING	AJ Information Sheet No. 1005 [**12**] *CP301, clauses 315–317, figs. 4–7, Size, construction [12]
	PIPE SPACING BASE	*BRS digest 6 (2nd series), Size construction, shallow only [12] *GOODIN & DOWNING, p. 194–7 (*general description and diagram*) [12]
	WALLS—bricks mortar arches over pipes	*BS 1301: 1946, Clay engineering brick [Fg2]
	SLAB OR CORBELLING	
	CHANNELS	*BS 65 [Ig4]
	BRANCH BENDS Y-JUNCTIONS DRAIN CHUTES BENCHING	
	STEP IRONS	*BS 1247:1955, Manhole step irons (malleable cast iron) [12] *CP 301, clause 318, Spacing, etc. [12]
	INTERCEPTING TRAPS	*BS 539, Stoneware [Ig4] *BS 1130, Cast iron [Id1] *CP 301, clause 319, Interceptors [12]
	FRESH AIR INLET VENT (if not achieved by S & VP)	
	DROP MANHOLES	*CP 301, fig. 8d, clause 320, Drop manholes [12]
SPECIAL CONSIDERATIONS	Cast iron inspection chambers Pitch fibre channels and branch bends	
PRECAST CONCRETE		Manufacturers' literature

COVERS:		Manufacturers' literature
MATERIAL	CI	*BS 497:1952, Cast manhole covers, road gully gratings and frames for drainage purposes [12]
	Concrete	
	Broadstel	AJ Information Sheet No. 1006, Manhole covers **[12]**
DIMENSIONS	Size	
	Weight (strength to carry traffic)	
TYPE	Recess to receive finish	
	Single seal	
	Double seal	
	Locking	
	Non-rocking	
FIXING	Alignment with paving	
	Bedding	
22 **Trenches**	MINIMUM WIDTH AT DRAIN CROWN	*BRS digests 124, 125, 134 (1st series), 6 (2nd series) [12]
	BEDDING: GRANULAR side fill over fill backfill CONCRETE bedding haunching surround backfilling after concrete	
23 **Drains passing through walls**	ARCH OVER DRAIN LINTEL OVER DRAIN	*BRS digest 125 [12] Model byelaws 87, Walls; 7, 8 and 32, Buildings [Aa6]
24 **Drains passing under building**	DRAIN MATERIAL COVER	Model building byelaws for burghs 102, 103; counties 103, 104 (Scotland) [Aa6] *CP 301, clause 302(f) [12]
25 **Sewer connection if not by local authority**	COMMUNICATION PIPE (as drain) JUNCTION: Saddle New pipe junction introduced into sewer RODDING ACCESS from last manhole or interceptor TESTING	

Specification

26 **GENERAL**	Drains to be laid at commencement of contract	*Specification, London, annual, Arch. Press [Ba5]
	Excavation to proceed upstream	
	Backfilling to be done at earliest opportunity	
	Trench widths to be kept to maximum specified	*BRS digest 125 [12]
	Timbering	*CP 301, clause 322, Excavations [12]
	Dumping	
	Handling and storage	
27 **Materials, laying and testing**	PIPES AND FITTINGS—SPECIFY THOSE REQUIRED	
	LAYING AND JOINTING	*CP 301, clause 505, Laying stoneware, concrete and cast iron [12] *BS 2760, appendix, Laying pitch fibre pipes [In2] Manufacturers' catalogues, Laying asbestos cement pipes
	TRENCH: widths for various drain diameters	*BRS digest 125 (1st series) [12]
	bedding—*granular*	*BRS digest 6 (2nd series) [12]
	concrete	*BRS digests 124, 125, 134 (1st series) [12]
	backfill and disposal of surplus	*BRS digest 6 (2nd series), Backfill and bedding [12]
	backfill under roads	*BRS digest 125 (1st series) [12]
	MANHOLES	*BRS digest 6 (2nd series) [12]
	SEWER CONNECTIONS	*CP 301, clause 507, Sewer connections [12]
	TESTING—watertightness	*CP 301, clause 602, Testing: water, ball, mirror [12]
	alignment	*BRS digests 125 (1st series), 6 (2nd series) [12]

		Model building byelaws for burghs 100 (6) and schedule E, counties 101 (6) and schedule E (Scotland) [Aa6]

Contract

28 **Progress schedule**		
29 **Supervision**	CHECK giving of notices setting out AGREE WITH CONTRACTOR: materials and fittings size of excavations, thoroughness of backfill DRAIN TESTING—alignment: ball and mirror watertightness: water test	*CP 301, clause 602(e), Ball and mirror [12] *BRS digests 125 (1st series), 6 (2nd series) [12] *CP 301, clause 602, Water and air tests [12]
30 **Handing over**	PROVIDE CLIENT WITH: record drawing suggested maintenance schedule	*CP 301, section 7, Maintenance [12]

Appendix A: Subsoil drainage

31 **DATA** As required for drainage (except positions of SW Foul drain inlets and flows) and in addition	Areas requiring subsoil drainage Details of watercourses: bed and bank levels Natural movement of subsoil water (*may not follow surface contours*)	**SfB (11) Ground: General** elemental design guide
BASIC DESIGN DECISIONS 32 **Drain materials**	CLAY CONCRETE (porous) PITCH FIBRE (perforated) FRENCH DRAIN OPEN CHANNEL	*BS 1196:1944, Clayware field drain pipes [Ig3] *BS 1194:1955, Concrete porous pipes for under-drains [If4] *BS 2760 [In2] *CP 303 (1952), clause 502(c) [12]
33 **Systems of pipe layout**	NATURAL (follows natural depressions) HERRINGBONE GRID FAN MOAT OR CUT-OFF (intercept flow around building)	*CP 303, clause 302(d) [12]
34 **Functional requirements**	DEPTH AND SPACING in relation to type of soil MINIMUM FALLS, sizes of pipes and maximum length of collectors	*CP 303, table 2 [12]
35 **Disposal**	METHODS POSITIONS	Appendix "B," Sewage disposal (surface water)
DETAIL DESIGN 36 **Prepare detailed layout**	Consider the following:— SYSTEM OF PIPE LAYOUT FALLS OF GROUND AND PIPES SIZES OF PIPES MAXIMUM LENGTH OF COLLECTORS TREES AND VEGETATION (watertight joints in vicinity) CATCH PIT—position entry and exit levels DISPOSAL POINTS	*GOODIN & DOWNING, p. 7–10 [12] *CP 303, clause 502 [12] Appendix "B," Sewage disposal (surface water)
37 **Prepare details of**	TRENCHES—bedding side and overfill minimum depth of cover CATCH PITS—size and depth	*CP 303, clause 502(a) [12] GOODIN & DOWNING, p. 395 and fig. 88 [12]

	construction—*base* *walls* *cover* entry and exit OUTFALLS TO WATERCOURSES SOAKAWAYS CONNECTIONS TO: surface water drainage or sewer foul or combined drain if permitted (*Note reverse action interceptor required*)	 Appendix " B " Appendix " B " *GOODIN & DOWNING, p. 7–9 [12]
SPECIFICATION		
38 **General**	Time to carry out subsoil drainage considered in relation to: *progress of contract* *time of year* *cultivation of site* Access for machines, etc. Preservation and replacement of top soil Handling and storage Disposal of surplus	*GOODIN & DOWNING, p. 7 [12]
39 **Materials and laying**	TRENCHES—minimum width bedding side and overfill mode of backfilling minimum cover PIPES AND FITTINGS—quality laying and alignment CATCH PITS—construction cover REVERSE INTERCEPTOR	*Develop clauses to cover construction proposed in light of references given above*
CONTRACT		
40 **Progress schedule Supervision**	Agree with contractor Check: SETTING OUT MINIMUM COVER MATERIALS QUALITY BACKFILL ALIGNMENT	
41 **Handing over**	Provide client with: RECORD DRAWING OF LAYOUT SUGGESTED MAINTENANCE SCHEDULE	 *Periodic inspection of catchpit and drains. Frequency depending on site conditions*

Appendix B Sewage disposal (surface water)

42 **DATA REQUIRED**	Surface water drain plan Details of watercourses: POSITION AND SIZE CHANNEL AND BACK LEVELS NORMAL AND FLOOD LEVELS For soakaways: RESULTS OF PERCOLATION TEST	 **ESCRITT, L. B., & S. F. RICH, Work of the public health engineer. London, 1959, Macdonald & Evans Ltd. Chap. 30. [Ab6]
BASIC DESIGN DECISIONS		
43 **Decide method of disposal** CONSIDERATIONS	 WATERCOURSES: distance levels rights of drainage to watercourse SOAKAWAYS: nature of subsoil level of water table STORAGE: desire for water storage or for soft water supply	 *Consult deeds. Check other owners and river board rights* *Overflow will be required to watercourse or soakaway*

44 **Disposal or storage installation**	Select position in relation to: Minimum length of drain Economical excavation and falls Avoidance of damage to building by overflow	
DETAIL DESIGN		
45 **Outfall to watercourse**	SITING, size, angles and construction of: headwall wings apron GRILLE TIDAL FLAP (if required) LEVELS in relation to water and bed levels	*GOODIN & DOWNING, p. 395, 396, 397 [12] *CP 303, clause 301 (iii) [12]
46 **Soakaways**	CAPACITY DEPTH BELOW DISCHARGE OF PIPES DIAMETER CONSTRUCTION base walls slab over cover	*CP 303, clause 301 (ii) [12]
47 **Surface water storage**	Cistern above or below ground. Capacity, siting and construction depend on nature of job and use for which water is required. Filters or other clearing devices may be required (overflow required)	Model byelaws 101 and 102 [Aa6] *CP 303, clause 301 (iii) **PHA section 140 Contaminated storage
SPECIFICATION		
48 **Outfall to watercourse**	Materials for headwall apron wings grating flap	See detail design, outfall to watercourse
49 **Soakaway or below ground storage**	Access for contractor Excavation and disposal of surplus Timbering Dewatering Construction Cover	**ESCRITT & RICH, Chap. 30 [Aa6]
CONTRACT		
50 **Progress schedule** **Supervision check** **Handing over**	Agree with contractor Setting out Sizes Materials and fittings Watertightness tests Provide client with suggested maintenance schedule	*Inspection at suitable intervals*

Appendix C Sewage disposal (foul)

51 **DATA REQUIRED**	SITE AND FOUL DRAINAGE PLANS DETAILS OF WATERCOURSES: position, size and flow channel and bank levels normal and flood levels FOR SUBSURFACE IRRIGATION: results of percolation tests	*US Department of Health, Education and Welfare. Manual of septic tank practice. p. 2. Washington DC, Government Printing Office [Ab6] *Ministry of Housing and Local Government Memorandum on principles of design for small domestic sewage treatment works. p. 11 1953 (reprinted 1957) [12]
BASIC DESIGN DECISIONS		
52 **Decide method of disposal** CONSIDERATIONS	Is site large enough for treatment plant or for cesspool?	*Minimum distance from buildings:* Model byelaws series IV, clause 99. [Aa6]

		Far enough to prevent nuisance Model building byelaws for burghs 122, counties 123 (Scotland) [Aa6] *40 ft. 0 ft. minimum from dwelling safe distance from water source* *CP 302.100: 1956. Small domestic sewage treatment works [12] *Minimum 50 ft. from house for works serving 10 persons* *300 ft. from house for works serving 100 or more*
	Can effluent and sludge be disposed of? Is there access for cesspool emptier?	*If the cesspool is not adjacent to the road the local authority should be consulted for the limits of distance and height through which the contents may be moved by the cesspool emptier. Distances will vary but it is unlikely that 200 ft.–0 ft. run or 15 ft.–0 ft. rise from cesspool bottom to road can be exceeded. The same considerations will apply if septic tanks are to be desludged*
POSSIBLE METHODS	CONSERVANCY: earth or chemical closet cesspool TREATMENT PLANT	
53 **Decide position of cesspool or treatment plant**	in relation to:— DRAIN FALLS DISTANCE FROM:—building water supply ACCESS for emptying or desludging DISPOSAL OF EFFLUENT	See references to considerations above
DETAIL DESIGN		
54 **Conservancy** EARTH OR CHEMICAL CLOSET	Lighting Ventilation Access to external air } not for chemical closets Container for earth } not for chemical closets Non absorbent floor Receptacle Ease of cleaning Waste water disposal	*GOODIN & DOWNING, p. 400-404 Model byelaws 98 [12] *GOODIN & DOWNING, p. 403 [12]
CESSPOOL	Capacity Depth Diameter Ventilation Interceptor and FAI for house drains Construction base walls slab cover precast	Model byelaws 99 [Ab6] *CP 302.200: 1949 Cesspools [12] *GOODIN & DOWNING, p. 404 [12]

AJ SfB (12)
Technical study UDC 628.2 Drainage : General

Recent developments in drainage

In this technical study Peter Burberry considers flow characteristics of pipes and describes recent developments in pipe materials, jointing and laying technique

The essential qualities of a drain are that it should discharge flows of liquids, sometimes containing solid matter, efficiently and without risk of blockage, that it should remain intact and watertight in the face of ground pressure and ground movements along and across the line of the drain, and that it should resist deterioration due to the passage of time and the nature of the ground or the nature of the liquids conveyed.

A drain designer must therefore be able to deal with the following problems :—

(1) Design of drains to carry the flows required.

(2) Design of drains to resist ground pressures and movements.

(3) Selection of drain materials.

(4) Suitable constructional details to ensure satisfactory performance.

(5) Regulations affecting drain design.

Architects in practice will be regularly taking decisions on these matters and producing installations which function satisfactorily. In the past few years a great deal of new knowledge about drain performance has become available and new drain materials have come into the market.

The extent to which individual architects follow new developments in drainage will vary widely. The Design Guide includes references to information and materials, but a separate summary of recent developments is of interest. It is difficult to settle the scope of such a summary and matters already familiar to many will be included. CP. 301: 1950 Building Drainage has been used as a guide and the information in this article is generally concerned with materials and techniques not covered by the code.

(1) *Design of drains to carry flows required*

The problem may be divided:

(*a*) Flows to be anticipated (i) surface water
(ii) foul
(iii) combined

(*b*) Discharge capacities of drains

(*a*) *Flows*

(i) SURFACE WATER. If economies in drain sizes are to be made as a result of the more accurate knowledge of drain discharge capacities now available, surface water flows must be closely assessed. The intensity of rainfall varies and the heavier the storm the less often it is repeated. To design for storms of very rare occurrence is clearly uneconomic. CP's 301 and 303 call for surface water drain sizes to be based on a rainfall rate of 1½ in. per hour on the plan area of the building and paving assuming 100 per cent run-off. BRS Digest 6 (2nd series) now proposes a rate of 2 in. per hour coupled with provision to prevent nuisance when the drainage system becomes overloaded by exceptionally heavy storms which will occur at rare intervals.

(ii) FOUL. Flows in foul drains result from the operation of sanitary fittings. On most building sites the number of fittings and the frequency of their operation will be insufficient to give a steady flow and the drain will carry intermittent surges of liquid. In the past there appears to have been no rational method in general building use for determining the critical flow and both architects and local authorities have tended to employ safe but excessively conservative rules, resulting in the change from 4 in. to 6 in. in diameter after a comparatively small number of sanitary fittings or dwellings have been served. CP 301 (clause 303 (*d*)) suggests that design for large groups of domestic buildings should be based on a flow of ⅜ cu. ft. per minute per 100 people, which appears to be based on water demand rates. Its limitations are that the peak flow will not increase in direct proportion to the increase in population, and that it provides no basis for non-domestic use.

A basis for assessing the number of fittings in a group in simultaneous use and thereby the peak flow from the group can be given by the use of the theory of probability. The capacity and discharge rate of sanitary appliances can be definitely established and the frequency of operation in various circumstances observed. This information together with the safety standard can be translated by the use of the theory of probability into terms which enable the peak flow from mixed groups of sanitary appliances to be assessed for drain design purposes. The basic theory of this method is described in a US Bureau of Standards publication* and data on British fittings and usage are given in a paper presented to the Royal Sanitary Institute by Wise and Croft.† Detailed data for the assessment of flows are to be published shortly in the Journal.

Since foul drains have a minimum diameter of 4 in. the main effect of this information on flow will be to enable 4 in. pipes to be used with confidence in many instances where 6 in. pipes would be introduced at present. It will be found, as all those familiar with the actual flows occurring in drains will appreciate, that only in comparatively large buildings or groups of dwellings will drains of 6 in. diameter and over be required.

(iii) COMBINED DRAINS The likelihood of peak surface water flow coinciding with peak foul flow is remote. Peak surface water flow will in most instances be greater than the peak foul flow. A suitable basis for design may therefore be peak surface water flow plus an allowance for minimum flow from sanitary appliances.

(*b*) *Discharge capacities of drains*

Chezy's formula, which is still in use today for sizing drains, dates from the 18th century. Engineers use a variety of formulae developed at later dates (eg Manning, Crimp and Bruges, etc.). Modern research has demonstrated discharge capacities of drains are, in fact, greater than those normally assessed by the use of the formulae mentioned and their many variants. The Colebrook-White equation developed at Imperial College in **1939** has been selected by the Hydraulic Research Station as giving an accurate measure of pipe discharge. The formula is not easy to apply and the Hydraulic Research Station have developed a series of charts‡ for use by designers. The charts themselves are still somewhat elaborate for use in the design of drains on building jobs and the accompanying diagrams based on the charts and on the roughness values for drain pipes established by Ackers§ have been prepared for easy reference. (See Fig 1.)

*US DEPARTMENT OF COMMERCE. National Bureau of Standards Building Materials and Structures Report BMS 65. Methods of estimating loads in plumbing systems, Roy B. Hunter.
†WISE, A. F. E., and J. CROFT. Investigation of single stack drainage for multi-storey flats. Journal of the Royal Sanitary Institute, 1954, **74** (9), 797-826.
‡DEPARTMENT OF SCIENTIFIC AND INDUSTRIAL RESEARCH. Hydraulics Research Paper No. 2. Charts for the hydraulic design of channels and pipes, 1958, HMSO
§ACKERS, Peter. The hydraulic resistance of drainage conduits. Proceedings of Institution of Civil Engineers, 1961, **19** (July) 307-336.

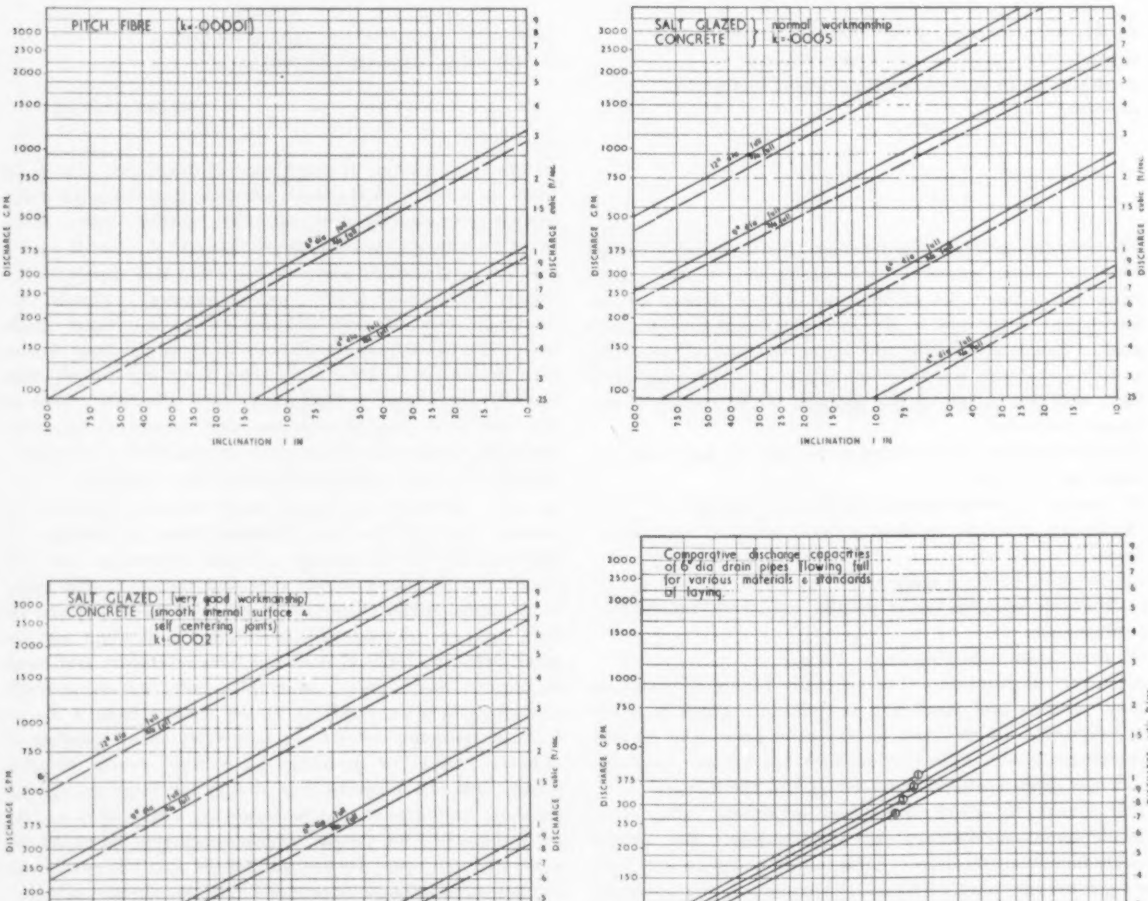


Fig 1 Charts of pipe discharge

2. *Design of drains to resist ground pressures and movements*
Architects are well aware of risk of fracture in ceramic drains and BRS Digests 124, 125, 134 and 6 (2nd series) give information on the causes of fractures and provide data and methods to enable drains to be constructed to resist successfully the forces to which they will be subjected. The principles set out are:—

(*a*) the drain must be strong enough to resist fracture resulting from pressures in the surrounding earth and, where necessary, from wheel loads.

(*b*) It is not practicable for drains to be strong enough to maintain their exact alignment in the face of ground movements and consequently the nature of the pipe or nature of the joint should provide flexibility.

(*a*) STRENGTH OF DRAINS The BRS Digests recommend the use of pipes which are strong enough to resist earth pressures without the use of concrete support, a layer of granular material being used instead to give proper bedding. This is in sharp contrast to present practice where concrete support is in widespread use and required, particularly under foul drains, by many local authorities. In fact continuous concrete support is likely to fracture in the face of earth movement, thereby localising the movement and encouraging serious drain fracture. Not all drain pipes at present available will resist the full range of pressures to which they might be subjected in drain installations. (BRS Digests 134, page 4 and 124 give data.) Where a pipe of inadequate strength must be used, concrete bedding can be employed to strengthen it but it is essential that the concrete be divided into separate sections under each pipe. (See Fig 2.) Loads on drains should be minimised by keeping trench widths at the level of the crown as narrow as possible BRS Digest 125 p. 4 gives data on this point.

(*b*) GROUND MOVEMENTS: Some degree of ground movement may be anticipated in drain installations. There are two main effects on the pipe. Movement across the line of the pipe, and, less widely appreciated, longitudinal movement due to the inevitable variation in drain length occurring as a result of curvature due to settlement. This variation may, in a bad case, be as much as 1 per cent of the length of the pipe (see BRS Digest 125). Rigid pipes with rigid joints will break down under these conditions and to prevent this flexible joints which permit longitudinal movement are needed (flexible-telescopic joints). Pipes which are inherently flexible (eg pitch-fibre) will accommodate themselves to a considerable degree of movement, but for bad cases special telescopic joints are available even for these.

Precautions must also be taken to prevent fractures due to

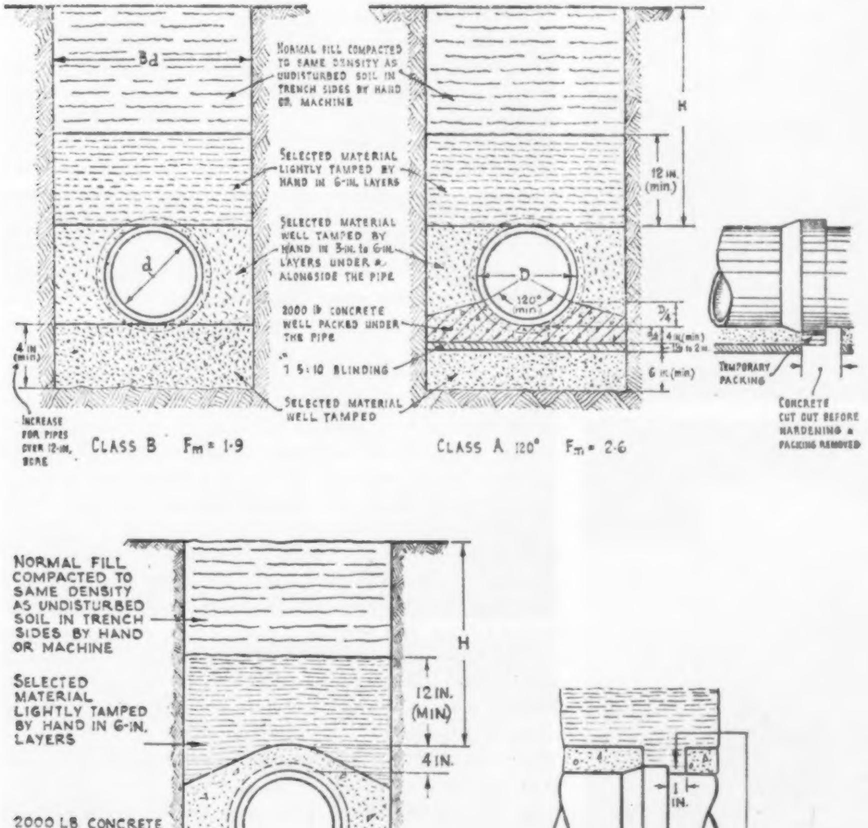


Fig 2 Methods of bedding drain pipes

(Reproduced from BRS Digest No. 124 with the permission of the Controller of HM Stationery Office)

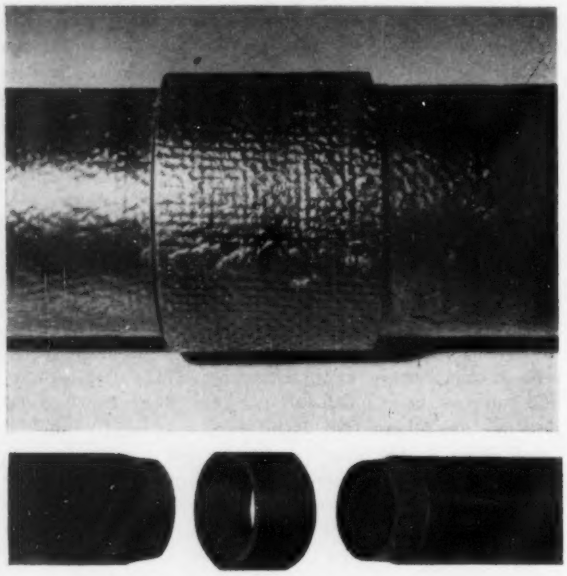


Fig 3 Pitch fibre pipe joint

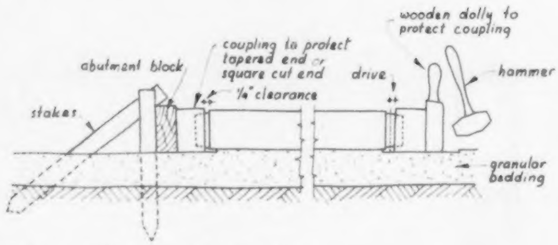


Fig 4 Jointing pitch fibre pipes

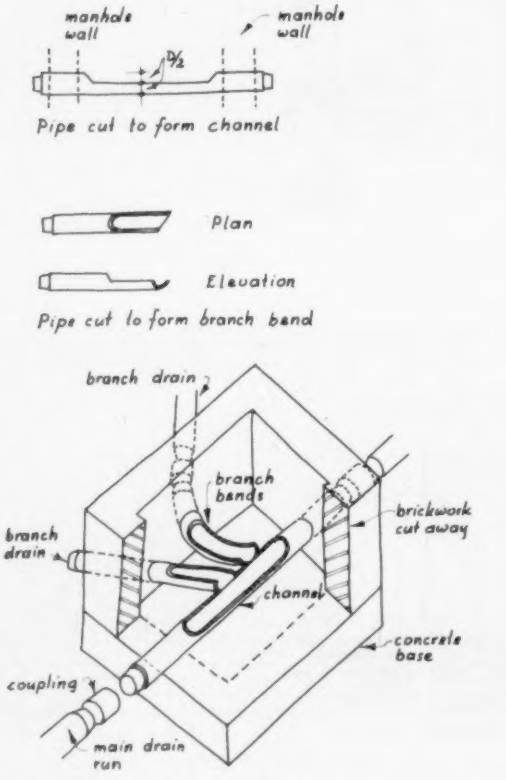


Fig 5 Manhole fittings in pitch fibre

differential settlement in pipes which pass through walls. A clearance should be provided round the pipe, and, if the soil is such that solid lumps might obstruct the clearance, precautions should be taken to prevent this.

Some of the jointing materials and methods developed to meet these requirements are described later with the pipes for which they are intended.

3. *Selection of drain materials*

Some of the new materials and joints which need to be taken into account in any comprehensive selection of drain materials are described below:—

(*a*) SALT GLAZED PIPES. (See Information Sheet No. 1003 for sizes available.) These pipes are rigid and the cement joint in current use is also rigid and this results in many failures due to ground movement. In addition the different thermal and moisture movements of the cement and ceramic frequently cause burst sockets. Rubber ring joints overcome these difficulties and are now available for 4 in. and 6 in. dia. pipes. Development of larger sizes is proceeding. Subsidiary advantages such as immediate testing and laying in spite of weather or trench conditions also result from this type of joint. For pipes over 6 in. diameter and up to 18 in. diameters hot poured bitumen joints can be employed.

At present salt glazed pipes complying with BS 65 do not necessarily have sufficient strength to be used throughout most normal drain installations without concrete support. BS 65 is being revised so that it will be possible to use salt glazed pipes in most situations without concrete.

The current practice of laying salt glazed pipes with cement joints and concrete bedding results in drains which from the points of view of cost and performance have been compared unfavourably with some other materials. However, with flexible joints and granular bedding instead of concrete it seems likely that future comparisons will rate salt glazed drains competitive on both these counts.

(*b*) PITCH FIBRE (see Information Sheet No. 1003 for sizes and lengths available). Pitch fibre pipes have been available for some years and are in widespread use. Those who have not used them may find the following summary of interest. (See Fig 3.)

While not as long-lasting a material as ceramic, pitch fibre pipes provide efficient and durable drain installations. The pipes have a very smooth internal surface with widely spaced joints which are automatically accurately aligned by the tapered coupling. Their flexibility enables them to resist some types of ground movement and the material of the pipes will not be affected by normal soils or effluents, but are unsuitable for continuously running hot water or effluent containing pitch solvent. (See Fig 4.)

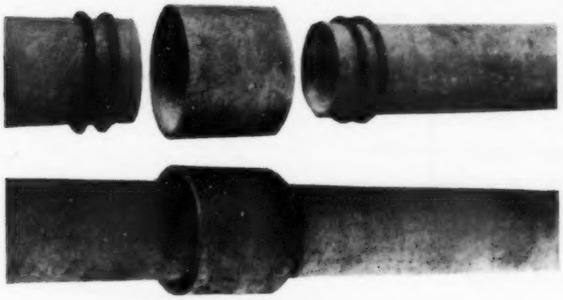
The pipes are light, easy to handle, may be laid by semi-skilled labour, and lengths of drain may even be jointed at ground level and lowered into the trench as a unit to overcome such difficulties as waterlogged trench bottoms. Testing may be carried out without delay and in frosty weather if necessary.

The range of fittings available for use with pitch fibre pipes is at present limited. Junctions and bends present no difficulty but gullies, branch bends, etc., are not available from all manufacturers. It is possible to manufacture manhole fittings by cutting ordinary pipes. (See Fig 5.)

This is, however, laborious and normally stoneware fittings will be used in conjunction with pitch fibre pipes.

Pitch fibre pipes are particularly well suited to mechanical digging, permitting narrow trenches as a result of their small outside diameter and simple jointing method.

(*c*) ASBESTOS CEMENT DRAIN PIPES (see Information Sheet No. 1003 for sizes and length). Asbestos Cement Pressure Pipes



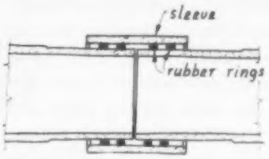
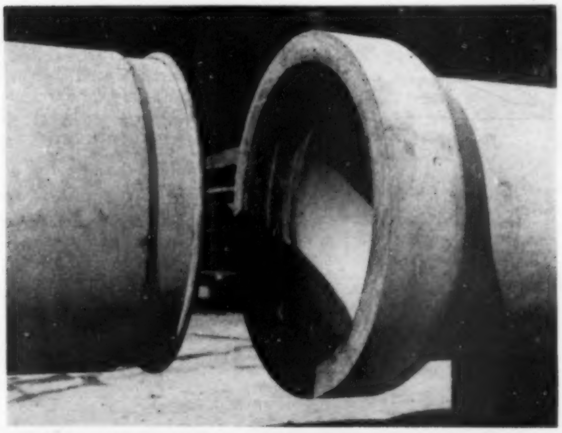


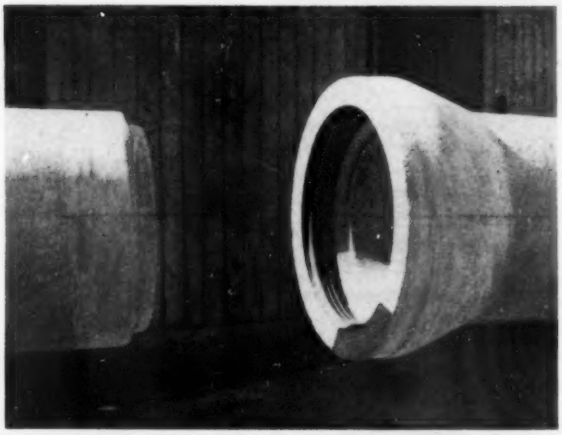
Fig 6 Above, and above right, flexible asbestos cement pipe joint

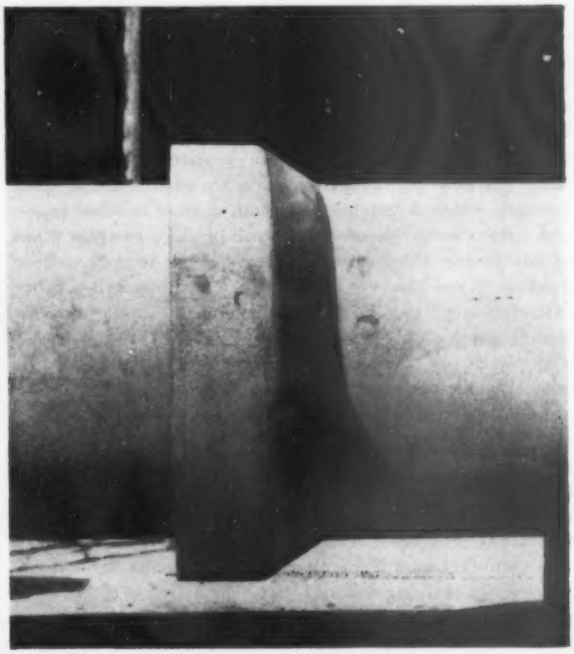
Figs 7 and 8 Cornelius rubber ring joint

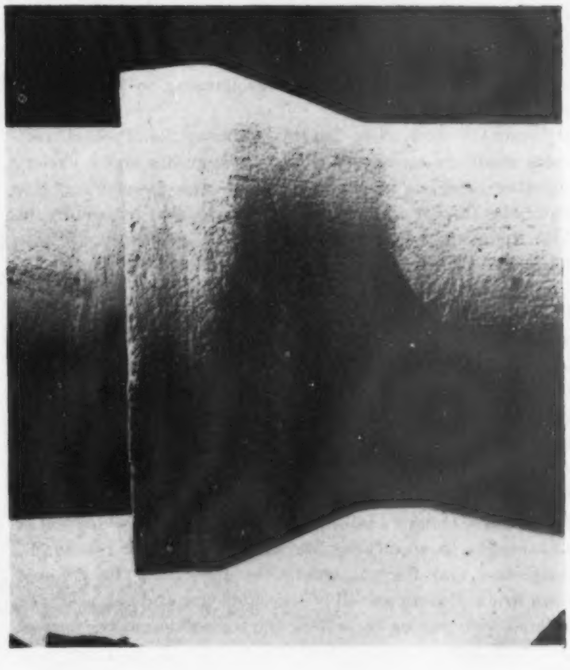
Figs 9 to 11 Tylox rubber ring joint

7 | 8
9 | 11
10









which have been on the market for many years make perfectly satisfactory drains. They are, however, expensive for this purpose. Very recently Turners Asbestos Co. Ltd. have produced an asbestos cement pipe specially intended for drains. The special features of this pipe are the joint and the length. The joint is formed by rubber rings and a sleeve, and is both flexible and telescopic, enabling the drain to remain intact in the face of most types of ground movement. Assembly is by means of a push fit, assisted by leverage in the larger sizes. The length of 13 ft. 1½ in. substantially reduces the number of joints when compared with other drain materials. (See Fig 6.)

In laying and handling properties asbestos cement drain pipes are similar to pitch fibre, but the range of fittings is at present even more limited. Diameters up to 21 in. are however produced (whereas pitch fibre is limited at present to 6 in. dia. except for 8 in. to special order from some manufacturers only) and specially strong pipe is available in the large diameters.

(*d*) CONCRETE DRAIN PIPES (BS 556) (See Information Sheet No. 1003 for dias. and length.) Concrete pipes although well known for many years, do not appear to be widely used on building sites. This is not entirely surprising since, if bedded in the same way, they appear to cost more than salt glazed pipes. They do however have a significant advantage in their strength which is greater than that of most ceramic pipes, and indeed some manufacturers will produce to order pipes of any required strength. This means that it may well be possible to use concrete pipes without bedding, when other materials might require it, thereby giving a sounder installation at lower cost.

The use of concrete pipes is almost inevitable for drains over 3 ft. 0 in. in diameter since in this range of sizes there are no competitors for building drainage applications.

A rubber ring joint (Cornelius joint) has been used for many years with concrete pipes. Joints of this type have been found in good condition after 100 years. Another type of rubber joint, the "Tylox," used for many years in America, is now fitted to pipes in this country. (See Figs 7 to 13.)

The manufacturers claim that "Tylox" joints can extend 1½ in. without losing seal and that a deflection of 9° between pipes is possible.

No flexible telescopic joint is so far available for agee joints, and since this type of joint cannot be made satisfactorily water proof with mortar, agee jointed pipes should only be used when infiltration into or out of the pipe is not significant (eg surface water discharging to local watercourse).

(*e*) PRECAST CONCRETE DRAIN ACCESSORIES. Precast concrete manholes, cesspools, soakaways, gullies and a variety of other products are available, although precast concrete manholes do not seem to be widely specified by architects. The following information may be of assistance for preliminary comparison with brick manholes. (See Fig 14.)

Contractors sometimes express dislike of this type of manhole because it is difficult to make the (agee joints between sections waterproof and because the base of the manhole is heavy to move. The force of the last objection is likely to be reduced by the increasing use of mechanical handling plant on building sites and some suppliers will also provide lifting tackle. On jobs where the heavy base would still present a difficulty, some of the virtues of this type of manhole can be retained by forming the base in-situ.

From the architect's point of view there are two important advantages to specifying precast manholes. In reasonable quantities and normal conditions they may be cheaper than brick. Covers are all of the same size and can easily be aligned with paving by setting the top section at the correct

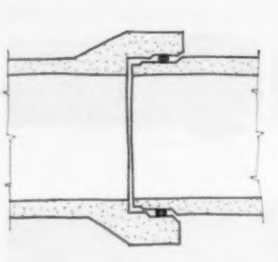


Fig 12 Cornelius rubber ring joint

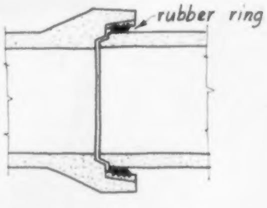


Fig 13 Tylox rubber ring joint

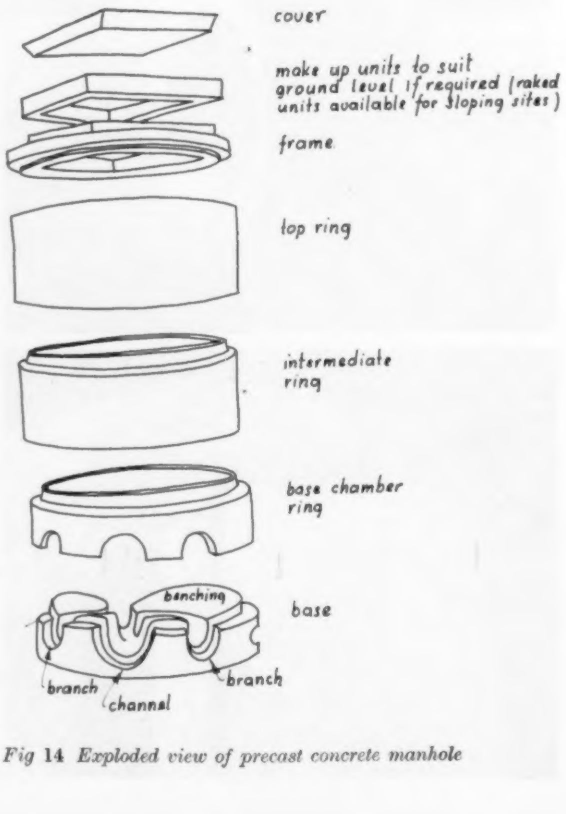
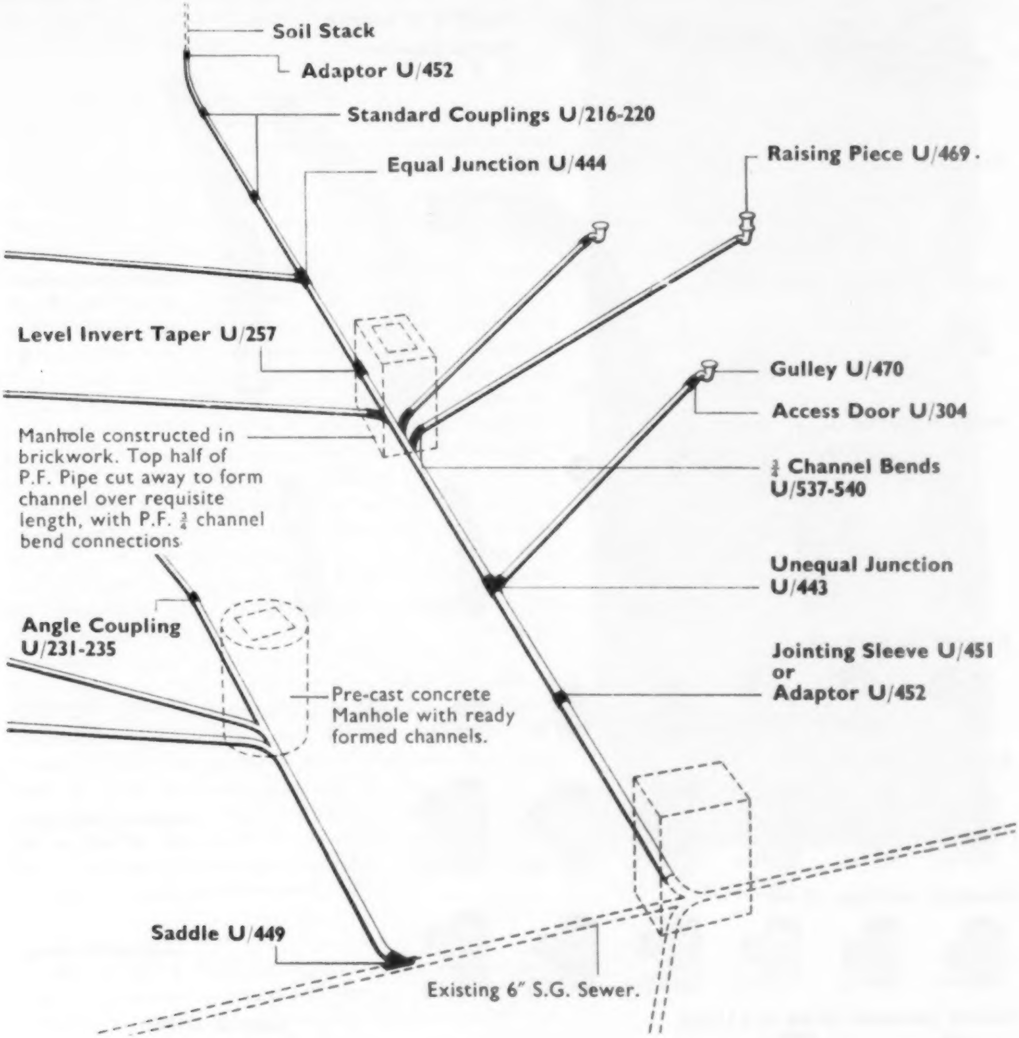


Fig 14 Exploded view of precast concrete manhole

DRAINAGE INSTALLATION

OF PITCH FIBRE PIPES



THE PIPE
To B.S. 2760. Pitch Impregnated Fibre Drain and Sewer Pipe.

FITTINGS
See comparative tables on back of this sheet.

DIMENSIONS AND WEIGHTS

Length
8′ 0″ standard length.

Internal Diameter	2″	3″	4″	5″	6″
Weight Per foot	1.20 lb.	1.80 lb.	2.30 lb.	3.75 lb.	4.90 lb.

PROPERTIES
See Data Sheet published by U.A.M.

DESIGN AND SPECIFICATION
See B.S. 2760 and B.R.S. Digest 97

SITEWORK AND FIXING
See B.S. 2760, Appendix C.

SUPPLY
From or through approved Builders' Merchants.

PRICES
See Price List Published by U.A.M.
For further information write for Union Fibre Pipes Products Catalogue.

Union Fibre Pipes (Great Britain) Ltd., Tolpits, Watford, Herts.
Telephone: Watford 41331. Branches: London, Birmingham, Manchester, Bristol, Glasgow.

In 2
The Architects Journal Supplement, October 4th, 1961

DRAIN AND SEWER PIPES
(PITCH FIBRE)
DATA SHEET

U.A.M. Group Information Service
October 1961

The Pipe

Length 8' 0" standard
Internal Diameters
2" 3" 4" 5" 6"

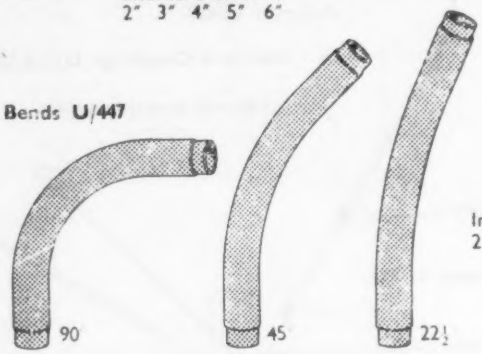
Standard Couplings U/216-220

To suit
2" 3" 4" 5" 6"
Internal Diameter Pipes.

Angle Couplings U/231-235

To suit
2" 3" 4" 5" 6"
Internal Diameter Pipes.

Bends U/447



Internal Diameters.
2" 3" 4" 5" 6"

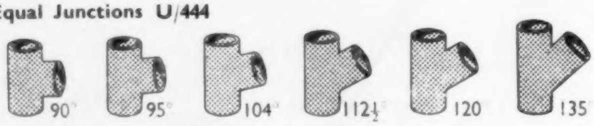
Medium Radius Bends U/447

Internal Diameter.
4"

Knuckle Bends U/446

Internal Diameters.
3" 4" 6"

Equal Junctions U/444



Internal Diameters.
2" 3" 4" 5" 6"

Unequal Junctions U/443

Internal Diameters.
3" 4" 5" 6"

Double Junctions U/448 and U/450

Internal Diameters.
4" Branches off 6" Main
4" Branches off 4" Main

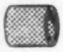
Saddles U/449

To suit 4" Pitch Fibre Pipe mounted on 6" earthenware pipe.

Adaptors U/452

To suit
3" 4" 6"
Internal Diameter Pipes.

Double Collars U/453

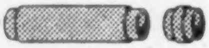


Internal Diameters.
2" 3" 4" 5" 6"

Jointing Sleeves U/451

To suit
2" 3" 4" 5" 6"
Internal Diameter Pipes.

Connector Pieces Short U/335 Long U/336



Internal Diameters.
4" 6"
Lengths.
6" 24"

Level Invert Tapers
6" to 4" U/253
4" to 3" U/257

Internal Diameters.
6" to 4"
4" to 3"

Concentric Tapers 6" to 4" U/258
4" to 3" U/260

Internal Diameters.
6" to 4" 4" to 3"

Gullies U/470

Internal Diameter.
4"

Raising Pieces U/469

To suit Gully bellmouth inlet.

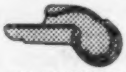
Access Doors U/304

To suit 4" Internal Diameter Pipes.

Channels

Internal Diameters.
2" 3" 4"
5" 6"
Lengths up to 8' 0" with plain or tapered ends.

¾ Channel Bends U/537-540



Right Hand, Left Hand.
To suit 4" Internal Diameter Pipes.

End Caps U/456-460

Internal Diameters.
2" 3" 4" 5" 6"

UAM
Union Fibre Pipes (Great Britain) Ltd., Tolpits, Watford, Herts.
Telephone : Watford 41331. Branches : London, Birmingham, Manchester, Bristol, Glasgow

angle on the supporting ring below. At least one manufacturer produces a concrete manhole cover which will accord even better with paving.

Comparative costs of drain installation
Different contractors will usually quote different prices for the same piece of work and the varying organisations and resources of different builders undoubtedly affect the price still further. With these reservations in mind the following observations on comparative costs are made.
At present the cost of 4 in. and 6 in. diameter pitch fibre drains seems to be similar to the same diameter in asbestos cement. Salt glazed "seconds" laid direct may give a cheaper drain but "BS" quality salt glazed pipes on a concrete bed will almost certainly be more expensive. These costs, however, are likely to be substantially influenced in the future by the new concepts of bedding discussed above. Pitch fibre and asbestos cement drains at present often laid on the trench bottom will cost slightly more with granular bedding while salt glazed drains should be noticeably cheaper in cases where granular bedding is substituted for concrete. It seems likely that with existing material costs salt glazed drains laid in this way will be highly competitive with pitch fibre and asbestos cement. For some applications, however, existing salt glazed pipe strengths are inadequate without support. New stronger pipes are proposed but this will also affect the cost.
Pipes over 6 in. in diameter are not readily available in pitch fibre and the prices of the larger diameter asbestos cement pipes rise sharply.
Concrete drains are generally more expensive than those made of other materials when laid in the same circumstances. The strength of these pipes can, however, sometimes obviate the need for concrete bedding and an economical and efficient drain can result. In large diameters the use of concrete is almost inevitable.


Fig 15 Trench digger

(4) *Drain details*
(*a*) GENERAL. The basic principles of good drain installations are generally accepted and familiar to all architects (straight runs, manholes at changes of direction, watertight joints, ventilation, access for cleaning, etc.). It seems, however, that little serious work has been done in analysing drain failures and blockages and translating this information into terms of better drain design. A study of this type could contribute not merely to better drain performance, but also to economy since wasteful safety standards could be made more realistic. One important contribution to this field is the Report of the Joint Committee on Field Research into Drainage Problems, sponsored by the Institution of Sanitary Engineers (now called Institution of Public Health Engineers) in association with BRS, the Institute of Plumbers and the Sanitary Inspectors Association.
In the field of drain design the report shows that while many local authorities still apply McGuire's rule others, taking a more scientific attitude, permit the use of substantially flatter gradients in appropriate circumstances with success. Minimum gradients of 1 in 110 for 4 ft. drains and 1 in 210 for 6 ft. drains are recorded in the report.
The report also reviews drain performance. The immediate causes of representative blockages are recorded. Apart from such main offenders as sanitary towels (37 per cent of blockages), and newspapers (23 per cent), unexpected obstructions such as coal and coke and roller skates, are mentioned. Architects have little control of misuse of drains, but although blockages are often caused by large articles that should not have found their way into the drain there is usually a basic constructional or design fault which locates the fault. The constructional details associated with the basic causes of blockage listed in the report may be very briefly summarised:—
Disconnecting traps.
Excessively flat gradients and oversized pipes unrelated to flow conditions.
Bends (and straight pipes used to form bends).
Branches entering against flow.
Fallen rendering from manhole walls.
Poor workmanship in pipe laying.
Setting of bends at bottoms of soil pipes.
Entry of tree roots.
Subsidence.
(b) *Mechanical excavation*—The decision to use mechanical rather than hand excavation is a detail of drain construction which is normally resolved by the contractor, who will try to employ the most economical system for the circumstances. Long straight runs in suitable soil uncomplicated by buried

services are normally required for the economic operation of conventional types of mechanical trench diggers. (See Fig 15.)
In these circumstances the use of mechanical excavation in combination with asbestos cement or pitch fibre drains may lead to substantial savings in drain costs since narrow trenches, easily produced by these machines can be used with the small outside diameters and simple and infrequent jointing of these pipe materials. It is worthy of note that the granular type of bedding recommended by BRS is well suited to mechanically dug trenches where it reduces the labour of hand trimming and where the slight extra depth can easily be achieved. In writing his specification the architect should bear in mind the possibility of mechanical excavation and where appropriate specify an installation which will lend itself to this technique.
On small or complex jobs where a trench digger would be uneconomic, use is being made of small cultivators which, whilst not removing the spoil from the trench as do the larger machines, can nevertheless break up the soil, reducing the labour of digging to that of shovelling out a ready formed trench. (See Fig 16.)
Trench widths suitable to most drainage applications can be achieved with these machines but depth of dig is limited and more than one pass will probably be required. The ease of manoeuvrability will enable most problems of access and trench arrangement to be overcome.

5. *Regulations affecting drain design*

Outside London, drain construction is governed by the Model Building Byelaws on which local authorities base their own Byelaws. (Model Byelaws Series 4 for England and Model Byelaws for Burghs and Counties in Scotland.) These byelaws are enforced by building inspectors often working in the Engineer's Department of the local authority. It does not seem to be the practice to demand that building inspectors should have any special theoretical knowledge of drains. The byelaws are not detailed in their provisions, leaving many decisions to be resolved by the designer. Model Byelaw 85 states: " Every drain . . . shall be constructed of *suitable* material, be of *adequate* strength, be *properly* supported and protected against injury, laid at a *proper* inclination and be provided with *suitable* watertight joints."
It is hardly surprising, in these circumstances, that considerable variations are to be discovered in the standards which various local authorities consider acceptable. The report of the Joint Committee on Field Research into Drainage Problems instances extraordinary variations. Minimum acceptable gradient for 4 in. diameter drains varies from 1 in 40 to 1 in 110. The maximum distance permitted between manholes varies between 60 ft. 0 in. and 300 ft. 0 in. and there are many other inexplicable differences.
Architects may well encounter requirements which they consider to be unreasonable. In these circumstances the problem may be referred to the justices, by joint agreement with the local authority referred to the Minister, or the work carried out and proceedings risked. While such courses may seem appropriate if the whole concept of the building is at issue, it seems most unlikely that such courses of action could be justified by disagreements about drainage.
While architects may feel that this situation is not entirely satisfactory, it is clear that at present it is necessary to discover both the special conditions, if any, which apply and the way in which the Byelaws are interpreted in the particular locality.

Fig 16 Merry Tiller (Wolseley Engineering Ltd.)

Owing to a printer's error we regret that this last page of Elemental Design Guide 072 SfB (12) Drainage: General appears out of the correct page sequence. Please remove this page and place it after page 564 of this issue.

55 **Small treatment plants** (up to 100 people): PRIMARY PROCESS (septic tank)	CAPACITY in relation to numbers served SHAPE in relation to flow and desludging BAFFLE BOARDS DIP PIPES inlet and outlet VENTILATION CONSTRUCTION: base walls cover	Model byelaws 99 *CP 302.100 Small domestic sewage treatment works [12] Memorandum on principles of design of small domestic sewage treatment works *GOODIN & DOWNING, p. 406–415 Small communities *Many local authorities have standard requirements for sewage treatment plants and the local authority should therefore be consulted at the commencement of the design*
SECONDARY	PERCOLATING FILTER: size maximum and minimum depth dosing mechanism filtration medium aeration of filtration medium floor channels outgo construction: *base* *walls* SUB-SURFACE IRRIGATION: layout trenches *bedding* *pipes* control of distribution vegetation	Refs. as above (except model byelaws) Refs. as above (except model byelaws)
56 **Large treatment plants**	Large plants are governed by the same general principles as small but expert guidance should be sought by architects	*GOODIN & DOWNING, Chap. 8, p. 233 (*general description*) *ISAAC, P.C.G. Public health engineering. London, 1953, Spon. [Ab6] (*more technical description*)
57 **Sewage pumping**	To be avoided if possible by siting but if inevitable consult expert. Main parts of a sewage pumping station are: WELL TO COLLECT SEWAGE PUMP MOTOR AND MOTOR CHAMBER AUTOMATIC CONTROL GEAR	The Institution of Public Health Engineers, Vauxhall Bridge Road, London, SW1, will recommend specialist consultants in this field

Specification

58 **Cesspools and treatment plants**	Access for contractor Excavation and disposal of surplus Timbering and dewatering Fittings *FAI's and vent* *covers* *dip pipes* *dosing mechanisms* *filtering medium* *filter floor channels* Constructional materials	*Evolve suitable clauses from Detail Design, para 55—small treatment plant and references quoted there*

Contract

59 **Progress schedule** **Supervision**	Agree with contractor—giving of notices CHECK Positions Sizes Materials Fittings Watertightness tests where appropriate	
Handing over	Provide client with suggested maintenance schedule	*Earth closets, chemical closets, cesspools; suggested frequency of cleaning in relation to conditions*

SfB (12 In2)

Pitch Fibre Pipes

FOR DRAINS AND SEWERS

PROPERTIES

Pitch Fibre Pipes are light, strong, flexible and tough. Resistance to acids, alkalis and soil corrosives is high. All pipes produced by PFPA members conform to BS 2760: 1956. Approved by M.O.H. for 30 year grants.

ADVANTAGES

HIGH SPEED LAYING Light weight, long lengths and simple jointing mean that up to 400ft of pipe can be laid per hour.

NO CONCRETE REQUIRED The resilience of pipes and joints allows them to withstand normal ground movement, so concrete bedding is not normally required.

ALL-WEATHER LAYING Dry driven joints make it possible to lay in all weathers and permit immediate testing and backfilling.

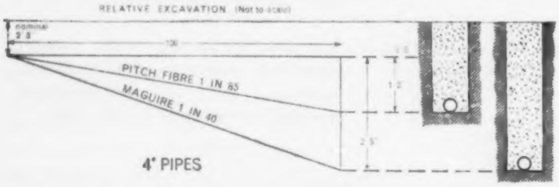
LOWER LAYING COSTS In addition to the saving of concrete, the high flow characteristics of the pipes allow a flatter gradient, i.e., shallower trenches.

FEWER BREAKAGES Inherent strength of pitch fibre pipes reduces breakages in normal handling.

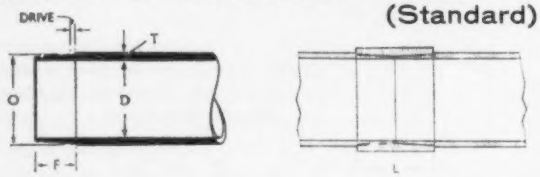
NO WASTED PIECES With a simple hand tool, pipes cut to fit the run and off-cuts can be tapered on site.

HYDRAULIC FLOW CAPACITY

From the report recently issued by the Hydraulics Research Station (DSIR) it can be taken that pitch fibre drain and sewer pipes can be used at gradients as low as 1 in 85 for 4in dia. pipes, and 1 in 145 for 6in dia. pipes when flowing a quarter full at the self-cleansing velocity of 2.5 ft per second.



RANGE OF DRAINAGE PIPES (Standard)



Internal diameters of 2in, 3in, 4in, 5in, 6in, in 5ft 6in, 8ft and 10ft lengths. Both ends tooled to fit couplings.

SIZE *All dimensions in inches*	2	3	4	5	6
D	2·00	3·00	4·00	5·00	6·00
F	1·43	1·69	1·94	1·94	1·94
L	2·90	3·42	3·92	3·92	3·92
T	0·25	0·28	0·32	0·41	0·46
O	2·470	3·448	4·493	5·726	6·782
Approx. Drive	0·25	0·25	0·25	0·25	0·25
Approx. Weight *lb. per ft. run*	1·20	1·80	2·30	3·75	4·90

Fittings: COUPLINGS (STRAIGHT) · COUPLINGS (5° ANGLED) · JUNCTIONS (EQUAL AND UNEQUAL) · JUNCTIONS (SEPTIC TANK) · BENDS (LONG AND SHORT RADIUS) · ADAPTORS · TAPERS (LEVEL INVERT AND ORDINARY) · CHANNELS AND CHANNEL BENDS · SLIPPER BENDS · END CAPS · SADDLES · GULLEY TRAPS AND JOINTING SLEEVES

LAYING

Trenches must have firm evenly-boned bottoms. Bricks and similar materials should not be used for boning.

1 Wipe pipe ends and couplings clean. Fit a coupling hand-tight to each pipe, and a second coupling to leading end of first length.

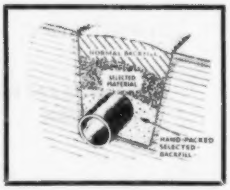
2 Lay pipes and couplings out along trench, or at trench side.

3 If necessary, construct a firm back stop in the trench to support the first pipe while others are driven home.

4 Drive pipes home into the couplings using a 4lb hammer and 2in thick wooden dolly.

5 In connecting to stoneware, concrete or cast iron, use the normal jointing compounds for these materials.

6 In stone-free soils, selected fill or imported material is hand packed and tamped in 3in to 6in layers along the sides of pipes to crown level. Above this 12in of selected material is lightly tamped by hand in 6in layers. Thereafter use normal backfill.



In rocky or stony ground trenches should be over excavated to a minimum of 4in depth and filled to grade with well-tamped selected material.

Further details of recommended laying procedure are given in Building Research Station Digest Nos. 97, 124 and 125.

Please write for a free copy of our manual 'Pitch Fibre Pipes'.

ISSUED BY
THE PITCH FIBRE PIPE ASSOCIATION OF GREAT BRITAIN

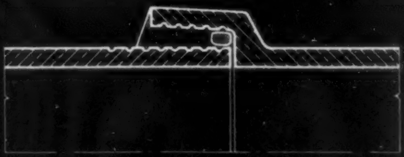
PFPA 27 Chancery Lane, London WC2 Telephone: CHAncery 6001

THE KEY ENGINEERING CO LTD · TEMPLE TUBES LTD · UNION FIBRE PIPES (GREAT BRITAIN) LTD · BOWATER-FLEXPIPE LTD.

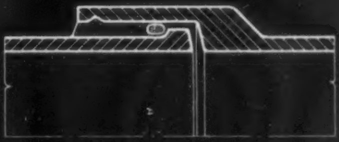
TGA PA10

AJ SfB (12)

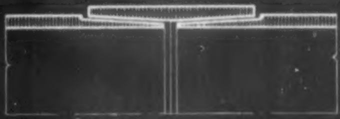
Information Sheet No. 1003 UDC696·134 Drainage : General



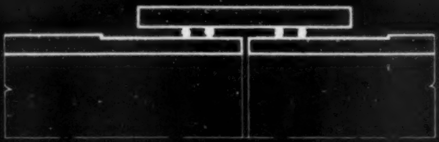
salt-glazed stoneware



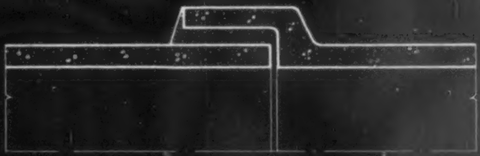
cast iron



pitch fibre



asbestos cement



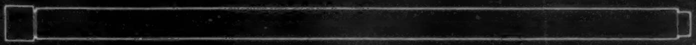
concrete

TYPICAL JOINTS. scale 1/4 full size

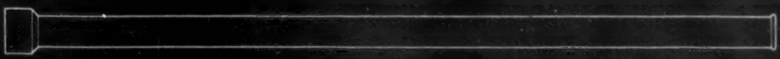
salt-glazed stoneware

note: for the purpose of comparison all pipes shown are 4 in. dia., the most commonly used in drainage work: larger diameters are, of course, available and the range is shown on the reverse of this Sheet: lengths shown are the most usual for each material, but again, others are obtainable.

concrete



pitch fibre



cast iron

asbestos cement

STANDARD SIZES scale 1/2" = 1'-0"

DRAINPIPES: MATERIALS, JOINTS AND SIZES.

SfB (12 In2)

Pitch Fibre Pipes

FOR DRAINS AND SEWERS

PROPERTIES

Pitch Fibre Pipes are light, strong, flexible and tough. Resistance to acids, alkalis and soil corrosives is high. All pipes produced by PFPA members conform to BS 2760: 1956. Approved by M.O.H. for 30 year grants.

ADVANTAGES

HIGH SPEED LAYING Light weight, long lengths and simple jointing mean that up to 400ft of pipe can be laid per hour.

NO CONCRETE REQUIRED The resilience of pipes and joints allows them to withstand normal ground movement, so concrete bedding is not normally required.

ALL-WEATHER LAYING Dry driven joints make it possible to lay in all weathers and permit immediate testing and backfilling.

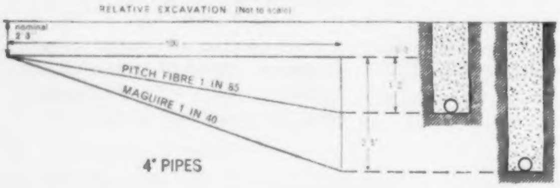
LOWER LAYING COSTS In addition to the saving of concrete, the high flow characteristics of the pipes allow a flatter gradient, i.e., shallower trenches.

FEWER BREAKAGES Inherent strength of pitch fibre pipes reduces breakages in normal handling.

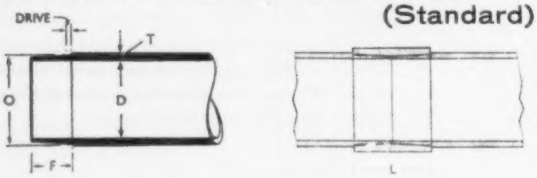
NO WASTED PIECES With a simple hand tool, pipes cut to fit the run and off-cuts can be tapered on site.

HYDRAULIC FLOW CAPACITY

From the report recently issued by the Hydraulics Research Station (DSIR) it can be taken that pitch fibre drain and sewer pipes can be used at gradients as low as 1 in 85 for 4in dia. pipes, and 1 in 145 for 6in dia. pipes when flowing a quarter full at the self-cleansing velocity of 2.5ft per second.



RANGE OF DRAINAGE PIPES (Standard)



Internal diameters of 2in, 3in, 4in, 5in, 6in, in 5ft 6in, 8ft and 10ft lengths. Both ends tooled to fit couplings.

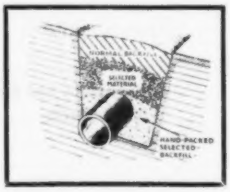
SIZE *All dimensions in inches*	2	3	4	5	6
D	2·00	3·00	4·00	5·00	6·00
F	1·43	1·69	1·94	1·94	1·94
L	2·90	3·42	3·92	3·92	3·92
T	0·25	0·28	0·32	0·41	0·46
O	2·470	3·448	4·493	5·726	6·782
Approx. Drive	0·25	0·25	0·25	0·25	0·25
Approx. Weight *lb. per ft. run*	1·20	1·80	2·30	3·75	4·90

Fittings: COUPLINGS (STRAIGHT) · COUPLINGS (5° ANGLED) · JUNCTIONS (EQUAL AND UNEQUAL) · JUNCTIONS (SEPTIC TANK) · BENDS (LONG AND SHORT RADIUS) · ADAPTORS · TAPERS (LEVEL INVERT AND ORDINARY) · CHANNELS AND CHANNEL BENDS · SLIPPER BENDS · END CAPS · SADDLES · GULLEY TRAPS AND JOINTING SLEEVES

LAYING

Trenches must have firm evenly-boned bottoms. Bricks and similar materials should not be used for boning.

1. Wipe pipe ends and couplings clean. Fit a coupling hand-tight to each pipe, and a second coupling to leading end of first length.
2. Lay pipes and couplings out along trench, or at trench side.
3. If necessary, construct a firm back stop in the trench to support the first pipe while others are driven home.
4. Drive pipes home into the couplings using a 4lb hammer and 2in thick wooden dolly.
5. In connecting to stoneware, concrete or cast iron, use the normal jointing compounds for these materials.
6. In stone-free soils, selected fill or imported material is hand packed and tamped in 3in to 6in layers along the sides of pipes to crown level. Above this 12in of selected material is lightly tamped by hand in 6in layers. Thereafter use normal backfill.



In rocky or stony ground trenches should be over excavated to a minimum of 4in depth and filled to grade with well-tamped selected material.

Further details of recommended laying procedure are given in Building Research Station Digest Nos. 97, 124 and 125.

Please write for a free copy of our manual 'Pitch Fibre Pipes'.

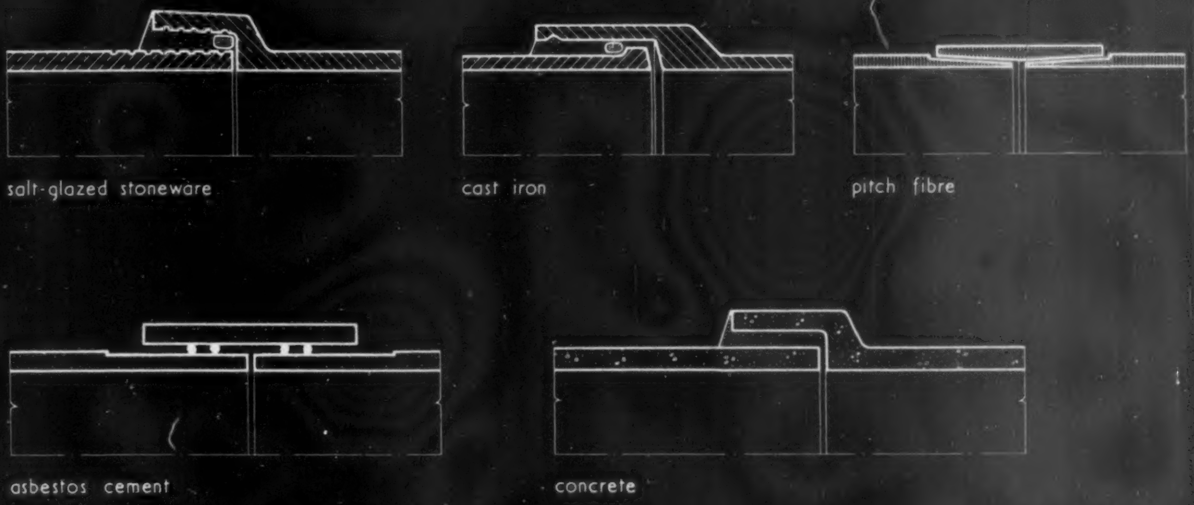
ISSUED BY
THE PITCH FIBRE PIPE ASSOCIATION OF GREAT BRITAIN

PFPA 27 Chancery Lane, London WC2 Telephone: CHAncery 6001

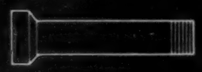
THE KEY ENGINEERING CO LTD · TEMPLE TUBES LTD · UNION FIBRE PIPES (GREAT BRITAIN) LTD · BOWATER-FLEXPIPE LTD.

TGA PA10

AJ SfB (12)
Information Sheet No. 10(3 UDC696·134 Drainage : General



TYPICAL JOINTS. scale 1/4 full size



salt-glazed stoneware

note: for the purpose of comparison all pipes shown are 4 in. dia., the most commonly used in drainage work: larger diameters are, of course, available and the range is shown on the reverse of this Sheet: lengths shown are the most usual for each material, but again, othess are obtainable.

asbestos cement

STANDARD SIZES scale 1/2" = 1'-0"

DRAINPIPES : MATERIALS, JOINTS AND SIZES.

DRAIN PIPES: COMPARISON OF MATERIALS

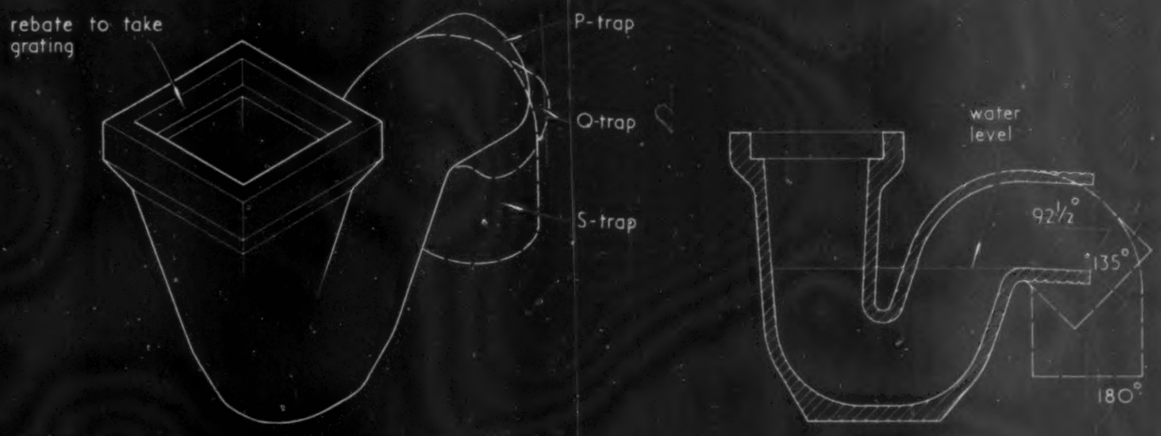
This Sheet compares the different materials in which drain pipes and fittings can be obtained. Although British Standard sizes are given as far as possible, any sizes that are not generally available from stock have been omitted. In the case of asbestos cement the information is supplied by Turners Asbestos Cement Co. Ltd. as, at the time of going to press, they appear to be the sole manufacturers of these pipes. There is no B.S. specification but one is in course of preparation. Asbestos-cement pressure pipes, which are manufactured by most asbestos cement companies, can be used for drainage but are heavier and more expensive than those described on this Sheet. Concrete pipes over 3 ft. 0 in. in diameter have not been listed as they are outside normal requirements, but in fact pipes up to 7 ft. 0 in. in diameter are obtainable.

Material	Nom. dia. (in.)	o/d (in.)	o/d joint (in.)	Length (ft. in.)	Radii available (in.)
Salt-glazed stoneware	3	$3\frac{7}{8}$	$4\frac{1}{2}$	2.0	$3\frac{1}{2}$, 6, 10, 15, 21, 30, 54
	4	5	$5\frac{3}{4}$	2.0, 2.6, 3.0	$3\frac{1}{2}$, 6, 10, 15, 20, 30, 54
	6	$7\frac{1}{4}$	$8\frac{1}{8}$	2.0, 2.6, 3.0	6, $7\frac{1}{2}$, 15, 18, 21, 36, 66
	9	$10\frac{1}{2}$	$11\frac{1}{2}$	2.0, 2.6, 3.0	$8\frac{1}{2}$, 21, 42
	12	14	$15\frac{1}{4}$	2.0, 2.6, 3.0	10, 24, 48
	15	$17\frac{1}{2}$	$18\frac{3}{4}$	2.0, 2.6, 3.0	18, 28, 54
	18	21	$22\frac{1}{4}$	2.0, 2.6, 3.0	14, 30
	21	$24\frac{1}{4}$	$25\frac{3}{4}$	2.0, 2.6, 3.0	16, 34
	24	$27\frac{1}{2}$	29	2.0, 2.6, 3.0	22, 36
	30	34	$35\frac{1}{2}$	2.0, 2.6, 3.0	No bends available
Cast iron	2	$2\frac{9}{16}$	$4\frac{7}{16}$	2.0, 3.0, 4.0, 6.0	Manufacturers' products vary considerably. B.S. 1130 gives no dimensions of radii
	3	$3\frac{5}{8}$	$5\frac{3}{4}$	2.0, 3.0, 4.0, 6.0, 9.0	
	4	$4\frac{3}{4}$	$7\frac{1}{8}$	1.0, 2.0, 3.0, 4.0, 6.0, 9.0	
	6	$6\frac{3}{4}$	$9\frac{1}{4}$	2.0, 3.0, 4.0, 6.0, 9.0	
	9	$9\frac{7}{8}$	$12\frac{7}{8}$	9.0	
Concrete	4	Wall thicknesses vary but pipes which comply with B.S. 556 would have walls of the crushing strength specified therein		3.0	$7\frac{5}{8}$–$11\frac{1}{2}$
	6			3.0	$7\frac{5}{8}$–$11\frac{1}{2}$
	9			3.0, 4.0, 6.0	$7\frac{5}{8}$–$11\frac{1}{2}$
	12			3.0, 4.0, 6.0	$15\frac{1}{4}$–$22\frac{7}{8}$
	15			4.0, 6.0	$15\frac{1}{4}$–$22\frac{7}{8}$
	18			4.0, 6.0	$15\frac{1}{4}$–$22\frac{7}{8}$
	21			4.0, 6.0, 8.0	$15\frac{1}{4}$–$22\frac{7}{8}$
	24			4.0, 6.0, 8.0	$15\frac{1}{4}$–$22\frac{7}{8}$
	27			4.0, 6.0, 8.0	No bends available
	30			4.0, 6.0, 8.0	,,
	33			4.0, 6.0, 8.0	,,
	36			4.0, 6.0, 8.0	,,
				Lengths vary with different manufacturers	*Manufacturers do not necessarily make all sizes*
Pitch fibre	2	2·50	2·97	5.0 min.; 10.0 max.	$9\frac{1}{2}$, 18, 24, 36
	3	3·56	4·008	5.0 min.; 10.0 max.	13, 24, 36
	4	4·64	5·133	5.0 min.; 10.0 max.	16, 36
	5	4·82	6·546	5.0 min.; 10.0 max.	24, 36
	6	6·92	7·702	5.0 min.; 10.0 max.	36
				8 *ft.* 0 *in. to* 10 *ft.* 0 *in. commercially available*	
Asbestos cement	4	4·80	B.S. pending	$13.1\frac{1}{2}$ (also supplied in half and quarter lengths)	24
	5	5·90		,,	30
	6	7·00		,,	36
	7	8·00		,,	No bends available
	8	9·00		,,	,, ,,
	9	10·04		,,	,, ,,
	10	11·06		,,	,, ,,
	12	13·48		,,	,, ,,
	15	16·68		,,	,, ,,
	18	19·88		,,	,, ,,
	21	23·00		,,	,, ,,

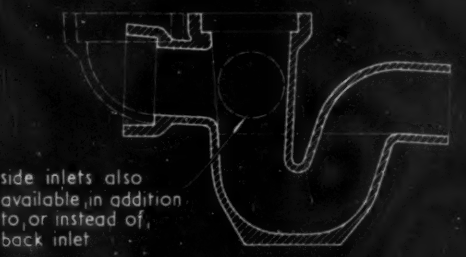
AJ SfB (12)
Information Sheet No. 1004 UDC696·13 Drainage : General

STONEWARE GULLIES

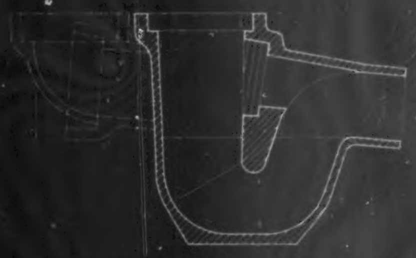
This Sheet illustrates the more common types of stoneware gullies and accessories. For purposes of comparison the drawings show a 4-in. outlet in every case. The designs are to B.S. 539, Part 1, except where otherwise stated and although the gullies shown are for square gratings, circular types to B.S. are available for identical applications. Manufacturers also produce a wide range not covered by B.S. both in the common types and for specialised applications, e.g. reversible intercepting gully. Many of the commoner types are available with P, Q or S traps. The B.S. outlets allow a 5 deg. tolerance in the angle of the horizontal connection but some manufacturers allow for a 95 deg. angle only.



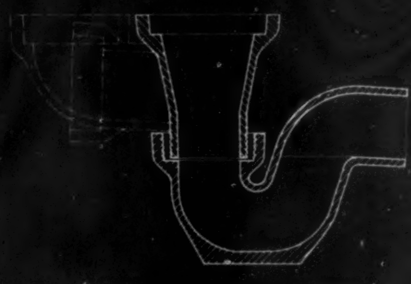
ISOMETRIC SKETCH AND SECTION OF TYPICAL GULLY



BACK-INLET GULLY



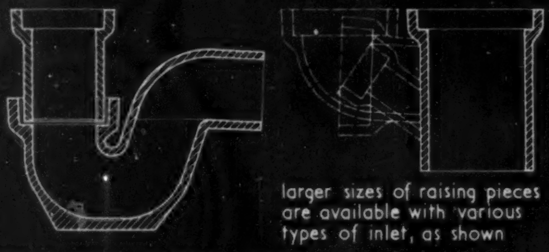
with internal access (Doulton's 'Universal' Fig 86)



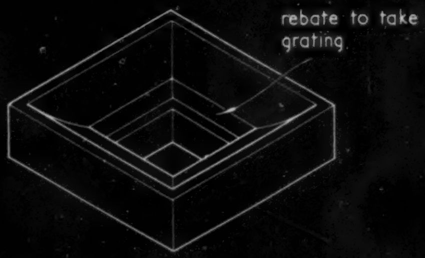
YARD GULLY (GULLY TRAP WITH HOPPER)

with external access (Doulton's 'Hygiean' Fig 85)

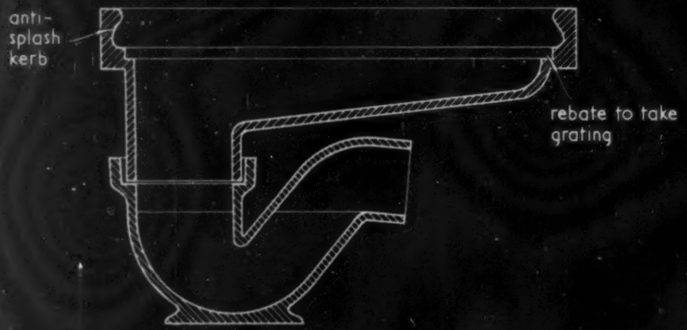
ACCESS GULLIES



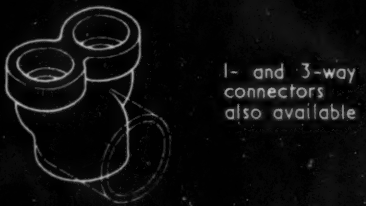
GULLY TRAP WITH RAISING PIECE.



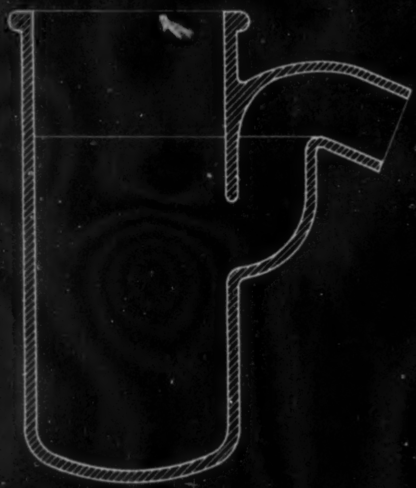
DISHED TOP. (Doulton's Fig. 239)



WASTE RECEIVER.
(Doulton's 'Manor' Fig. 202)

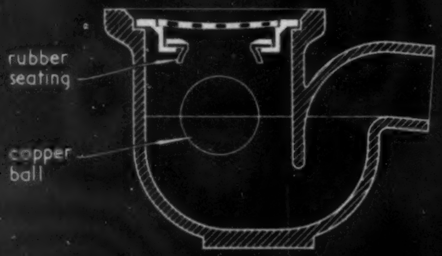


CONNECTOR. (Doulton's Figs. 445-50)

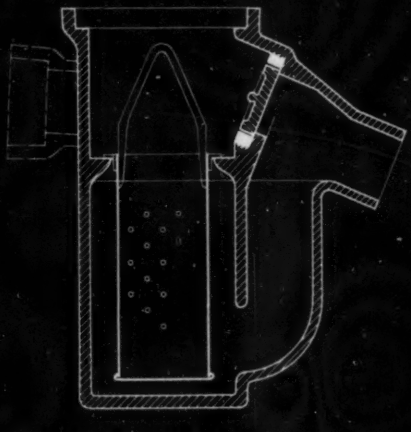


ROAD GULLY.

GREASE OR MUD GULLY.



ANTI-FLOODING GULLY.
(Doulton's 'Thames' Fig. 299)



GREASE OR MUD GULLY.
(SUITABLE FOR USE IN GARAGES)

STONEWARE GULLIES.

AJ SfB (12)

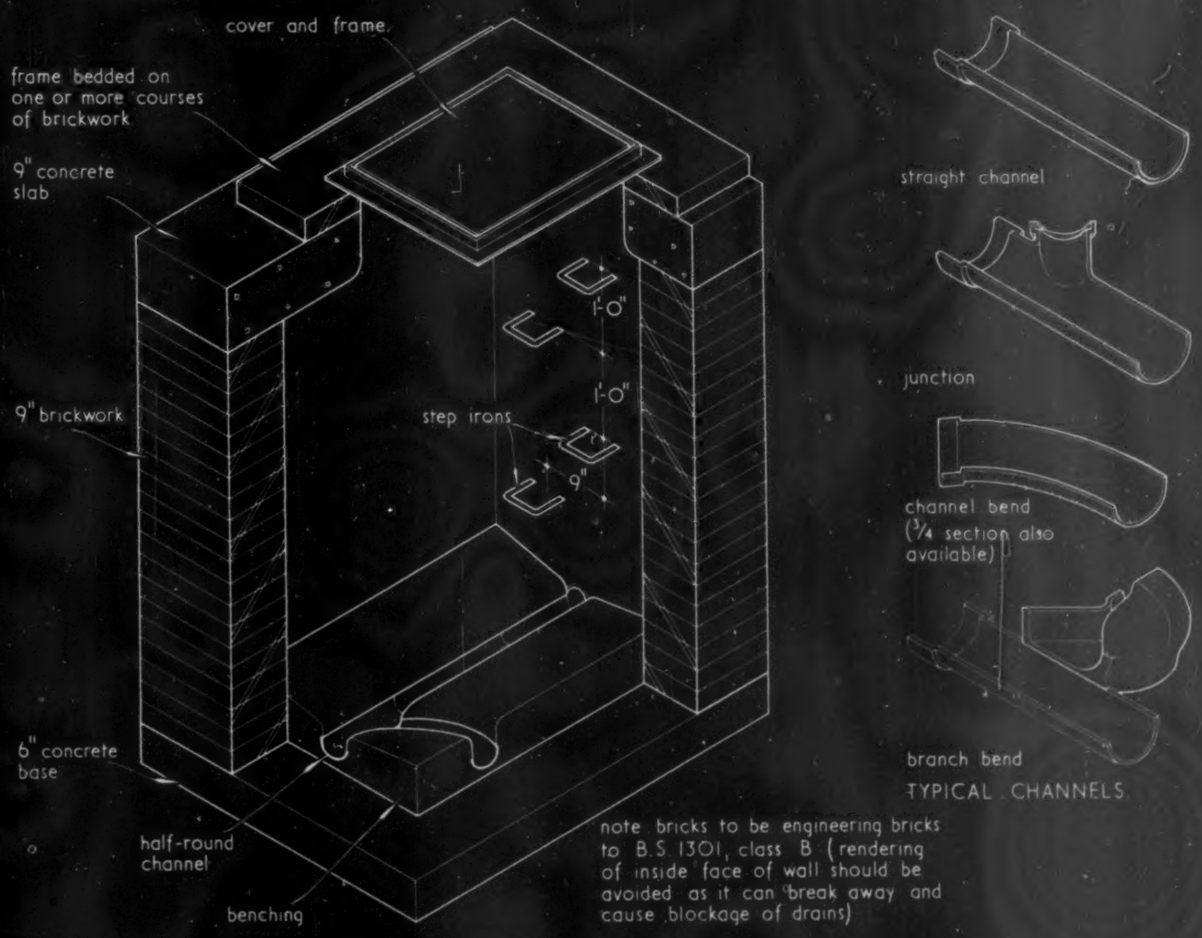
Information Sheet No. 1005 UDC696 134 Drainage : General

BRICK MANHOLES

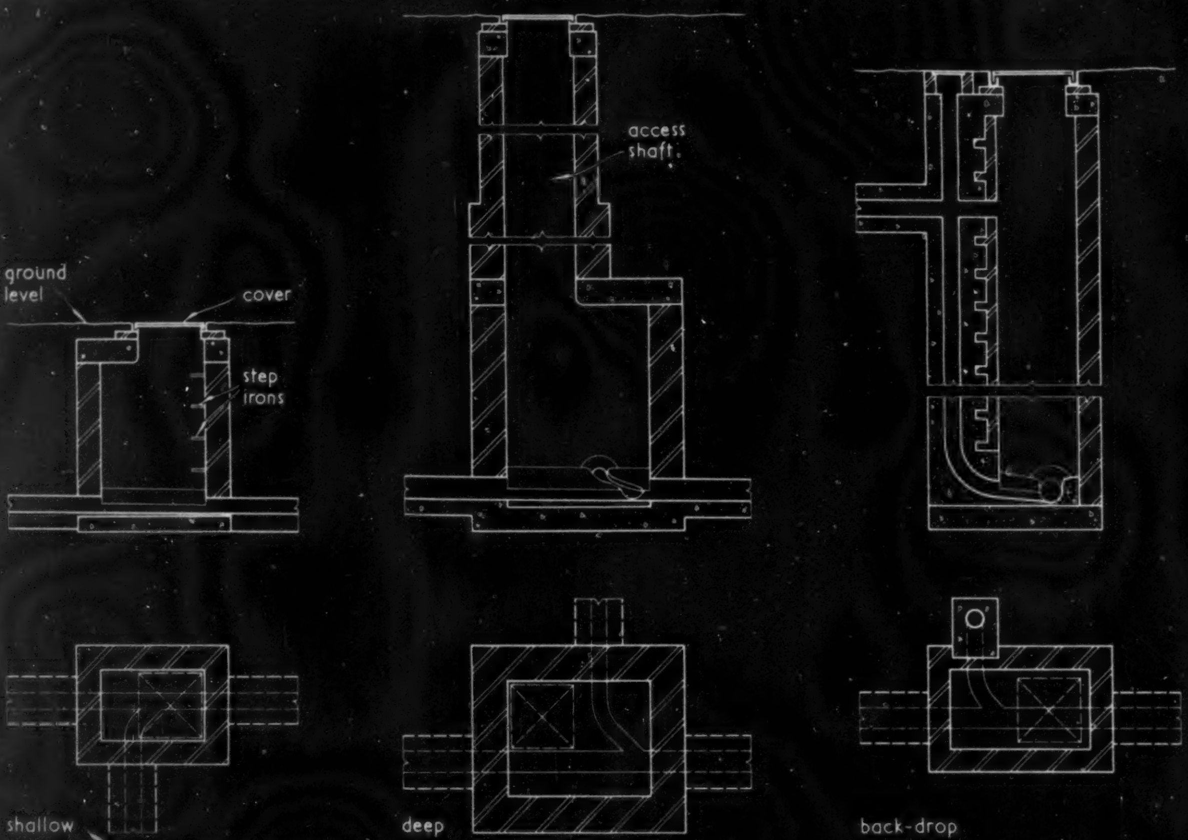
This Sheet describes the design and construction of brick manholes in accordance with B.S. Code of Practice C.P. 301. The isometric sketch below shows a typical construction and the diagrams on the reverse of the Sheet show the main types, shallow, deep and back-drop type, the latter being for use where branches are considerably shallower than the main drain to which they connect. In extra deep manholes over 20 ft. (not illustrated), rest platforms must be provided at intervals not exceeding 20 ft. There are two methods of roofing the chamber in deep and extra deep manholes, by means of a brick arch or, as shown in the drawing, by a concrete slab.

Where the manhole is built under a road, the roof of the chamber should be designed to carry the Ministry of Transport loading train for highway bridges, with allowance for load distribution by the depth of soil over the slab.

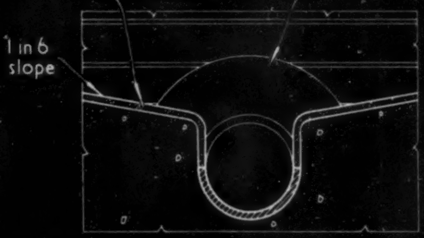
The more important details of construction are shown in the ancillary sketches.



ISOMETRIC SKETCH OF TYPICAL SHALLOW MANHOLE



DIAGRAMS OF TYPICAL MANHOLES



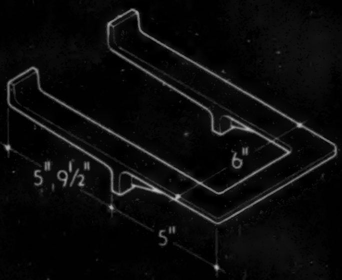
DETAIL OF BENCHING AND PIPE PASSING THROUGH MANHOLE WALL

type	depth to outgoing invert (ft. and in.)	internal dimensions		thickness of walls (in.)	thickness of base slab (in.)
		length (ft. and in.)	width (ft. and in.)		
	up to 2-0	2-0	1-6	4½	4
shallow	2-0 to 3-0	2-5	1-10½	4½	4
	3-0 to 6-0	3-4½	2-3	9	6
deep	6-0 to 15-0	4-6	2-7½	9	9

table of minimum sizes for rectangular manholes extracted from B.R.S. Digest (2nd series) no. 6

length allowance for branches
1'-0" per branch for 4" dia. pipe
1'-3" " " " 6" " "
(plus allowance for angle of entry of lowest branch)

DIMENSIONS OF MANHOLES



DETAIL OF STEP IRON

BRICK MANHOLES

AJ SfB (12)
Information Sheet No. 1006 UDC696·134 Drainage : General

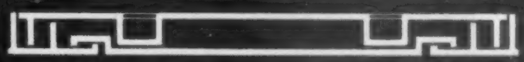
single seal, flat cover

double seal, flat cover

single seal, recessed cover

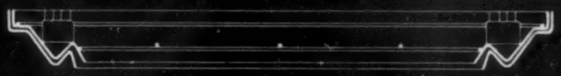
double seal, recessed cover

single seal, hinged cover

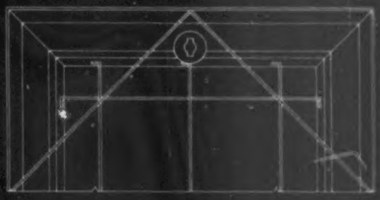


double seal, double cover

LIGHT DUTY COVERS . . scale 1/8 full size



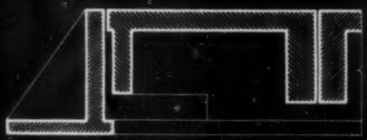
section : scale 1/8 full size



part plan scale 1/4 full size

Broadstel locking cover (Broads Manufacturing Co., Ltd.)

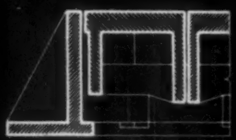
MEDIUM DUTY COVERS.



part section : scale 1/8 full size

double triangular cover

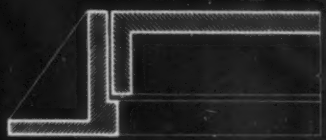
plan : scale 1/16 full size



part section : scale 1/8 f.s.

lamphole cover

plan : scale 1/16 f.s.



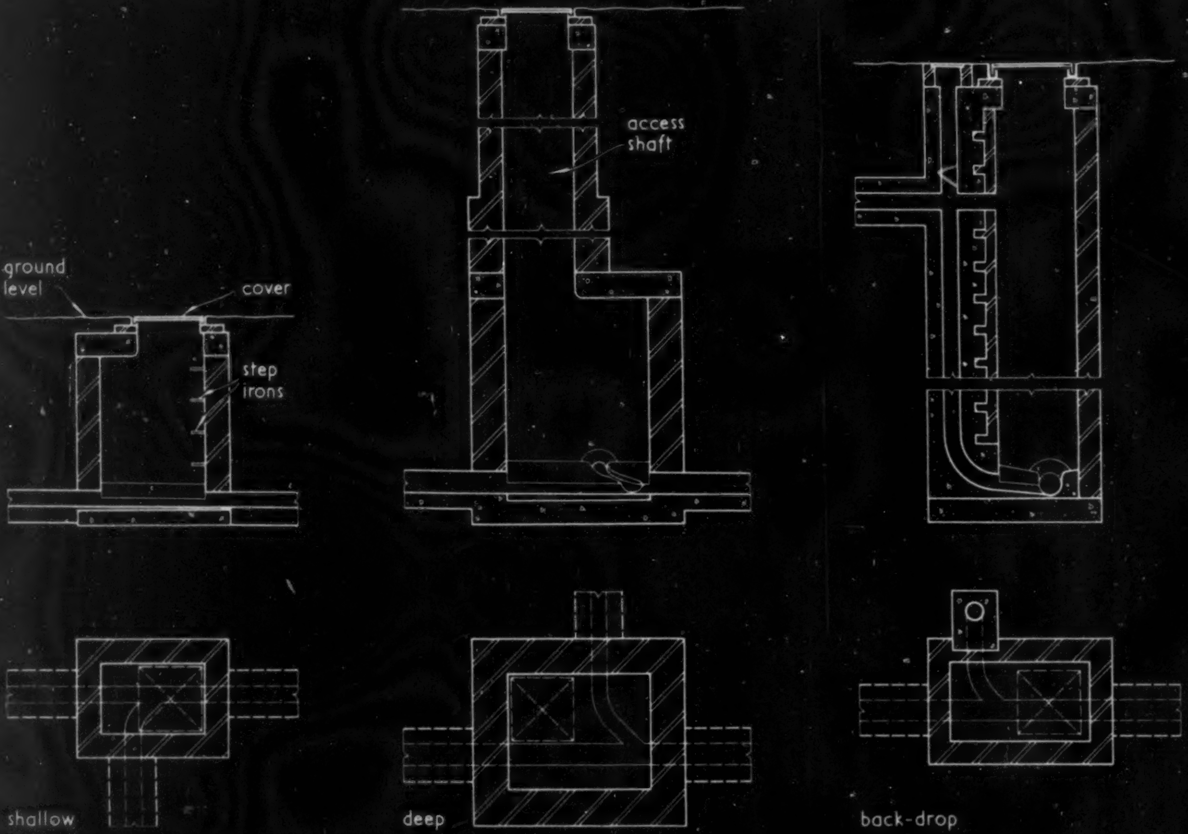
part section : scale 1/8 f.s.

single triangular cover

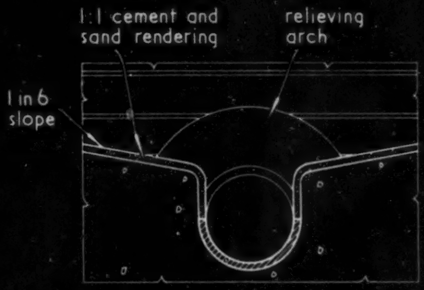
plan : scale 1/16 f.s.

HEAVY DUTY COVERS

MANHOLE COVERS.



DIAGRAMS OF TYPICAL MANHOLES



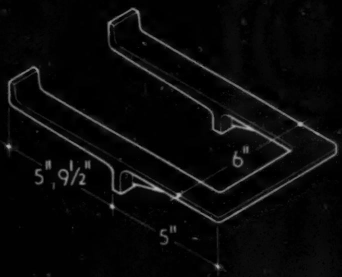
DETAIL OF BENCHING AND PIPE PASSING THROUGH MANHOLE WALL

type	depth to outgoing invert (ft. and in.)	internal dimensions		thickness of walls (in.)	thickness of base slab (in.)
		length (ft. and in.)	width (ft. and in.)		
shallow	up to 2-0	2-0	1-6	4½	4
	2-0 to 3-0	2-5	1-10½	4½	4
	3-0 to 6-0	3-4½	2-3	9	6
deep	6-0 to 15-0	4-6	2-7½	9	9

table of minimum sizes for rectangular manholes extracted from B R S Digest (2nd series) no 6

length allowance for branches:
1'-0" per branch for 4" dia pipe
1'-3" " " " 6" " "
(plus allowance for angle of entry of lowest branch)

DIMENSIONS OF MANHOLES

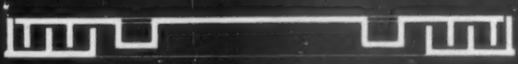


DETAIL OF STEP IRON

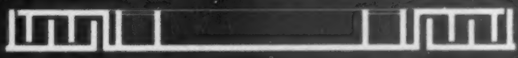
BRICK MANHOLES

AJ SfB (12)
Information Sheet No. 1006 UDC696·134 Drainage : General

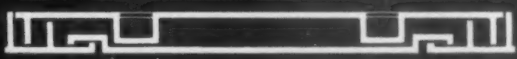

single seal, flat cover


double seal, flat cover

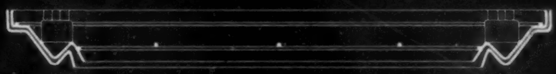

single seal, recessed cover

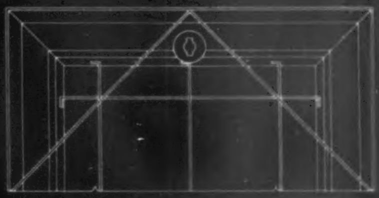

double seal, recessed cover

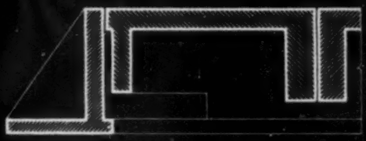

single seal, hinged cover


double seal, double cover

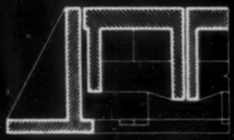
LIGHT DUTY COVERS. scale 1/8 full size


section : scale 1/8 full size
Broadstel locking cover (Broads Manufacturing Co., Ltd.)
MEDIUM DUTY COVERS.


part plan : scale 1/4 full size

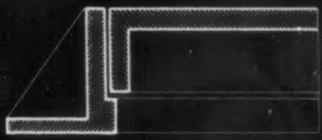

part section : scale 1/8 full size
double triangular cover


plan : scale 1/16 full size


part section : scale 1/8 f.s.


plan : scale 1/16 f.s.

lamphole cover
HEAVY DUTY COVERS.


part section : scale 1/8 f.s.
single triangular cover


plan : scale 1/16 f.s.

MANHOLE COVERS.

MANHOLE COVERS

This Sheet shows the main types of cast-iron and steel manhole covers available for light, medium and heavy duty. The table below gives the overall dimensions of the covers, which are in accordance with B.S. 497 in most cases. Although dimensions have been given only for the same three clear opening sizes given in each case in B.S., larger sizes are often available. The drawings on the face show typical sections (and, where necessary for clarity, plans also).

Type of manhole		Overall dimensions (in.) Frame	Clear opening
Light duty	single seal, flat cover	22 × 22, 22 × 28, 28 × 28 } × 1⅝ deep	18 × 18, 18 × 24, 24 × 24
	single seal, recessed cover	22 × 22, 22 × 28 } × 1⅝ deep; 28 × 28 × 1¾ deep	18 × 18, 18 × 24, 24 × 24
	single seal, hinged cover	25 × 25, 24 × 31, 30 × 31 } × 2 deep	18 × 18, 18 × 24, 24 × 24
	double seal, flat cover	24½ × 24½, 24½ × 30½, 30½ × 30½ } × 1⅝ deep	18 × 18, 18 × 24, 24 × 24
	double seal, recessed cover	24½ × 24½, 24½ × 30½, 30½ × 30½ } × 1⅝ deep	18 × 18, 18 × 24, 24 × 24
	double seal, double cover	25½ × 25½, 25½ × 31½, 31½ × 31½ } × 3 deep	18 × 18, 18 × 24, 24 × 24
Medium duty	Broadstel, locking cover	23¼ × 23¼, 23¼ × 29¼, 29¼ × 29¼ } × 2¾ deep	18 × 18, 18 × 24, 24 × 24
Heavy duty	single triangular	30 × 30 × 6 deep	19½
	double triangular	30 × 30, 32 × 32 } × 6 deep	20, 22
	lamphole	18 × 18	9 (dia.)

The Architect's Journal
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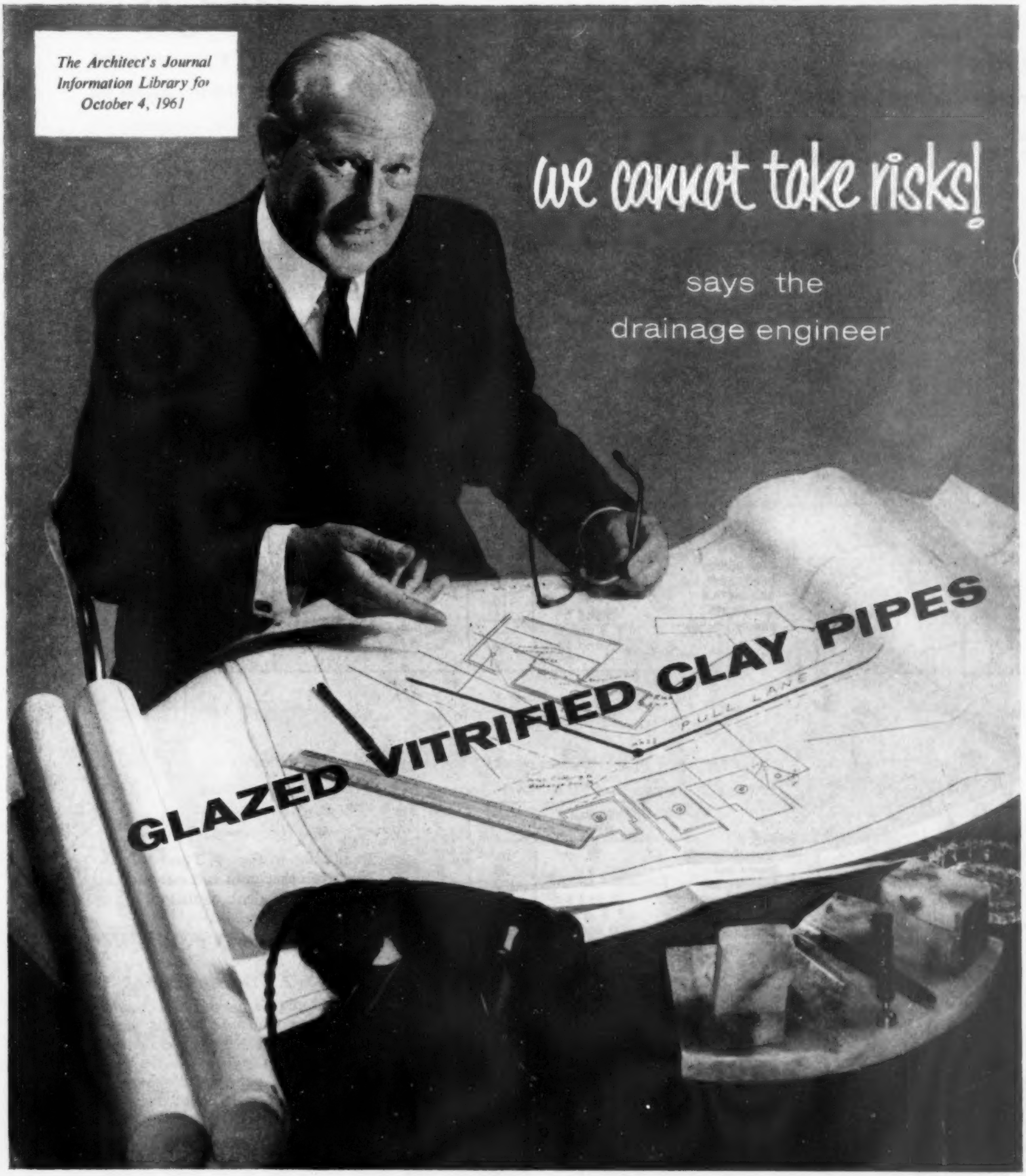

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we can really trust

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NATIONAL SALT GLAZED PIPE MANUFACTURERS' ASSOCIATION

Hanover Court, Hanover Square, London, W.1

Telephone: MAYfair 0364

GLAZED VITRIFIED CLAY PIPES

SETTING-OUT DIMENSIONS

for glazed vitrified clay (G.V.C.) pipes and fittings to B.S. 65: 1952

The dimensions of fittings given in the figures and tables are regarded as indicative only and the B.S. does not require accurate compliance with them.

BENDS AND CHANNEL BENDS

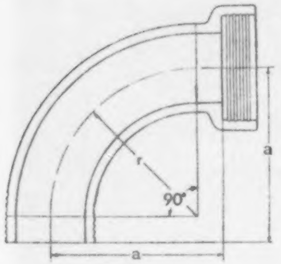


Fig. 1 One-quarter bends and half-section one-quarter channel bends

Internal diameter	Short		Medium		Long	
	r	a	r	a	r	a
in.	in.	in.	in.	in.	in.	in.
3	3½	5½	6	7½	—	—
4	3½	5½	6	7½	8½	10
5 and 6	6	7½	7½	9	9	10½
7, 8 and 9	—	—	8½	10½	—	—
10 and 12	—	—	10	12	—	—

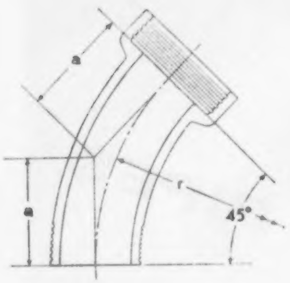


Fig. 2 One-eighth bends and half-section one-eighth channel bends

Internal diameter	Short		Medium		Long	
	r	a	r	a	r	a
in.	in.	in.	in.	in.	in.	in.
3	10	4	15	6	—	—
4	10	4	15	6	20	8½
5 and 6	15	6	18	7½	1	8½
7, 8 and 9	—	—	21	8½	—	—
10 and 12	—	—	24	10	—	—

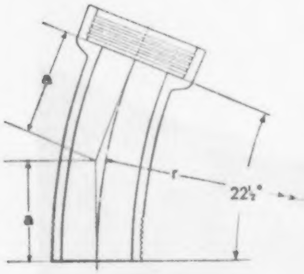


Fig. 3 One-sixteenth bends and half-section one-sixteenth channel bends

Internal diameter	r	a
in.	in.	in.
3	30	6
4	30	6
5 and 6	36	7
7, 8 and 9	42	8½
10 and 12	48	9¼

In addition to Figs. 1, 2 and 3 bends of other radii and internal dimensions are available.

TAPER PIPES

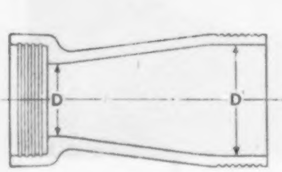


Fig. 4 Concentric

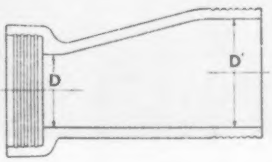


Fig. 5 Level invert (eccentric)

Taper pipes and half-section taper channels may be ordered in any normal combination of diameters, including reverse tapers.

In addition to the fittings for which setting-out dimensions are given, the following are available: square, oblique and curved junctions, both whole pipes and channels; gullies, raising pieces, interceptors, traps, manhole channels; with a range of special fittings for modern drainage all made in glazed vitrified clay.

(*Sheet one*)

SfB (12)

SETTING-OUT DIMENSIONS *(continued)*

for glazed vitrified clay (G.V.C.) pipes and fittings to B.S. 65: 1952

The dimensions of fittings given in the figures and tables are indicative only and the B.S. does not require accurate compliance with them.

TAPER BENDS

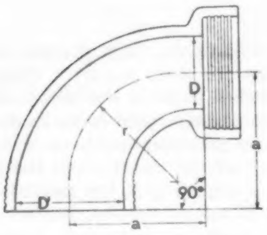


Fig. 6
One-quarter taper bends

Internal diameter			
D	D'	r	a
in	in	in	in
3	4	6	7½
4	6	6	7½
6	9	7½	9

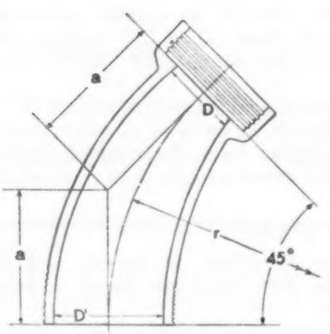


Fig. 7
One-eighth taper bends

Internal diameter			
D	D'	r	a
in	in	in	in
4	6	15	6
6	9	18	7½

In addition to Figs. 6 and 7 bends of other internal diameters are available.

The following British Standards specify glazed vitrified clay pipes and fittings:

BRITISH STANDARD 65: 1952 (amended March, 1955) SALT-GLAZED WARE PIPES.

BRITISH STANDARD 539: Part 1: 1951 Dimensions of DRAIN FITTINGS.

BRITISH STANDARD 1143: 1955 SALT-GLAZED WARE PIPES with Chemically Resistant Properties

---

METHODS OF JOINTING GLAZED VITRIFIED CLAY PIPES

1. TARRED GASKIN AND CEMENT MORTAR.

This is still the most common method of jointing stoneware pipes. The method of jointing is laid down in British Standard Code of Practice CP 301 (1950) as follows:—

Glazed-ware Pipes. Tarred gaskin should first be wrapped round the spigot of each pipe and the spigot should then be placed well home into the socket of the pipe previously laid; the pipe should then be adjusted and fixed in its correct position and the gaskin caulked tightly home, so as not to fill more than one-quarter of the total depth of the socket.

The remainder of the socket should be filled with a stiff mix of cement mortar, *one part cement to one part sharp sand. When the socket is filled, a fillet should be formed round the joint, with a trowel forming an angle of 45° with the barrel of the pipe.

Mortar should be mixed as wanted for immediate use, and no mortar should be beaten up and used after it has begun to set.

After the joint is made any extraneous materials should be removed from the inside of the joint with a suitable scraper or 'badger.'

The newly-made joints should be protected, until set, from the sun, drying winds, rain or frost. Sacking or other suitable materials, which should be kept damp except in frosty weather, may be used for this purpose. The joint holes should be kept free from flowing water.

***The Building Research Station recommends that a mix *not richer than* one part cement to TWO parts sand should be used for mortar joints of glazed-ware pipes.**

2. 'STANFORD' JOINT.

This joint is made in the factory by casting a ring of a durable material on the spigot and one inside the socket of each pipe. On site the spigot of one pipe is placed in the socket of the last pipe laid. This joint is widely used for glazed vitrified clay conduits, and to

(Sheet two)

N

METHODS OF JOINTING GLAZED VITRIFIED CLAY PIPES *(continued)* SfB (12)

a lesser extent, for sewerage and drainage when the joint is usually completed by filling in with a fillet of cement.

3. 'HASSALL' JOINT.

(i) Double Lined. This joint has two rings of durable material cast on the spigot end of the pipe and two inside the socket. Plastic cement is applied to the composition rings and then the pipe is pushed home. Cement grout is then poured into the cavity through one of the two holes provided in the socket, the other providing for escape of air as the cavity fills. Pouring continues until the cement completely fills the cavity and encircles the pipe.

(ii) Single Lined. This joint consists of a single ring cast on the spigot and another inside the socket of the pipe. Plastic cement is applied to the face of the composition rings, and the pipes are pushed home. A roll of clay is then pushed into the mouth of the socket and the joint is completed by filling in with cement grout, poured through one of the holes provided, in a similar manner as for Hassall's Double Lined, continuing until the pipe is encircled with cement grout.

4. SELF-CENTREING JOINT.

This joint consists of a tapered shoulder around the inside of the socket and a tapered spigot. A small quantity of plastic cement is wiped round the inside shoulder and the next pipe is pushed home. The plastic cement is to fill any small irregularities between the spigot and socket and so prevent percolation of any cement into the invert when the joint is being completed No gaskin or yarn is required and when the pipe has been pushed home jointing is completed in the conventional manner using cement mortar.

The bearing of the spigot on the tapered shoulder inside the socket prevents movement of the pipes whilst the cement joint is being made.

5. 'FLEXADRAIN' JOINT.

Flexadrain pipes are jointed with a rubber sleeve having a bead or cord at one end. The sleeve is placed on the spigot of the pipe and the bead is rolled back over the sleeve to give a diameter matching the joint space to be filled. The position of the sleeve on the spigot is adjusted so that the rolled bend is flush with the spigot end and the pipe is gently pushed home with the rolled bead gripping and rolling between spigot and socket. The latter is deeper than standard with a tapered lead-in designed to give moderate compression to the rolled head.

6. 'HEPSEAL' JOINT.

This is a factory-made joint comprising of polyester precision moulding on the spigot and inside the socket of the pipes, ensuring a perfect circumference to take a rubber gasket ring. It is a piston type telescopic joint, in which the rubber ring does not roll but slides into position, and the joint is completed when the pipes are pushed together, thus compressing the rubber ring between the polyester surfaces. Under test, water pressure of 20 lb. per square inch is maintained when the following displacements are made:

(a) Angular movement of 5° (0.087 radians) in any direction, per joint.

(b) Lineal movement, or draw, of ¾ in. per joint.

7. 'OANCO' JOINT.

This joint consists of bituminous rings precast in the socket and on the spigot to form a cavity when the spigot of one pipe is pushed home in the socket of the next pipe. Each socket contains pour-holes leading to the cavity. The rings are precision-cast to an accuracy which ensures alignment of the invert when the pipes are laid. The seal is provided by a hot poured bituminous material which on setting remains flexible.

This joint, if properly made, is watertight under an internal pressure of 20 lb. per square inch, and that under this pressure a 6-in. joint will:

(a) with zero draw tolerate an angular deformation from the straight of about 2° (0.035 radians) without imposing any significant bending moment on the line.

(b) permit a maximum straight draw of about 1 in.

The comparative figures for an 18-in. diameter joint are an angular deformation from the straight of about 1½ degrees and a maximum straight draw of about ½ in.

8. 'DRAWFLEX' JOINT.

This joint permits flexibility, is durable and fully resistant to attack from chemicals found in normal sewage effluent.

A resilient plastisol is cast on to the spigot and into the socket of each pipe at the factory and the joint has been designed to withstand internal and external hydraulic pressure even at considerable deflection and draw.

The method of jointing is to lubricate the surface of the joint with water, preferably soapy water, and push home the spigot into the socket. The joint thus formed is capable not only of being deflected but also of accommodating telescopic action and still remain leak proof under pressure.

Tests have shown that under water pressure of 20 lb. per square inch the joint will withstand:

(a) Angular movement of 5° (0.087 radians) in any direction, per joint.

(b) Lineal movement, or draw, of ¾ in. per joint.

LONGITUDINAL STRAINS AND PIPE LENGTH.

Pipelines are commonly liable to longitudinal stresses due to soil movements brought about by change of moisture content, mining, differential settlement, etc. The D.S.I.R. Building Research Station have shown that these stresses may be combatted by the use of telescopic flexible joints. The stresses may be either compressive or tensile and a total "draw" in a joint of $\frac{1}{20}$ inch per foot of pipe length is desirable in general cases of this kind, whilst ¼ of an inch per foot of pipe length may be required on occasion.

The lengths in which G.V.C. pipes are commonly made allow the resultant strains to be readily accommodated without dangerously large movement at any joint.

(Sheet three)

For further information write to the Engineer:

NATIONAL SALT GLAZED PIPE MANUFACTURERS' ASSOCIATION, HANOVER COURT, HANOVER SQUARE, LONDON, W.1.

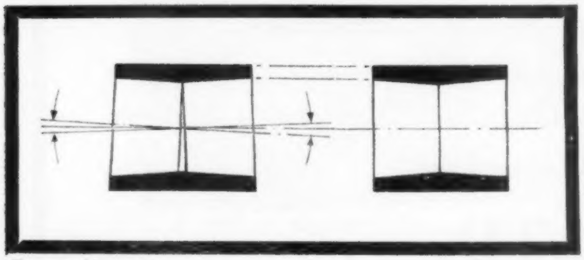
Flexpipe

SfB	(12Ij2)
UDC	69·133

Flexpipe pitch fibre pipe is available in 2", 3", 3½", 4", 5" and 6" internal diameters. The standard length is 10′ 0"—2′ 0" longer than any other pitch fibre drain pipe.

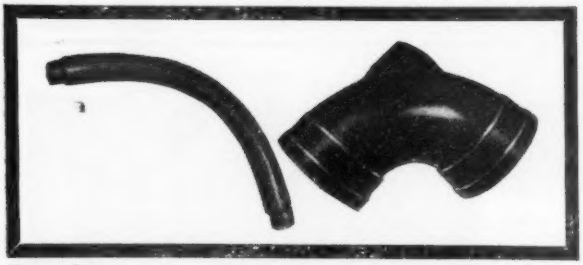
BS 2760-1956

Flexpipe conforms to the requirements of BS2760. It is unaffected by acids, alkalis, detergents or boiling water and will withstand the abrasion of sand and water. It is strong, smooth bored, resilient and light (4" Flexpipe weighs 2.7 lbs. per ft. Salt glaze 11 lbs.)



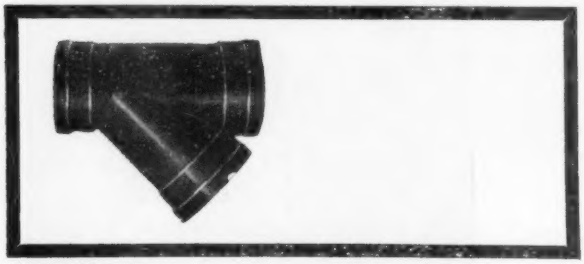
Couplings

5° and 7° angle couplings are available for slow bends in addition to the standard coupling.



Bends

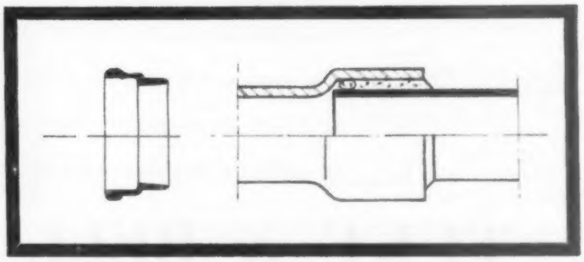
Long and medium radius bends can be obtained at angles of 11¼°, 22½°, 45° and 90°.
Knuckle bends of polypropylene are made at 45° and 90° angles.



Junctions

Standard junctions come in angles of 90°, 95°, 112° and 135°.

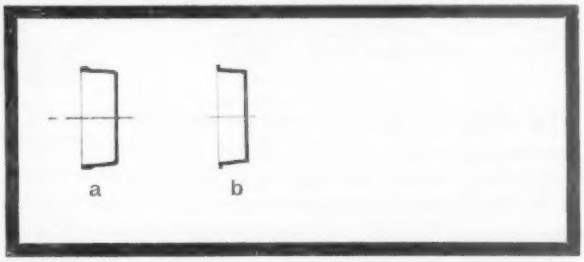
Technical representatives are available to give advice. The new Flexpipe Technical Manual (SfB and A4) will be available shortly giving full information on pipes and fittings, properties and technical data.



Adaptors

(a) for coupling a Flexpipe tapered spigot to stoneware or cast iron. The joint is caulked and sealed with a sand/cement mixture.

(b) for coupling a stoneware socket to an untapered end of Flexpipe by caulking and sealing it with sand and cement mixture as shown.



Plugs

(a) to fit a tapered spigot

(b) to fit into a tapereed coupling.

Jointing sleeves

These are in 7" lengths for the range of diameter sizes and are used for connecting either to untooled pitch fibre pipes or untapered pitch fibre pipe to cast iron.

Invert taper

This enables a 4" drain pipe to be connected to a 6" pipe with a level invert.

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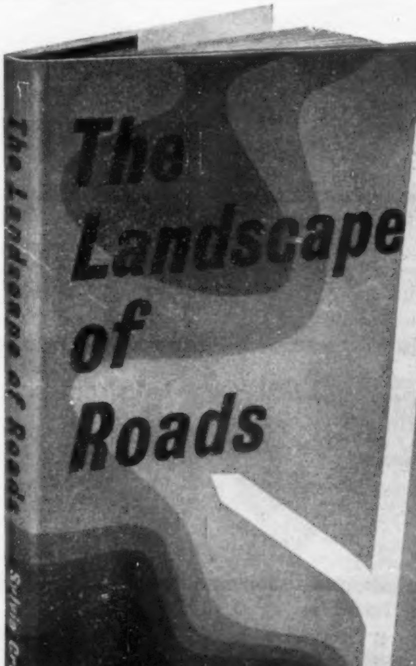
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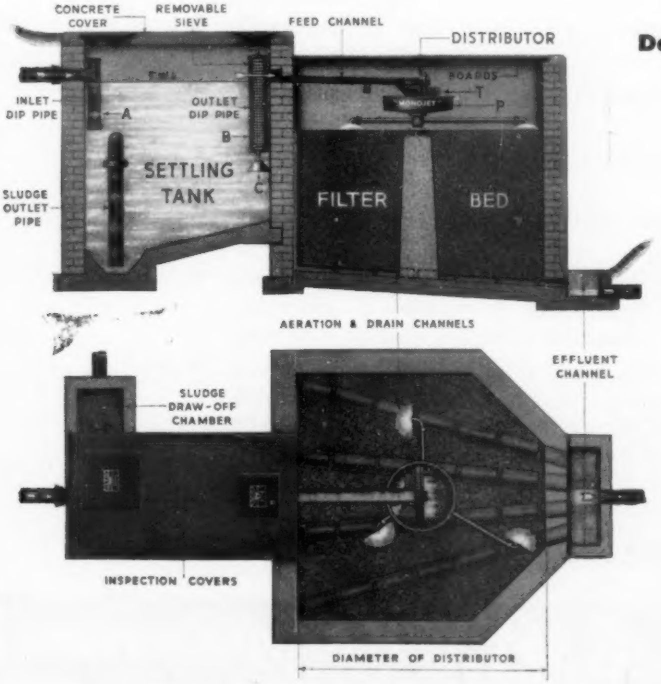

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1. Each distributor has two, three or four arms with a single curved large-bore nozzle at the end of each arm.
2. The nozzles are virtually non-choking
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   (b) because they are fitted at the end of the pipe instead of along its length;
   (c) because of the high velocity of the liquid passing through them. (This high velocity is due to the specially-designed profile of the nozzles and also to the relatively small bore of the distributor arms.)
   (d) because there are no right-angle bends from arm to nozzles.
3. 'MONOJET' nozzles are hinged so that, if on some rare occasion, a tube should silt up, the nozzle can be swung back, and the tube can be rodded with the greatest of ease.
4. Each nozzle has a special dashplate which gives the issuing jet a wide spread—without loss of the reactionary force which revolves the distributor.
5. Each arm of the distributor is a different length; and this fact coupled with the wide jet-spread by the special dashplates ensures that the whole area of the bed is covered.
6. All the arms are balanced so that there is no uneven wear on the centre-bearing or centre-column.

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1. Nature of property; and whether resident or only day-time use.
2. Number of residents to be catered for; and in cases of schools, etc., number of persons attending during day-time.
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AJ SfB (12)

Drainage: General

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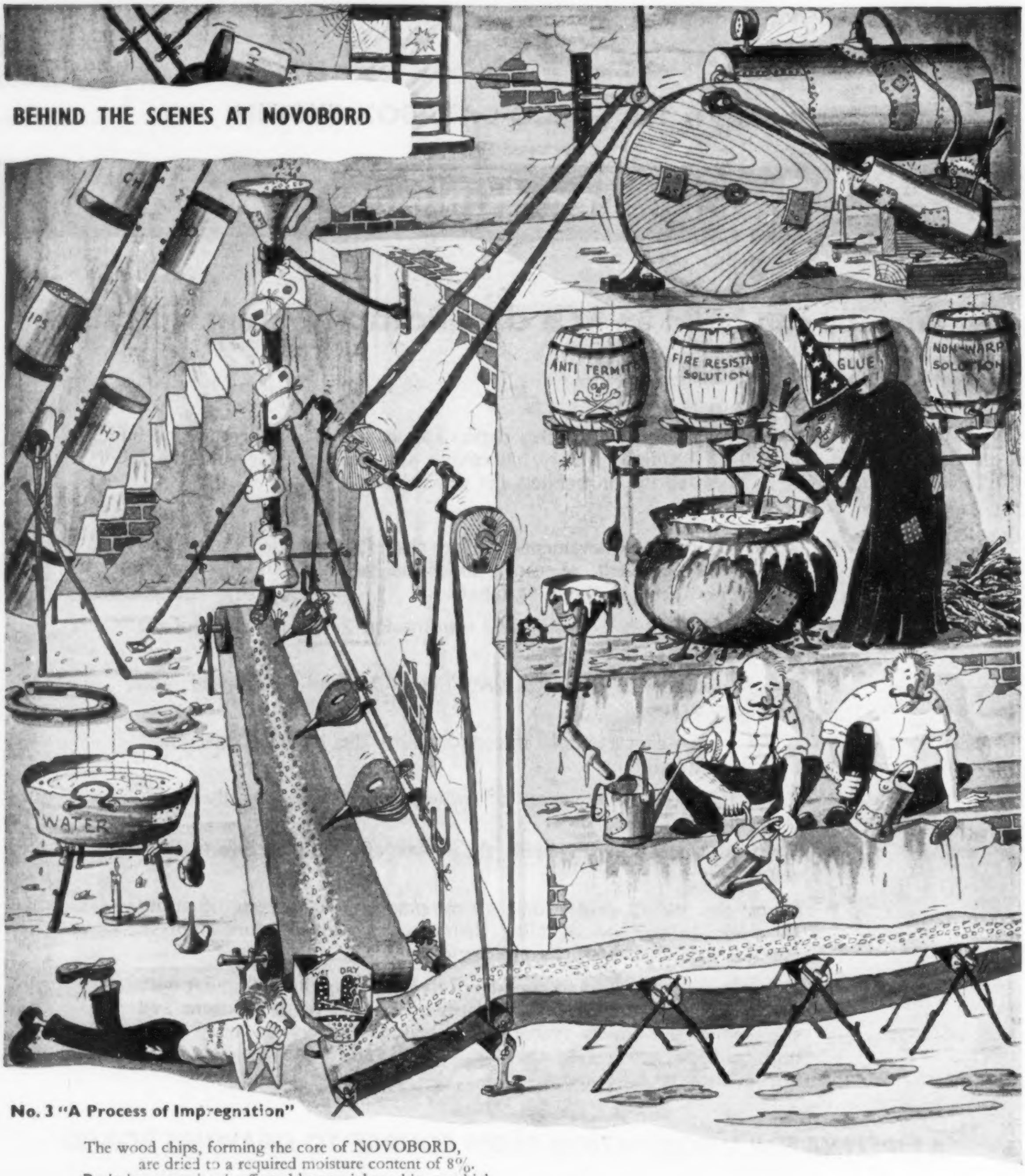

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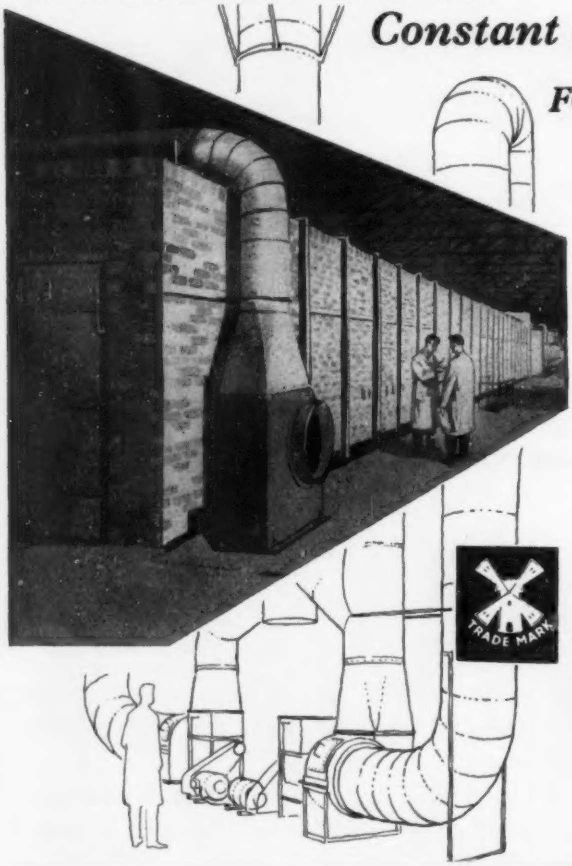

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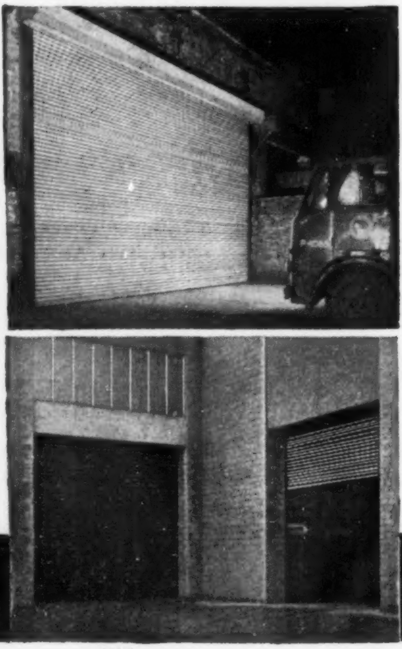

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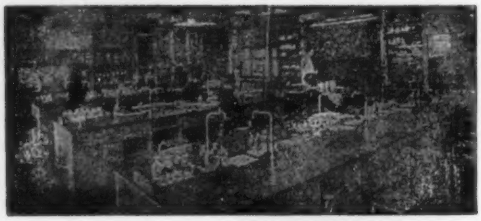

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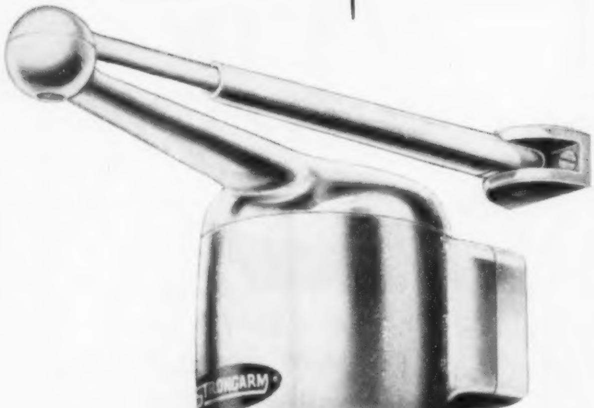
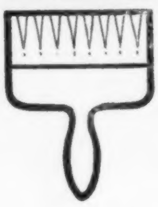


Armstrong Patents Co. Ltd. Eastgate, Beverley, Yorkshire. Tel: Beverley 82212 (10 lines)



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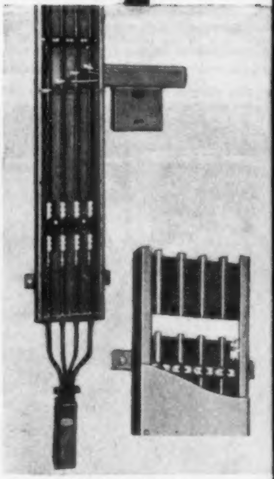

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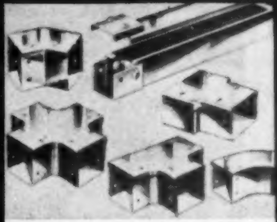

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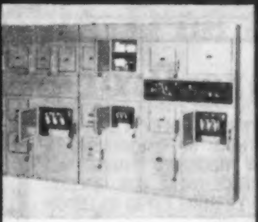

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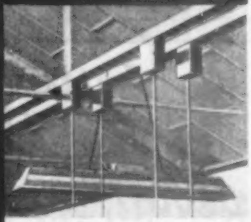

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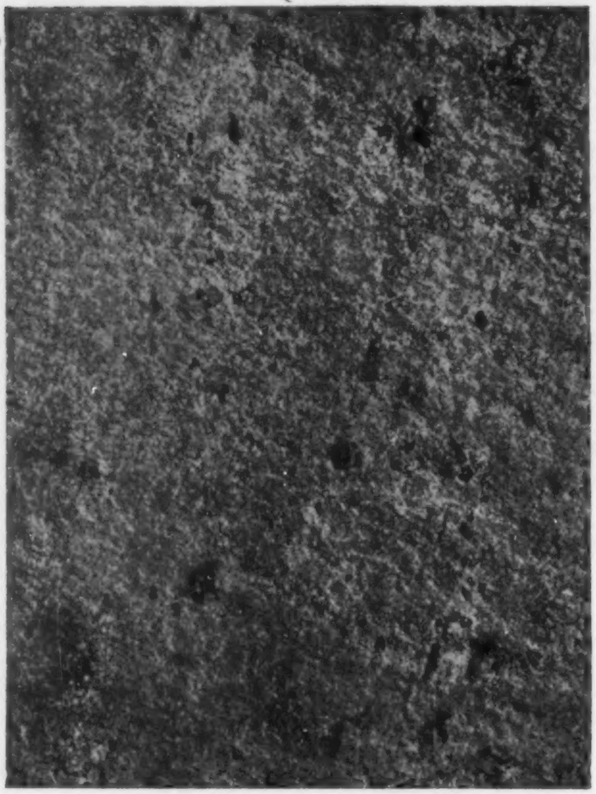

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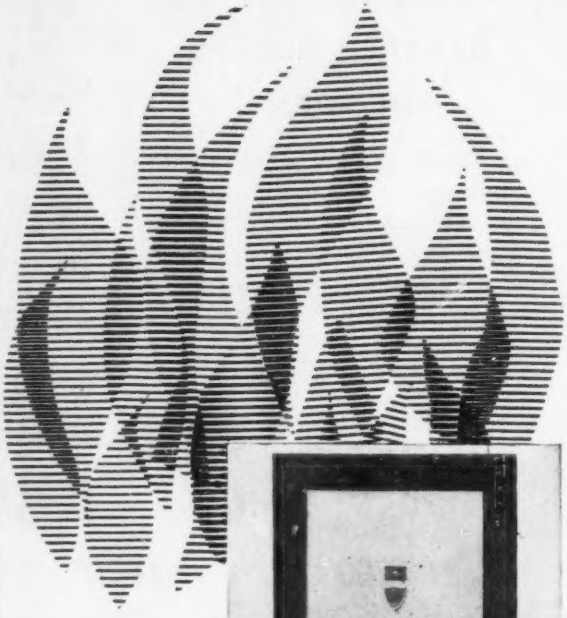

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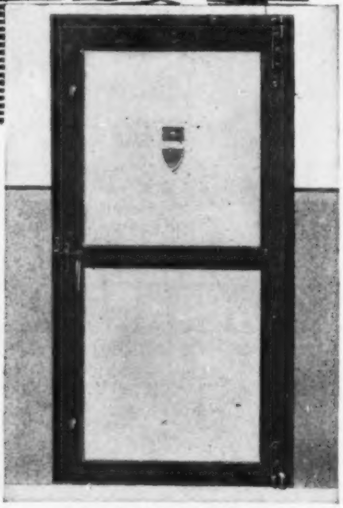

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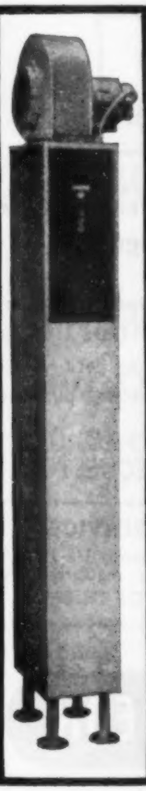

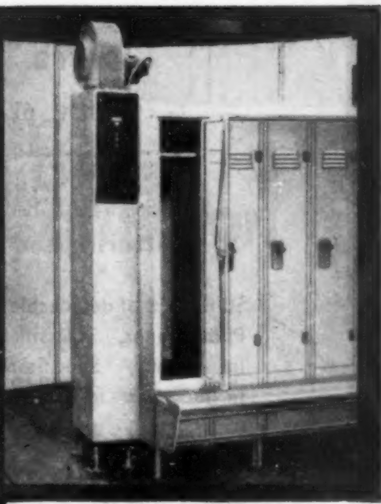

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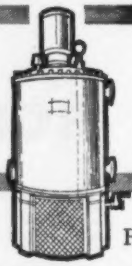

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are factory-mixed and combine the important physical properties of the various 'Sirapite' plasters and Perlite or Vermiculite lightweight aggregate. They offer the following advantages:—

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on the building, and for the operative to handle

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Heat loss through walls is reduced, surface warming expedited, condensation and pattern staining minimised.

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The natural fire-resisting property of Gypsum plaster is further improved by the addition of Vermiculite or Perlite.

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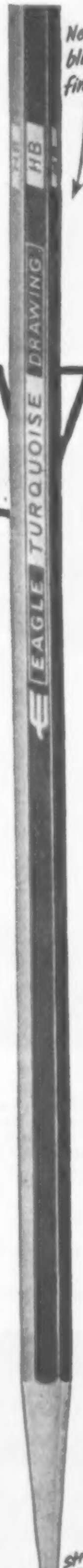

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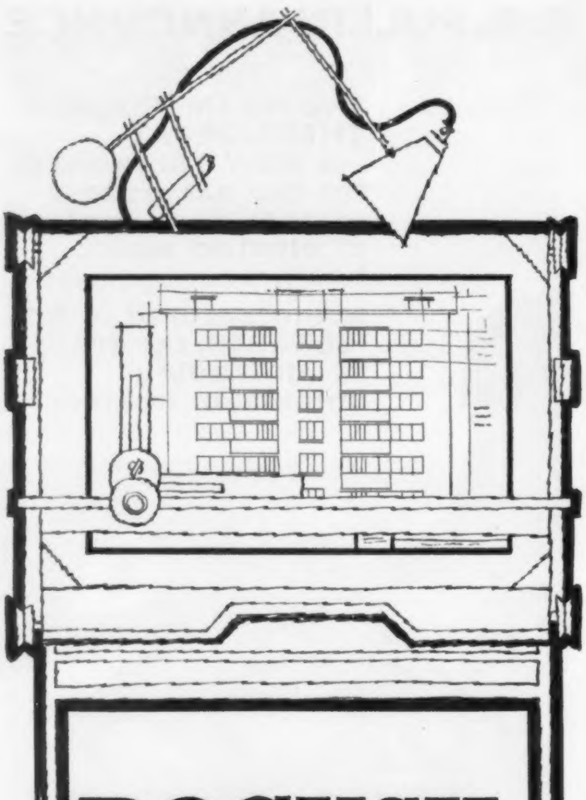

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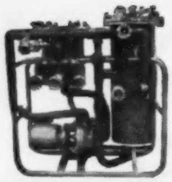

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Replies to Box Numbers should be addressed care of "The Architects' Journal," at the address given above.

AIR-MAIL SERVICE available on request.

In response to requests from a number of Overseas subscribers for air-mail delivery of Public and Official Appointment details and Other Appointments Vacant, we have been pleased to arrange that cuttings of all such classified advertisements appearing in the A.J., shall be despached by air-mail each week. The cost of this special service to Overseas subscribers will be 5s. for four weeks (1s. 3d. for each additional week) and prepayment should be sent by subscribers wishing to take advantage of this service. The charge we are making represents only the actual cost of the postage involved.

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(c) SENIOR ASSISTANT ARCHITECTS, £1,140—£1,310.

Candidates for (a) must be members of the R.I.B.A., have had sound experience and be capable of acting as Group Leaders on an extensive programme of education buildings. Candidates for (b) must be members of the R.I.B.A., have had considerable office experience and be capable of taking charge of contracts from inception to completion. For (c), should be members of the R.I.B.A., have had office experience and be capable of taking charge of small contracts. Lodging allowance and removal expenses may be paid to a married man. Apply on form obtainable from County Architect, 123, London Road, Leicester. TC9044

BOROUGH OF CASTLEFORD
APPOINTMENT OF ARCHITECTURAL ASSISTANT

Applications are invited for this appointment in the Borough Architect's Department. Salary—Grade A.P.T. II (£815—£960). Applicants should have passed the Intermediate Examination of the R.I.B.A. or its equivalent at one of the recognised Schools of Architecture.

N.J.C. Service Conditions; Superannuable; terminable on one month's notice on either side; housing accommodation if required for successful married applicant.

Applications, on forms obtainable from me, to be returned not later than 9 a.m. on the 12th October, 1961.

Canvassing disqualifies.

ERNEST HUTCHINSON,
Town Clerk.

Town Hall,
Castleford. 9474

CITY ENGINEER & SURVEYOR'S DEPARTMENT
AREA PLANNING OFFICER GRADE B

Applications are invited from suitably qualified persons for the above appointment on the staff of the City Engineer and Surveyor and Town Planning Officer (Mr. C. R. Warman, B.Sc., M.I.C.E., M.I.Mun.E., M.T.P.I.).

The post is established in Grade B (£1,480—£1,670 p.a.).

Candidates should have a Town Planning qualification and an architectural or other suitable additional qualification would be an advantage.

The commencing salary will be in accordance with experience and qualifications.

Superannuable post. N.J.C. Conditions of Service. Medical Examination.

Applications stating age, education and training, qualifications, experience, present and past appointments (with dates and salaries) and quoting the names of two referees should be submitted to the undersigned by the 15th October next.

JOHN HEYS,
Town Clerk.

Town Hall,
Sheffield, 1. S9472

CORBY NEW TOWN
ASSISTANT ARCHITECTS

There are vacancies for Assistant Architects within the department of the Chief Architect at salaries within Grade A.P.T. IV (£1,140—£1,310). The appointments offer exceptional experience and extensive development work will continue for many years.

Housing is available and removal expenses will be paid. There is a Superannuation Scheme either under the conditions of the Local Government Superannuation Act or under the New Towns Pension Fund.

Apply by Tuesday, 17th October, stating age, present appointment and salary, details of qualifications and experience, and the names of two referees, to: R. F. Brooks Grundy, General Manager, Corby Development Corporation, Spencer House, Corby, Northants. 9524

BOROUGH OF WREXHAM
ENGINEER AND SURVEYOR'S DEPARTMENT
ARCHITECTURAL ASSISTANTS

Applications are invited for the following architectural appointments in the Borough Engineer & Surveyor's Department.

(a) A.P.T. Grade II (£815—£960).

Applicants should have passed the Intermediate Examination of the R.I.B.A. and have had several years drawing office experience.

(b) A.P.T. Grade I (£645—£815).

Applicants should be studying for the R.I.B.A. Intermediate Examination and have had drawing office experience.

Housing accommodation available if required and the Council will consider the payment of removal expenses.

Further particulars and form of application from the Borough Engineer & Surveyor, Guildhall, Wrexham.

Applications to be returned to the undersigned not later than Monday, 16th October, 1961.

PHILIP J. WALTERS,
Town Clerk.

Guildhall,
Wrexham.
September, 1961. S9491

BOROUGH OF NUNEATON
APPOINTMENT OF ARCHITECTURAL ASSISTANTS

Applications are invited for:—

(a) ASSISTANT ARCHITECT. Salary A.P.T. III/IV, £960—£1,310 according to qualifications.

(b) JUNIOR ARCHITECTURAL ASSISTANT. Salary A.P.T. I/II, £645—£960.

The posts will provide scope and opportunity for a varied experience as the Borough Council has a large building programme including houses, flats, swimming baths, schools and other public buildings.

Housing accommodation will be made available if necessary.

Further details and forms of application which must be returned not later than 16th October, 1961, may be obtained from me.

A. A. CRABTREE,
Town Clerk.

Council House,
Nuneaton.
22nd September, 1961. S9492

ADMIRALTY—NAVY WORKS DEPARTMENT
ARCHITECTURAL AND CIVIL ENGINEERING ASSISTANTS

Vacancies exist in Navy Works Department Drawing Offices for ARCHITECTURAL and CIVIL ENGINEERING ASSISTANTS as shown. Posts are non-pensionable. Opportunities for transfer to Established Staff will occur.

Engineering Assistants:—

Vacancies exist at Pinner (Middlesex), Liverpool, Rosyth, Greenock and Glen Douglas (Dumbartonshire) and occur at Establishments elsewhere in the United Kingdom from time to time.

Applicants must be competent Draughtsmen and experienced designers in one or more of the following types of civil engineering works:—Structural steelwork, reinforced concrete; dock and harbour works; airfield construction; oil fuel schemes; roads, rail services and water supplies. O.N.C. or equivalent qualification is essential.

Architectural Assistants:—

Vacancies exist at Head Office Architects Branch, Pinner (Middlesex), and also at Portsmouth, Devonport, Greenock and Chatham. Applicants must be competent Draughtsmen and will be required for work on the preparation of designs for a wide range of new works, including housing projects, all forms of accommodation buildings, specialised technical buildings and industrial type buildings in H.M. Dockyards. Preference given to candidates studying for professional qualifications.

Salary. (National Rate—subject to slight variation dependent on location) starting from £603 p.a. (at age 21) to £905 p.a. (28 and over): maximum of scale—£993 p.a. Opportunities occur for promotion to Leading grade—salary maximum £1,160 p.a. National Rate.

Five-day week. Annual leave 18 days rising to 22 after 10 years.

Consideration will be given to successful candidates being granted assistance to obtain professional or technical qualifications.

Candidates, who must be British subjects, are invited to apply, in writing (giving details of experience), to:—Director General, Navy Works (45/96/7/(30)), Admiralty, Chamberlain Way, Pinner, Middlesex.

Interview will be arranged locally. S9390

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DEPARTMENT OF THE BOROUGH ARCHITECT
QUANTITY SURVEYING ASSISTANT
(SALARY £1,005 to £1,185 PER ANNUM)

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Further details if required may be obtained from the Borough Architect and written applications should reach the undersigned within seven days of the appearance of this advertisement.

E. R. FARR,
Town Clerk.

Town Hall,
Barking. 9497

METROPOLITAN BOROUGH OF CAMBERWELL
APPOINTMENT OF ARCHITECTS IN BOROUGH ARCHITECT'S DEPARTMENT

The Borough Architect, having an interesting programme of housing and public buildings and a senior staff producing good contemporary work requires ASSISTANTS from good Schools of Architecture to back them up.

Newly elected Associates may expect a salary starting at £1,005 per annum and more for those with several years experience: those who lack only the Professional Practice examination would commence at £840 to £855 per annum.

To arrange an interview write to Town Clerk, Town Hall, S.E.5. TC9424

CORPORATION OF LONDON

Applications are invited for the following posts in the Building and Architectural Division of the City Surveyor's Office:—

A. ASSISTANT BUILDING SURVEYOR
(Two vacancies).

Candidates must have passed the Final examination of the R.I.C.S., possess a sound knowledge of building construction and the ability to prepare specifications for works of maintenance and supervise contracts.

Salary range £1,055—£1,310.

B. ARCHITECTURAL ASSISTANT

Applicants must be of Intermediate R.I.B.A. standard with the ability to prepare working and detailed drawings.

Salary scale £690—£1,095.

C. JUNIOR ARCHITECTURAL OR SURVEYING ASSISTANT

Applicants should be studying for Intermediate examination of the R.I.B.A. or R.I.C.S. and should possess a sound knowledge of building construction.

Salary scale £630—£990.

Write giving age and full details of previous experience, with the names of two referees, within fourteen days, to The City Surveyor, Guildhall, E.C.2. S9422

BOROUGH OF HESTON AND ISLEWORTH
APPOINTMENT OF SENIOR PLANNING ASSISTANT

Applications are invited for the post of Senior Planning Assistant at a salary in accordance with Grades III-IV of the A.P.T. Division of the National Joint Council's Scale of Salaries (£960—£1,310 plus London "weighting").

Candidates should have passed at least the Intermediate Examination of the Town Planning Institute or other equivalent and must have had experience in a Town Planning Department of a local authority.

The Council is unable to assist the successful candidate with housing accommodation.

Applications are to be submitted by 23rd October, 1961, on forms obtained from and returned to the Borough Engineer and Surveyor, 88, Lampton Road, Hounslow.

Will applicants please quote code AJ.

D. MATHIESON,
Town Clerk.

Town Hall,
Hounslow,
Middlesex. S9556

THE SOUTH WALES ELECTRICITY BOARD
GENERAL ASSISTANT ENGINEER
(ARCHITECTURAL ASSISTANT)

Applications are invited for the position of General Assistant Engineer (Architectural Assistant) in the Chief Engineer's Department at Head Office, St. Mellons.

Salary: N.J.B. Class J, Grade 12, Scale 6, £815—£1,015 per annum.

The successful applicant will receive a commencing salary of at least £890 per annum.

Applicants should preferably be of Intermediate R.I.B.A. standard.

Applications, stating age, present position, present salary, qualifications and experience, should be addressed to the undersigned at St. Mellons, Cardiff, to arrive not later than 21st October, 1961. Please quote reference 119/61/AJ, endorsing envelope "General Assistant Engineer (Architectural Assistant)".

R. G. WILLIAMS,
Secretary.
9543

WEMBLEY BOROUGH COUNCIL invite applications from suitably qualified persons for the established post of SENIOR PLANNING ASSISTANT (Development Control). Salary A.P.T. V, £1,355—£1,525 inclusive. Application forms available from Borough Engineer and Surveyor, Town Hall, Wembley. Quote ref. "A." Closing date 16th October, 1961. 9535

BOROUGH OF LUTON
DEPUTY BOROUGH ARCHITECT

Applications invited from qualified Architects with wide local authority experience. Commencing salary in Scale "D" (£1,710—£1,975) commensurate with qualifications and experience.

Application form and particulars of appointment obtainable from Town Clerk, Town Hall, Luton, to be returned by 20th October, 1961. S9541

CLASSIFIED ADVERTISEMENTS

Advertisements should be addressed to the Advertisement Manager, "The Architects' Journal," 9, 11 and 13, Queen Anne's Gate, Westminster, S.W.1, and must reach there by first post Friday morning for inclusion in the following Wednesday's paper.

Replies to Box Numbers should be addressed care of "The Architects' Journal," at the address given above.

AIR-MAIL SERVICE available on request.

In response to requests from a number of Overseas subscribers for air-mail delivery of Public and Official Appointment details and Other Appointments Vacant, we have been pleased to arrange that cuttings of all such classified advertisements appearing in the A.J., shall be despached by air-mail each week. The cost of this special service to Overseas subscribers will be 6s. for four weeks (1s. 3d. for each additional week) and prepayment should be sent by subscribers wishing to take advantage of this service. The charge we are making represents only the actual cost of the postage involved.

Public and Official Announcements

36s. per inch; each additional line 3s.

ADMINISTRATIVE COUNTY OF LEICESTER
(a) PRINCIPAL ASSISTANT ARCHITECT, £1,410—£1,565.
(b) CHIEF ASSISTANT ARCHITECTS, £1,310—£1,480.
(c) SENIOR ASSISTANT ARCHITECTS, £1,140—£1,310.

Candidates for (a) must be members of the R.I.B.A., have had sound experience and be capable of acting as Group Leaders on an extensive programme of education buildings. Candidates for (b) must be members of the R.I.B.A., have had considerable office experience and be capable of taking charge of contracts from inception to completion. For (c), should be members of the R.I.B.A., have had office experience and be capable of taking charge of small contracts. Lodging allowance and removal expenses may be paid to a married man. Apply on form obtainable from County Architect, 123, London Road, Leicester. TC9044

BOROUGH OF CASTLEFORD
APPOINTMENT OF ARCHITECTURAL ASSISTANT

Applications are invited for this appointment in the Borough Architect's Department. Salary —Grade A.P.T. II (£815—£960). Applicants should have passed the Intermediate Examination of the R.I.B.A. or its equivalent at one of the recognised Schools of Architecture.

N.J.C. Service Conditions; Superannuable; terminable on one month's notice on either side; housing accommodation if required for successful married applicant.

Applications, on forms obtainable from me, to be returned not later than 9 a.m. on the 12th October, 1961.

Canvassing disqualifies.

ERNEST HUTCHINSON,
Town Clerk.

Town Hall,
Castleford. 9474

CITY ENGINEER & SURVEYOR'S DEPARTMENT
AREA PLANNING OFFICER GRADE B

Applications are invited from suitably qualified persons for the above appointment on the staff of the City Engineer and Surveyor and Town Planning Officer (Mr. C. B. Warman, B.Sc., M.I.C.E., M.I.Mun.E., M.T.P.I.).

The post is established in Grade B (£1,480—£1,670 p.a.).

Candidates should have a Town Planning qualification and an architectural or other suitable additional qualification would be an advantage.

The commencing salary will be in accordance with experience and qualifications.

Superannuable post. N.J.C. Conditions of Service. Medical Examination.

Applications stating age, education and training, qualifications, experience, present and past appointments (with dates and salaries) and quoting the names of two referees should be submitted to the undersigned by the 15th October next.

JOHN HEYS,
Town Clerk.

Town Hall,
Sheffield, 1. S9472

CORBY NEW TOWN
ASSISTANT ARCHITECTS

There are vacancies for Assistant Architects within the department of the Chief Architect at salaries within Grade A.P.T. IV (£1,140—£1,310). The appointments offer exceptional experience and extensive development work will continue for many years.

Housing is available and removal expenses will be paid. There is a Superannuation Scheme either under the conditions of the Local Government Superannuation Act or under the New Towns Pension Fund.

Apply by Tuesday, 17th October, stating age, present appointment and salary, details of qualifications and experience, and the names of two referees, to: R. F. Brooks Grundy, General Manager, Corby Development Corporation, Spencer House, Corby, Northants. 9524

BOROUGH OF WREXHAM
ENGINEER AND SURVEYOR'S DEPARTMENT
ARCHITECTURAL ASSISTANTS

Applications are invited for the following architectural appointments in the Borough Engineer & Surveyor's Department.

(a) A.P.T. Grade II (£815—£960).

Applicants should have passed the Intermediate Examination of the R.I.B.A. and have had several years drawing office experience.

(b) A.P.T. Grade I (£645—£815).

Applicants should be studying for the R.I.B.A. Intermediate Examination and have had drawing office experience.

Housing accommodation available if required and the Council will consider the payment of removal expenses.

Further particulars and form of application from the Borough Engineer & Surveyor, Guildhall, Wrexham.

Applications to be returned to the undersigned not later than Monday, 16th October, 1961.

PHILIP J. WALTERS,
Town Clerk.

Guildhall,
Wrexham.
September, 1961. S9491

BOROUGH OF NUNEATON
APPOINTMENT OF ARCHITECTURAL ASSISTANTS

Applications are invited for:—

(a) ASSISTANT ARCHITECT. Salary A.P.T. III/IV, £960—£1,310 according to qualifications.

(b) JUNIOR ARCHITECTURAL ASSISTANT. Salary A.P.T. I/II, £645—£960.

The posts will provide scope and opportunity for a varied experience as the Borough Council has a large building programme including houses, flats, swimming baths, schools and other public buildings.

Housing accommodation will be made available if necessary.

Further details and forms of application which must be returned not later than 16th October, 1961, may be obtained from me.

A. A. CRABTREE,
Town Clerk.

Council House,
Nuneaton.
22nd September, 1961. S9492

ADMIRALTY—NAVY WORKS DEPARTMENT
ARCHITECTURAL AND CIVIL ENGINEERING ASSISTANTS

Vacancies exist in Navy Works Department Drawing Offices for **ARCHITECTURAL** and **CIVIL ENGINEERING ASSISTANTS** as shown. Posts are non-pensionable. Opportunities for transfer to Established Staff will occur.

Engineering Assistants:—

Vacancies exist at Pinner (Middlesex), Liverpool, Rosyth, Greenock and Glen Douglas (Dumbartonshire) and occur at Establishments elsewhere in the United Kingdom from time to time.

Applicants must be competent Draughtsmen and experienced designers in one or more of the following types of civil engineering works:—Structural steelwork, reinforced concrete; dock and harbour works; airfield construction; oil fuel schemes; roads, rail services and water supplies. O.N.C. or equivalent qualification is essential.

Architectural Assistants:—

Vacancies exist at Head Office Architects Branch, Pinner (Middlesex), and also at Portsmouth, Devonport, Greenock and Chatham. Applicants must be competent Draughtsmen and will be required for work on the preparation of designs for a wide range of new works, including housing projects, all forms of accommodation buildings, specialised technical buildings and industrial type buildings in H.M. Dockyards. Preference given to candidates studying for professional qualifications.

Salary. **(National Rate—subject to slight variation dependent on location) starting from £603 p.a. (at age 21) to £905 p.a. (28 and over): maximum of scale—£993 p.a. Opportunities occur for promotion to Leading grade—salary maximum £1,160 p.a. National Rate.**

Five-day week. Annual leave 18 days rising to 22 after 10 years.

Consideration will be given to successful candidates being granted assistance to obtain professional or technical qualifications.

Candidates, who must be British subjects, are invited to apply, in writing (giving details of experience), to:—Director General, Navy Works (45/96/7/(30)), Admiralty, Chamberlain Way, Pinner, Middlesex.

Interview will be arranged locally. S9390

CORPORATION OF BARKING
DEPARTMENT OF THE BOROUGH ARCHITECT
QUANTITY SURVEYING ASSISTANT
(SALARY £1,005 to £1,185 PER ANNUM)

The departmental establishment includes a separate section responsible for quantities and the work covers housing redevelopment schemes including multi-storey flats, a large education programme, clinics, and other public buildings. This is a permanent appointment offering opportunity.

Further details if required may be obtained from the Borough Architect and written applications should reach the undersigned within seven days of the appearance of this advertisement.

E. R. FARR,
Town Clerk.

Town Hall,
Barking. 9497

METROPOLITAN BOROUGH OF CAMBERWELL
APPOINTMENT OF ARCHITECTS IN BOROUGH ARCHITECT'S DEPARTMENT

The Borough Architect, having an interesting programme of housing and public buildings and a senior staff producing good contemporary work requires ASSISTANTS from good Schools of Architecture to back them up.

Newly elected Associates may expect a salary starting at £1,005 per annum and more for those with several years experience: those who lack only the Professional Practice examination would commence at £840 to £855 per annum.

To arrange an interview write to Town Clerk, Town Hall, S.E.5. TC9424

CORPORATION OF LONDON

Applications are invited for the following posts in the Building and Architectural Division of the City Surveyor's Office:—

A. ASSISTANT BUILDING SURVEYOR (Two vacancies).

Candidates must have passed the Final examination of the R.I.C.S., possess a sound knowledge of building construction and the ability to prepare specifications for works of maintenance and supervise contracts.

Salary range £1,055—£1,310.

B. ARCHITECTURAL ASSISTANT

Applicants must be of Intermediate R.I.B.A. standard with the ability to prepare working and detailed drawings.

Salary scale £690—£1,095.

C. JUNIOR ARCHITECTURAL OR SURVEYING ASSISTANT

Applicants should be studying for Intermediate examination of the R.I.B.A. or R.I.C.S. and should possess a sound knowledge of building construction.

Salary scale £630—£990.

Write giving age and full details of previous experience, with the names of two referees, within fourteen days, to The City Surveyor, Guildhall, E.C.2. S9422

BOROUGH OF HESTON AND ISLEWORTH
APPOINTMENT OF SENIOR PLANNING ASSISTANT

Applications are invited for the post of Senior Planning Assistant at a salary in accordance with Grades III-IV of the A.P.T. Division of the National Joint Council's Scale of Salaries (£960—£1,310 plus London "weighting").

Candidates should have passed at least the Intermediate Examination of the Town Planning Institute or other equivalent and must have had experience in a Town Planning Department of a local authority.

The Council is unable to assist the successful candidate with housing accommodation.

Applications are to be submitted by 23rd October, 1961, on forms obtained from and returned to the Borough Engineer and Surveyor, 88, Lampton Road, Hounslow.

Will applicants please quote code AJ.

D. MATHIESON,
Town Clerk.

Town Hall,
Hounslow,
Middlesex. S9556

THE SOUTH WALES ELECTRICITY BOARD
GENERAL ASSISTANT ENGINEER
(ARCHITECTURAL ASSISTANT)

Applications are invited for the position of General Assistant Engineer (Architectural Assistant) in the Chief Engineer's Department at Head Office, St. Mellons.

Salary: N.J.B. Class J, Grade 12, Scale 6, £815—£1,015 per annum.

The successful applicant will receive a commencing salary of at least £890 per annum.

Applicants should preferably be of Intermediate R.I.B.A. standard.

Applications, stating age, present position, present salary, qualifications and experience, should be addressed to the undersigned at St. Mellons, Cardiff, to arrive not later than 21st October, 1961. Please quote reference 119/61/AJ, endorsing envelope "General Assistant Engineer (Architectural Assistant)".

R. G. WILLIAMS,
Secretary.
9543

WEMBLEY BOROUGH COUNCIL invite applications from suitably qualified persons for the established post of SENIOR PLANNING ASSISTANT (Development Control). Salary A.P.T. V, £1,355—£1,525 inclusive. Application forms available from Borough Engineer and Surveyor, Town Hall, Wembley. Quote ref. "A." Closing date 16th October, 1961. 9535

BOROUGH OF LUTON
DEPUTY BOROUGH ARCHITECT

Applications invited from qualified Architects with wide local authority experience. Commencing salary in Scale "D" (£1,710—£1,975) commensurate with qualifications and experience.

Application form and particulars of appointment obtainable from Town Clerk, Town Hall, Luton, to be returned by 20th October, 1961. S9541

BOROUGH OF HESTON AND ISLEWORTH
APPOINTMENT OF
SENIOR ARCHITECTURAL ASSISTANT

Applications are invited for the permanent appointment of a Senior Architectural Assistant in the Borough Engineer and Surveyor's Department. Salary in accordance with A.P.T. Grade V (£1,310—£1,480 plus London "weighting").

Applicants must have had good experience in architectural design and building work under construction, and, other things being equal, preference will be given to applicants who have passed the examination for Associate R.I.B.A. or hold a University Degree or Diploma in architecture accepted by that Institute.

The Council is unable to assist the successful candidate with housing accommodation.

Applications are to be submitted by 23rd October, 1961, on forms to be obtained from and returned to the Borough Engineer and Surveyor, 88, Lampton Road, Hounslow.

Will applicants please quote code AJ.

D. MATHIESON,
Town Clerk.

Town Hall,
Hounslow,
Middlesex. S9557

BOROUGH OF CHELTENHAM

Applications are invited for the following appointments:—

(a) BOROUGH PLANNING OFFICER—Scale "B," £1,565—£1,670.

(b) PLANNING ASSISTANT—A.P.T. III/IV, £960—£1,310.

Applicants for (a) should be both an Associate of the Royal Institute of British Architects and an Associate Member of the Town Planning Institute, and must have had considerable experience in development control. The person appointed will be responsible to the Council for the work of the Planning Department and report direct to the Planning Committee. Both knowledge of problems associated with period architecture and experience of modern design are equally desirable. The Council operate part III functions of the Planning Act through an Executive Planning Committee under an Agreement with Gloucestershire County Council for the delegation of these functions.

Applicants for (b) should be an Associate Member of the Town Planning Institute with experience in development control.

Commencing salaries of both posts will be fixed according to qualifications, ability and experience.

These appointments are subject to the National Joint Council Conditions of Service and a five-day working week.

The Council are prepared to assist in the provision of housing accommodation if required. Half of approved removal expenses re-imbursed.

Applications, stating age, qualifications, and experience, giving names of two referees, to be received by the undersigned not later than 16th October, 1961.

F. D. LITTLEWOOD,
Town Clerk.

P.O. Box No. 12,
Municipal Offices,
Cheltenham. 9551

WEST SUSSEX COUNTY COUNCIL
COUNTY ARCHITECT'S DEPARTMENT

Applications are invited for the following appointment:—

ASSISTANT ARCHITECT at a salary within the range £960—£1,310. Commencing salary will be determined according to the experience of the successful candidate.

Further particulars should be obtained from the County Architect, County Hall, Chichester, to whom all detailed applications must be submitted not later than 23rd October, 1961.

T. C. HAYWARD,
Clerk of the County Council.

County Hall,
Chichester. 9540

BOROUGH OF RUGBY
APPOINTMENT OF ASSISTANT ARCHITECT

Applications are invited for the above appointment in the Borough Engineer and Surveyor's Department, which has an interesting and varied programme of work.

The commencing salary will depend on qualifications and experience and will be within A.P.T. Grade IV (£1,140—£1,310).

Housing accommodation will be provided if required and a car allowance on the essential user scale will be paid.

The appointment is subject to a satisfactory medical examination, the Local Government Superannuation Acts and determination by one month's notice.

Further particulars and form of application may be obtained from the Borough Engineer and Surveyor, Town Hall, Rugby, to whom completed applications must be sent not later than 18th October, 1961.

T. L. DUFFY,
Town Clerk.
9536

METROPOLITAN BOROUGH OF
CAMBERWELL
ARCHITECTS

Vacancies for Architects in the Borough Architect's Department within a salary range of £855 and £1,525 (Grades A.P.T. II to V of the National Scales). Grade and commencing salary according to qualifications and experience. The work of the department includes design and construction of public buildings, housing estates, including multi-storey construction. Application form from Town Clerk, Town Hall, S.E.5. TC7928

BOROUGH OF ENFIELD
BOROUGH ENGINEER AND SURVEYOR'S DEPARTMENT
APPOINTMENT OF CHIEF PLANNING ASSISTANT, A.P.T. V (£1,310—£1,480 p.a.)

Applications are invited for the above post.

The Borough has a population of 110,000 and an area of 12,400 acres, of which 2,750 acres are preserved as Green Belt plus approximately 1,000 acres as parks and public open spaces. The Department has under preparation schemes of Comprehensive Development including the re-planning of The Town Centre and the lay-out of an Industrial Estate.

The successful applicant will be a Section Head and must have considerable ability, leadership and imagination.

All applicants must have passed the Final Examination of the Town Planning Institute, and Membership of another related professional body will be considered an advantage. Experience in the control of staff, Committee work, Planning Inquiries and general administration is essential.

The appropriate London weighting allowance will be paid in addition to the above salary, which will be fixed at a point within the scale commensurate with qualifications and experience. An "Essential Car User's" allowance is payable in connection with the duties of the post.

The Council are prepared to consider the provision of housing accommodation if required, or 100 per cent. advance to the successful applicant for house purchase within the Borough.

Five-day week.

Details of appointment and application form obtainable from H. D. Peake, M.Sc.(Eng.), Borough Engineer and Surveyor, 7 Litle Park Gardens, Enfield, Middx.

CYRIL E. C. R. PLATTEN,
Town Clerk.

Civic Centre,
Enfield, Middx. S9419

COUNTY BOROUGH OF SOUTHAMPTON
BOROUGH ENGINEER AND SURVEYOR'S DEPARTMENT

Applications are invited for the following appointments:

(a) ASSISTANT ARCHITECT, Grade A.P.T. V (£1,310—£1,480), for duties in connection with an extensive and varied programme of housing development including multi-storey flats. Applicants must hold the qualification A.R.I.B.A. with wide experience in the design and administration of major building works.

(b) ASSISTANT ARCHITECT, Grade A.P.T. III/IV (£960—£1,310), for duties in connection with housing estate development. Applicants must have passed Parts I and II of the R.I.B.A. Final examination. Commencing salary according to experience and qualifications.

The appointment is subject to N.J.C. conditions of service.

Housing accommodation available in approved cases and approved removal expenses reimbursable up to a maximum of £50.

Apply on application forms obtainable from the Borough Engineer and Surveyor, Civic Centre, Southampton, to be returned by Monday, 16th October, 1961. S9441

NEWCASTLE REGIONAL HOSPITAL BOARD
SPECIAL AREA COMMITTEE FOR
CUMBERLAND AND NORTH WESTMORLAND
APPOINTMENT OF ASSISTANT ARCHITECT

The Committee has a vacancy for a permanent (superannuable) appointment as subscribed.

The Carlisle Area-office of the Regional Architect's Department deals with the development of the hospital service in Cumberland and North Westmorland (embracing a considerable part of the Lake District National Park) and a modified form of five-day week is in operation.

The appointment is for an Assistant Architect and the salary scale is £905 × £35 (1) × £45 (6) × £50 (2)—£1,310, the commencing salary being at a point taking account of relevant practical experience appropriate to the post, and of the applicant's age.

Applicants must be Associates of the Royal Institute of British Architects, experience of hospital work is not essential.

Applications stating age, qualifications, past and present appointments, present salary and details of experience, together with the names of three referees (of whom at least two must be architects) should be forwarded to the Clerk to the Special Area Committee, 72, Warwick Road, Carlisle, within 14 days of the appearance of this advertisement.

W. J. BALL,
Clerk to the Special Area Committee.

72, Warwick Road,
Carlisle. 9523

ARCHITECTS

The Northern Ireland Housing Trust has vacancies for ASSISTANT ARCHITECTS, Class IIA, on scale £1,258—£1,430. Candidates must be Associates of The Royal Institute of British Architects.

The persons appointed will be required to contribute to a superannuation scheme which allows for the transfer of benefits in local government schemes in suitable cases.

Housing accommodation may be arranged for married candidates.

Please apply, not later than 14th October, 1961, giving details of age, education, qualifications and experience, including present post and salary to the General Manager, Northern Ireland Housing Trust, 12, Hope Street, Belfast 12.

Please mark envelope 33/97. 9549

COUNTY BOROUGH OF SWANSEA
BOROUGH ARCHITECT'S DEPARTMENT
ASSISTANT QUANTITY SURVEYORS

Applications are invited for the following posts:

(a) One—Salary Grade A.P.T. IV (£1,140 to £1,310 p.a.).

(b) One—Salary Grade A.P.T. III (£960 to £1,140 p.a.).

(c) One—Salary Grade A.P.T. II (£815 to £960 p.a.).

Applicants for Post (a) must have passed the Final Stage of R.I.C.S. (Quantities) and had at least five years' experience; Post (b) recently passed the Final examination; and Post (c) the Intermediate Stage.

Candidates must be under 45 years of age, unless already in Superannuated Service of a local or public authority in respect of which superannuation inter-change is available.

The appointments will be subject to the provisions of the Local Government Superannuation Acts and may be terminated by one month's notice on either side. The successful applicants will be required to pass a medical examination.

Forms of application may be obtained from the Borough Architect, the Guildhall, Swansea, to whom they must be returned not later than the 23rd October, 1961.

Canvassing disqualifies.

IORWERTH J. WATKINS,
Town Clerk.

Guildhall,
Swansea,
22nd September, 1961. 9525

COUNTY BOROUGH OF BIRKENHEAD
BOROUGH ARCHITECT'S DEPARTMENT

Applications are invited from suitably qualified persons for the following permanent positions:—

(a) ASSISTANT QUANTITY SURVEYOR, Grade A.P.T. III/IV (£960—£1,310).

(b) ASSISTANT ARCHITECTS, Grade A.P.T. III/IV (£960—£1,310).

(c) JUNIOR ARCHITECTS, A.P.T. I (£645—£815).

Salary according to experience and qualifications. Many major projects including Community Centre/Baths/Municipal Offices are in the Corporation's Building Programme. Canteen, five-day week. Form of application from Borough Architect, 3, Conway Street, Birkenhead, to be returned by 18th October, 1961. Relationship to Members or Senior Officers of the Council must be disclosed. 9529

ROYAL COUNTY OF BERKSHIRE

SENIOR ASSISTANT ARCHITECT, Grade J.N.C. "B," £1,425—£1,670. Candidates must show they are capable of handling large projects at all stages or alternatively produce evidence of exceptional ability in one branch of the profession.

ASSISTANT ARCHITECT, A.P.T. Grade V, £1,310—£1,480. Candidates must be Associates of the R.I.B.A. and have had considerable experience in design and the running of contracts.

The programme of work includes a Teachers' Training College (£750,000), Court Houses and Divisional Police Headquarters, and a great variety of work, very few of which are less than £20,000 projects.

There is a number of staff houses and flats, some of which become available from time to time, and assistance up to 75 per cent. of removal expenses is given.

Application forms obtainable from J. T. Castle, A.R.I.B.A., A.M.T.P.I., County Architect, Wilton House, Parkside Road, Reading, are to be returned by October 10th, 1961. 9503

BOROUGH OF MARGATE
ARCHITECTURAL STAFF

Applications are invited for the appointment of ARCHITECTURAL ASSISTANT in the office of the Borough Engineer at a salary in accordance with A.P.T. II (£815 rising by annual increments to a maximum of £960 per annum).

Candidates should have had experience in general architectural work.

Applications, giving details of experience and the names of two referees, and endorsed "Architectural Staff," are to be received by the Borough Engineer and Surveyor, 38, Grosvenor Place, Margate, by Saturday, 14th October, 1961.

The Council will assist in the provision of housing accommodation if required and candidates should disclose whether they are related to any member or Chief Officer of the Council.

T. F. SIDNELL,
Town Clerk.

Town Clerk's Office,
40, Grosvenor Place,
Margate.
25th September, 1961. 9502

MEXBOROUGH URBAN DISTRICT COUNCIL

Applications are invited for the following permanent appointment:

ARCHITECTURAL ASSISTANT, Salary Grade A.P.T. II (£815—£960).

The post is superannuable and subject to the provisions of the National Scheme of Conditions of Service.

Applications, giving age, details of training, qualifications and experience, together with the names and addresses of two referees, to be sent to the undersigned not later than 17th October, 1961.

S. H. E. CRANE,
Clerk of the Council.

Council Offices,
Adwick Road,
Mexborough,
Yorks.
22nd September, 1961. 9511

COUNTY BOROUGH OF DEWSBURY
DEPARTMENT OF BOROUGH ARCHITECT AND BUILDINGS SURVEYOR

Applications are invited for the following appointments within the scope of the grades stated:—

(a) TOWN PLANNING ASSISTANT—A.P.T. Grade IV (£1,140—£1,310).
(b) ASSISTANT QUANTITY SURVEYOR—A.P.T. Grade IV (£1,140—£1,310).
(c) ARCHITECTURAL ASSISTANT — A.P.T. Grade I (£645—£815).
(d) JUNIOR ARCHITECTURAL ASSISTANT/DRAUGHTSMAN—General Division (£260—£630).

The provision of housing accommodation will be considered if required for appointments (a), (b) and (c).

Applications for forms and particulars of appointments to A. G. Beckett, A.R.I.B.A., A.M.T.P.I., Borough Architect and Buildings Surveyor, Town Hall, Dewsbury. Closing date 17th October, 1961.

A. NORMAN JAMES,
Town Clerk.

Town Hall,
Dewsbury.
25th September, 1961. 9500

WARWICKSHIRE COUNTY COUNCIL
ARCHITECT'S DEPARTMENT

ASSISTANT ARCHITECTS, Grade A.P.T. IV (£1,140—£1,310).

Applications are invited from qualified Architects. The persons appointed will work in groups on large projects and an opportunity will be given to men with enthusiasm and ability to design and carry out projects under a group architect.

ARCHITECTURAL ASSISTANTS, Grade A.P.T. II (£815—£960).

Vacancies exist for Assistants who are up to Intermediate R.I.B.A. standard and who require experience in a variety of interesting projects.

The commencing salary can be within the grade according to ability. Five-day week worked. The Council have schemes for the payment of removal expenses and a lodging allowance to married officers. Application forms and full conditions applicable to the appointments can be obtained from Eric Davies, F.R.I.B.A., A.M.T.P.I., County Architect, Shire Hall, Warwick.

L. EDGAR STEPHENS,
Clerk of the Council.

26th September, 1961. S9571

INVERNESS COUNTY COUNCIL invite applications for appointments in the County Architect's Department in connection with an extensive programme of new school building and other major works as follows:—

(a) ONE SENIOR ASSISTANT ARCHITECT—Section Leader—Salary Scale £1,140—£1,365 per annum.
(b) ONE FIRST ASSISTANT ARCHITECT—Salary Scale £1,135—£1,200 per annum.
(c) TWO SECOND ASSISTANT ARCHITECTS—Salary Scale £850—£1,150 per annum.
(d) ONE THIRD ASSISTANT ARCHITECT—Salary Scale £640—£845 per annum.

Applicants for (a), (b) and (c) must be fully qualified. Applicants for (d) should be qualified or about to qualify to Intermediate standard. Appropriate placing on salary scales will be given in accordance with qualifications and experience. Housing accommodation may be made available if required. Applications, together with the names and addresses of referees, to the County Clerk, County Buildings, Ardross Street, Inverness. 9510

BOROUGH OF LUTON
BOROUGH ARCHITECT'S DEPARTMENT

Applications are invited for the following appointments:—

(a) PRINCIPAL ASSISTANT ARCHITECTS—Scale A (£1,380—£1,565).
(b) SENIOR ASSISTANT ARCHITECTS—A.P.T. V (£1,310—£1,480).
(c) ASSISTANT ARCHITECT—A.P.T. IV (£1,140—£1,310).
(d) ARCHITECTURAL ASSISTANT—A.P.T. III (£960—£1,140).
(e) ARCHITECTURAL ASSISTANT—A.P.T. I (£645—£815).

Applicants for posts (a), (b) and (c) must be Associate Members of the Royal Institute of British Architects.

Under (d) the Council will consider applications from candidates who have completed professional training but have not passed their Final examinations.

The salaries at which all appointments will be made will depend on qualifications and experience.

Consideration will be given to the provision of housing accommodation for married applicants and payment of reasonable removal expenses for all appointments.

Luton is a rapidly developing borough with a large and varied programme of capital works in hand or projected which offers exceptional opportunities of gaining experience.

Forms of application may be obtained from the Borough Architect, Town Hall, Luton, by whom applications should be received not later than 23rd October, 1961.

Borough Architect's Department,
Town Hall,
Luton.
September, 1961. S9568

BOROUGH OF HENDON
BOROUGH ENGINEER AND SURVEYOR'S DEPARTMENT

Applications are invited for the following appointments:

SENIOR ASSISTANT ARCHITECT—Grade A.P.T. V (£1,310—£1,480 plus London weighting). Applicants must be Associate Members of the Royal Institute of British Architects. The person appointed will be directly responsible to the Chief Assistant Architect with opportunity for suitable applicants to act as Group Leaders.

SENIOR ASSISTANT ARCHITECT—Grade A.P.T. IV (£1,140—£1,310 plus London weighting). Applicants must be Associate Members of the Royal Institute of British Architects.

ASSISTANT ARCHITECT—Grade A.P.T. III (£960—£1,140 plus London weighting). Applicants must have an Intermediate or equivalent qualification.

Previous experience in school-work, housing and redevelopment or civic buildings will be an advantage.

Pensionable post. National Scheme. Medical examination. Appointment terminable by one month's notice on either side.

Applications, stating age, education, qualifications, experience, present appointment and salary, together with the names and addresses of two referees, must reach the Borough Engineer and Surveyor, Town Hall, Hendon, N.W.4, by Monday, the 16th October, 1961.

Canvassing will disqualify.

R. H. WILLIAMS,
Town Clerk.

Town Hall,
Hendon,
N.W.4. 9506

COUNTY COUNCIL OF THE WEST RIDING OF YORKSHIRE
OFFICE OF THE COUNTY ARCHITECT

Applications are invited for the appointment of SENIOR ASSISTANT ARCHITECT—J.N.C. Scale "A"—salary range £1,315—£1,565. The commencing salary will be fixed at a point within the scale commensurate with qualifications and experience. Five-day week operated.

Applicants, who must be qualified Architects, should possess a sound knowledge of contemporary design and construction, and be able to handle major building contracts in their entirety.

Applications to be submitted by the first post on Tuesday, 17th October, 1961, on forms to be obtained from and returned to the undersigned.

A. W. GLOVER, F.R.I.B.A.,
County Architect.

Bishopgarth,
Westfield Road,
Wakefield. 9509

LANCASHIRE COUNTY COUNCIL
PLANNING DEPARTMENT HEADQUARTERS AT PRESTON

CENTRAL AREA REDEVELOPMENT—Experienced TECHNICAL OFFICERS with appropriate qualifications capable of original and imaginative work are invited to join a team for Central Area Redevelopment in Lancashire towns.

Vacancies exist on J.N.C. Grade "A" (£1,400—£1,565), A.P.T. Grade V (£1,310—£1,480) and A.P.T. Grade IV (£1,140—£1,310).

Car allowances will be provided and disturbance allowances to a maximum of £125 towards removal expenses, adjustments to furnishings, travelling expenses and legal expenses on house acquisition are available.

Applications, stating grade applied for and giving details of age, experience, qualifications, present appointment and the names and addresses of two referees, should be addressed to the County Planning Officer (I), East Cliff County Offices, Preston, by the 9th October, 1961. 9517

APPOINTMENT OF ARCHITECTS
LEEDS REGIONAL HOSPITAL BOARD
SALARIES UP TO £1,310

per annum will be paid to suitably qualified applicants.

Applications, stating age, qualifications, previous experience, together with names of two referees, to the Secretary, Park Parade, Harrogate. 9572

METROPOLITAN BOROUGH OF FULHAM
QUANTITY SURVEYORS

(a) A.P.T. I *(£645—£815). Studying for or having R.I.C.S. Examination or equivalent.
(b) A.P.T. II *(£815—£960). Studying for or having R.I.C.S. Examination or equivalent.
(c) A.P.T. III *(£960—£1,140). Final R.I.C.S.
(d) A.P.T. IV *(£1,140—£1,310). Final R.I.C.S. or A.I.A.S. (Quantities) and reasonable post-examination experience.

* Plus London weighting of £15, £25, £40 or £45 according to age.

Application forms from Town Clerk, Town Hall, Fulham, S.W.6, to be returned by 16th October. 9560

SURVEYING ASSISTANT — DRAUGHTSMAN

Applicants should be good and quick Architectural and Surveying Draughtsmen, capable of surveying land and industrial buildings. Good knowledge of construction essential. Salary £796—£840.

Applications, stating present position and previous experience, should be forwarded to the Divisional Manager, British Road Services, Andrews Arcade, Queen Street, Cardiff, to be received not later than Saturday, 14th October, 1961. 9498

HAMPSTEAD BOROUGH COUNCIL

ARCHITECTURAL ASSISTANTS required in the Housing Architect's Department for new development including multi-storey blocks of flats. Salary will start at a point within A.P.T. Grades I-IV (£645—£1,310 per annum plus London weighting) according to qualifications and experience. Local Authority experience not essential. Group system of working. Advances for house purchase up to 100 per cent. of valuation will be considered in suitable cases. Applications with names of two referees to Town Clerk, Town Hall, Haverstock Hill, N.W.3. TC7886

MINISTRY OF HOUSING AND LOCAL GOVERNMENT — vacancies for unestablished BASIC GRADE ARCHITECTS in the Development Group. Duties include research into design and costs of housing and other types of local government building, preparation of advisory bulletins, and carrying out selected development projects in the housing field. London starting salary from £991 to £1,318 according to age. Scale maximum: £1,490. Forms from Ministry of Labour, Technical and Scientific Register (K), 28, King Street, London, S.W.1, quoting J.350/1A. 9534

COUNTY BOROUGH OF EAST HAM
HOUSING DEPARTMENT
SENIOR ARCHITECTURAL ASSISTANT
A.P.T. IV (£1,185—£1,355 p.a.)

Salary in excess of the minimum may be paid according to qualifications and experience.

A subsistence allowance may be granted over a reasonable period to the person appointed if unable to obtain suitable housing accommodation necessitating the maintenance of two homes.

Further details and application form, returnable by 20th October, 1961, from the Town Clerk, Town Hall, E.6. 9504

Competition

36s. per inch; each additional line 3s.

THE UNIVERSITY OF LIVERPOOL

OPEN COMPETITION

Architects are invited to submit designs for halls of residence for 1,100 to 1,200 students on the Carnatic site at Mossley Hill, Liverpool. The cost of the works will be approximately £1,500,000.

Assessors:	Sir James Mountford, M.A., D.Litt., D.C.L., LL.D. (Vice-Chancellor).
	Donald Gibson, C.B.E., M.A., D.C.L., F.R.I.B.A., M.T.P.I.
	Professor Myles Wright, M.A., F.R.I.B.A., M.T.P.I.
Premiums:	£5,000; £3,000; £1,000. Further premiums, to a total not exceeding £2,000, may be awarded at the discretion of the Assessors for other designs of merit.
Sending in Day:	4 September, 1962.
Last Day for Questions:	1 January, 1962.

Conditions may be obtained, upon payment of a deposit of £3, from The Registrar, The University of Liverpool, Liverpool, 3. Quoting Reference RVCH/518/AJ. 9547

Architectural Appointments Vacant

3s. per line; minimum 12s. Box Number, including forwarding replies, 2s. extra

CITY Architects urgently require SENIOR ASSISTANTS. Long term projects of contemporary design. Assistants would be in charge of projects to completion. Five-day week. Salary up to £1,750 per annum plus Luncheon Vouchers. Box S9466.

RALPH TUBBS has vacancies for ARCHITECTS for a variety of interesting jobs. Good opportunities for keen and competent persons. Pleasant office in Harley Street area. Phone WELbeck 0694 or write 46 Queen Anne Street, London, W.1. S9562

LANCHESTER & LODGE urgently require ARCHITECTURAL ASSISTANTS of all grades. Work includes hospitals, laboratories, universities, offices, housing, etc. Write full particulars or ring for interview: 10, Woburn Square, W.C.1. MUS 0845-6-7. TC7248

A FEW vacancies still left for experienced and confident ARCHITECTS to fill positions of responsibility in a growing and varied practice with industrial and commercial work throughout the southern half of the country. Applicants must have initiative as well as architectural ability to carry through contracts up to £100,000, working directly with Principals but with minimum supervision. Apply in writing to Thomas Mitchell & Partners, 20 Bedford Square, London, W.C.1. TC7443

£1,000 / £2,000 p.a. will be paid to experienced competent ARCHITECTS by a private practice in the City of London. The work will be primarily on the drawing board on new and interesting projects of magnitude. A high standard of design and detailing ability is required. Please apply in writing to Box TC9360.

BRYAN & NORMAN WESTWOOD require ASSISTANT ARCHITECTS. Salaries up to £1,200. Apply to 21 Suffolk Street, S.W.1, Trafalgar 1106. TC8600

£850-£1,600. ARCHITECTURAL ASSISTANTS required. Long term prospects. Non-contributory pension and life assurance schemes. Five-day week. Telephone or write: Ronald Ward & Partners, 29, Chesham Place, Belgrave Square, S.W.1. Belgravia 3361 TC6105

ARCHITECTS' ASSISTANT required, up to Intermediate standard, to work on large and interesting projects. Salary within range £600—£800. Applicants must be good draughtsmen, with sound knowledge of detailing. Please write giving full particulars of experience, age, etc., to: F. W. Beech & E. Curnow Cooke, F./L.R.I.B.A., 15, Dix's Field, Exeter. TC8706

ARCHITECTURAL ASSISTANTS of all grades, particularly Intermediate standard, required on varied and interesting projects. High salaries will be paid in accordance with skill or experience of applicant. Lewis Solomon, Kaye & Partners. City 8811. TC5970

HOWARD V. LOBB & PARTNERS require ASSISTANT ARCHITECTS. Salaries would be between £750 and £1,250 per annum. Please write to 20, Gower Street, W.C.1. TC7789

SOUTHAMPTON. ASSISTANT of at least Intermediate standard required to help with projects in Hampshire and the Isle of Wight. Apply to E. M. Galloway & Partners, F./A.R.I.B.A., 10 Portland Street, Southampton. TC9098

£950-£1,500. ARCHITECTURAL ASSISTANTS with imagination and designing ability required to assist with large and important new developments in the central London Area. Telephone or write: Trehearne & Norman, Preston & Partners, 83, Kingsway, W.C.2. HOLborn 4071. TC8915

ARCHITECTURAL ASSISTANTS required in Busy Bloomsbury office with varied practice. Good salary and prospects for suitable applicants. Five-day week. Write giving particulars of age, qualifications, experience, etc., to Box 918, c/o 7, Coptic Street, W.C.1. TC5647

SENIOR ARCHITECTURAL ASSISTANTS. Large Office has a limited number of vacancies for Senior Architectural Assistants, salary range £900—£1,500, to undertake work of a varied and interesting character.
Reply with particulars of experience to Box TC6875.

ROBERT MATTHEW & JOHNSON-MARSHALL have vacancies in their London office for ARCHITECTS at all levels of experience for a variety of interesting jobs. Apply to Robert Matthew & Johnson-Marshall, 24, Park Square East, N.W.1. TC6547

SENIOR ASSISTANTS required immediately. Salary by arrangement. Theo. H. Birks, 38, Portland Place, London, W.1, LAN. 7236. TC1486

ERIC FIRMIN & PARTNERS require ASSISTANT of Intermediate or Final standard preferably with previous office experience for interesting variety of projects. Five-day week, Luncheon Vouchers, holiday arrangements respected. Salary by arrangement according to qualifications and experience. Write to Thavies Inn House, Holborn Circus, E.C.1, or 'phone CITy 8811. TC8904

ASSISTANT ARCHITECT required, qualified and experienced, for interesting work. Salary according to experience and ability. Apply in writing with full particulars to Henry C. Smart & Partners, 120 Moorgate, London, E.C.2. S9069

SENIOR and INTERMEDIATE ASSISTANTS required immediately in an expanding practice to work on large contracts:—
Schools; Housing; Office Blocks; Central, Commercial and Industrial developments.
Good salaries commensurate with ability and experience paid to keen men capable of taking responsibility.
Write to W. S. Hattrell & Partners, 1, Queens Road, Coventry. S9343

ROMFORD, ESSEX. SENIOR ASSISTANT, Qualified or Finals standard, experience in commercial buildings, housing and high flats desirable, three weeks annual leave, luncheon vouchers, non-contributory pension scheme with immediate life cover, motor expenses, removal and interview expenses if appropriate, salary by arrangement, write L. D. Tomlinson & Partners, F/A/A.R.I.B.A., Quadrant Arcade, Romford 42533. S9329

WELCH AND LANDER require ASSISTANTS: must be keen, efficient, dedicated and almost brilliant. In return we can offer you £800—£1,000 and the prospect of working till you are cross-eyed, and have gained plenty of all-round experience the hard way. No doubt this is what you need. WEL 6551. S9327

SENIOR and INTERMEDIATE ASSISTANTS required immediately in an expanding practice, to work on large and varied contracts.
Good salaries commensurate with ability and experience paid to keen men capable of taking responsibility.
Write or telephone: W. S. Hattrell & Partners, 31, Cleveland Place, King Street, S.W.1. Whitehall 4076. S9344

CITY Architects urgently require JUNIOR ASSISTANTS experienced in detailing and capable of assisting in design. Long term projects. Five-day week. Salary up to £1,250 per annum plus Luncheon Vouchers. Box 9467.

JUNIOR ASSISTANT required for small congenial office in Grays Inn. Approaching Intermediate standard, £400—£500 per annum and luncheon vouchers. Telephone HOLborn 9687. TC9358

ASSISTANT ARCHITECT required with sound general experience, for progressive varied and growing practice. Full particulars of experience, age, etc., in confidence to G. Barry Davies & Associates, Denbigh. 9450

SENIOR and JUNIOR ASSISTANT ARCHITECTS required with progressive outlook, for work on a wide range of projects. Starting salaries up to £900 for Intermediate standard and up to £1,250 for Final standard, according to experience. Five-day week. Box TC9219.

SIR WILLIAM HALCROW & PARTNERS require ARCHITECTS and ASSISTANTS to join Design Group in London developing a large overseas industrial project. Please write with particulars of qualifications and experience to: Sir William Halcrow & Partners, 47 Park Lane, London, W.1. S9371

JUNIOR, INTERMEDIATE and SENIOR ARCHITECTURAL POSTS offered with good salaries and working conditions. Salary by arrangement and according to ability. Interesting projects at home and overseas. Apply in writing with full details to Covell, Matthews and Partners, 34 Sackville Street, Piccadilly, W.1. S9369

MICHAEL LYELL ASSOCIATES immediately require experienced Junior and Senior ARCHITECTURAL ASSISTANTS to work on major commercial and residential developments; initiative and responsibility encouraged; salary according to ability. Please write with full details to 16 Yeomans Row, London, S.W.3. S9387

ERNO GOLDFINGER requires several qualified ASSISTANTS and DRAUGHTSMEN with at least two years' experience to take part in a growing programme of interesting work which includes large office buildings, central developments, schools and private houses. Good salaries and scope for men with sound knowledge of construction. Phone HYDe Park 5657. TC9448

GEORGE, TREW & DUNN

We need help with many projects and invite your application to work with us. Please write, giving the usual details to 50, Eastbourne Terrace, W.2. TC9477

ELIE MAYORCAS requires ARCHITECTURAL ASSISTANTS with a minimum of three years' office experience in this country. Write, giving brief particulars of architectural education and experience, to: 13, David Mews, Baker Street, W.1. TC9442

EXPANDING Brewery Architects Department requires a recently qualified GRADUATE of initiative, ability, and progressive ideas to take charge of projects through all stages in an interesting programme of new work and alterations to Hotels and Public Houses. Generous salary according to ability and experience. Pension scheme. Three weeks holiday. Write with full details to:—
The Leigh Area Architect,
Peter Walker (Warrington) Limited,
Leigh Brewery,
LEIGH, Lancashire. S9437

BIRMINGHAM—We need a young ARCHITECT, either qualified or in training, with a good sense for clean and straightforward design. There is plenty of scope for the right man. Salary according to ability and experience. Apply: J. Alfred Harper & Son, 63, Temple Row, Birmingham. S9436

ARCHITECTS' CO-PARTNERSHIP require ASSISTANTS, both qualified and Intermediate, with some experience for interesting and varied work. Write 44, Charlotte Street, W.1, or telephone LANgham 5791. S9426

INTERMEDIATE TO FINAL ASSISTANTS required immediately. Salary from £1,000 onwards and luncheon vouchers. Theo. H. Birks, 38, Portland Place, London, W.1. LAN 7236. TC8906

C. H. ELSOM & PARTNERS have vacancies in their Victoria office for ARCHITECTS at all levels of experience for work on town centre redevelopment, schools, housing, commercial buildings and hotels. Superannuation scheme and luncheon vouchers. Applications in writing only please, giving brief details to 10, Lower Grosvenor Place, London, S.W.1. S9231

KINGSTON-UPON-THAMES. SENIOR ASSISTANT required (male or female) for interesting and varied work. Salary up to £1,150 per annum for suitable applicant. Pleasant and congenial office conditions. Five-day week. Applications in writing only giving full particulars. Donaldson & Co., Architects, 75 London Road, Kingston-upon-Thames. TC9281

SEVERAL ARCHITECTURAL ASSISTANTS required up to Intermediate and Final standard in progressive Hampstead office. Five-day week. Experience on flat design necessary. Please apply B. Newton, A.R.I.B.A., M.R.S.H., of 307 Finchley Road, N.W.3. Tel.: SWI 5152. S9238

FREDERICK GIBBERD. ARCHITECTURAL ASSISTANTS. Final and Intermediate. Interesting work, excellent experience for anyone wishing to succeed in architecture. Salary according to ability. Five-day week. Pleasant and well organised office. Write giving full details: 8 Percy Street, W.1. S9242

SENIOR ARCHITECTURAL ASSISTANTS with good design ability and site experience required for interesting jobs. Excellent prospects for those capable of carrying responsibility. Profit sharing and Pension Schemes available. Good salary range comparable with age and experience. Apply in writing to Beard, Bennett, Wilkins & Partners, 101, Baker Street, London, W.1. S9270

EXPERIENCED ASSISTANT ARCHITECT required in West End office. Varied work, must be a competent designer and administrator. Opportunity for advancement to position of responsibility. Starting salary up to £1,250 according to experience. Luncheon vouchers. Five-day week. Box TC9218.

THE following vacancies occur in Bristol for:—
(1) SENIOR ASSISTANT ARCHITECT
£1,200—£1,400.
Applicants must be qualified and have had post-graduate experience, or have had ten years' experience.
(2) ARCHITECTURAL ASSISTANTS
£750—£1,200.
Applicants should have had several years' experience in an Architect's office and be capable of producing working drawings and details with the minimum of supervision.
Salaries progressive on merit; permanent pensionable positions. Applications stating full details of qualifications, experience, age, etc., should be forwarded to the Senior Architect. Box S9287.

JUNIOR ASSISTANT required; also a SENIOR ASSISTANT with view to associate partnership required immediately in small private practice. Capable of working on own initiative. Five-day week. Please reply, stating age, training, experience and salary required. Graham & Bellamy, Chartered Architects, 15, The Tything, Worcester. S9457

ARCHITECTURAL ASSISTANT required for small private practice, Worcester. Five-day week. Please write, stating age, training, experience, and salary required. Box S9458.

ASSISTANT ARCHITECTS OF INTERMEDIATE STANDARD REQUIRED BY E. R. COLLISTER AND ASSOCIATES, 41, BUCKINGHAM PALACE ROAD, LONDON, S.W.1. SALARY WILL BE BY ARRANGEMENT. S9461

GOLLINS, MELVIN, WARD & PARTNERS require an ARCHITECTURAL ASSISTANT for their Sheffield Office to work on interesting projects. Five-day week. Write: 281, Glossop Road, Sheffield, 10, or telephone Sheffield 29922, for an appointment. S9462

ASSISTANTS, Intermediate or Qualified. Wimbledon Office overlooking the Common, five-day week, no town travelling, varied work in U.K. and Overseas. Apply J. E. K. Harrison, F.R.I.B.A., Eagle House, Wimbledon, S.W.19, or 'phone WIM. 4244. S9463

ARCHITECT'S OFFICE IN CENTRAL LONDON HAS VACANCIES FOR STAFF TO WORK ON A VARIETY OF INTERESTING BUILDING PROJECTS. SALARY BETWEEN £850 AND £1,500. ACCORDING TO QUALIFICATIONS AND EXPERIENCE. PLEASE WRITE BOX S9468.

BRIGHTON

Progressive firm of architects require **SENIOR** and **JUNIOR ASSISTANTS**. Salary up to £1,300 paid according to ability and experience. Five-day week, luncheon vouchers. Apply to Gotch & Partners, Chartered Architects, 26, Regency Square, Brighton, or phone Brighton 29381. 9483

EXPERIENCED ASSISTANT required of either Intermediate or Final standard for progressive office to run large and interesting contracts. Victor Bloom & Partners, 12, Gloucester Place, W.1. HUNter 2069. S9485

BIRMINGHAM.—Frustrated and unappreciated **ARCHITECTS** seeking a change and having the initiative to take responsibility, are invited to contact **James A. Roberts**, A.R.I.B.A., Lichfield House, Smallbrook, Ringway, Birmingham 5. Qualifications and salary are secondary to keenness, hard work and ability. Informal atmosphere in new modern offices. Three weeks holiday. Five-day week. 9489

QUALIFIED ASSISTANT required for Jersey, C.I., office. Write stating salary, experience, etc., to Box S9451.

CLIFFORD CULPIN AND PARTNERS need additional staff in their London and Hemel Hempstead offices. Men of about Intermediate standard particularly required to join small teams of keen men on important, varied projects. All must have a sound sense of modern design. 39, Doughty Street, London, W.C.1. CHAncery 5395. TC9379

FARMER AND DARK
have some vacancies for
QUALIFIED ARCHITECTS, age 25/35,
preferably with office experience
for varied and interesting home
and overseas work. Five-day week.
Apply to Romney House, Tufton Street, S.W.1.
Tel.: ABBey 6311. S9456

SMALL PROGRESSIVE AND CONTEMPORARY LONDON OFFICE REQUIRES ASSISTANTS. GOOD OPPORTUNITY FOR PEOPLE WISHING TO GAIN EXPERIENCE IN ALL ASPECTS OF A VARIED PRACTICE. BOX S9447.

ARCHITECTURAL ASSISTANT required of Intermediate standard, capable of working on own initiative. Ample opportunity to control projects from design to completion. Write or 'phone: Nicholson and Rushton, 2, New Square, Lincoln's Inn, W.C.2. HOLborn 2095. TC9446

SENIOR ARCHITECTURAL ASSISTANT. Vacancy occurs in leading Bristol Office engaged in highly interesting projects. Applicant must possess initiative and be thoroughly conversant with supervision in addition to being first-class in design and details. The position offered covers the use of a car and inclusion in a Non-Contributory Pensions Scheme. Apply with full details of experience etc., and indication of salary required to: Alec F. French Esq., F.R.I.B.A., Pearl Assurance House, Queen Square, Bristol, 1. S9522

A NEW POST

AN ARCHITECT is required to develop a new department in the office of Yorke, Rosenberg & Mardall, to select, classify and advise on technical data and design information and to run the photograph and reference library.

Reply to Yorke, Rosenberg & Mardall, 2, Hyde Park Place, London, W.2. 9537

BIRMINGHAM **£1,600.** LEONARD J. MULTON & PARTNERS require QUALIFIED ARCHITECTS AND ASSISTANTS. Five-day week. Private Pension Scheme. Salary up to £1,600 per annum, according to qualifications and experience. Work includes Multi-storey Flats and Housing, Hospital Work, Factories and Centre City Development. If you require a progressive position, please write to 6, Greenfield Crescent, Edgbaston, or telephone Edgbaston 4188. S9538

SCHERRER AND HICKS
REQUIRE in their London Office
Junior Assistants with two or three years' experience.
Salary £500/£700 per annum.
Intermediate Assistants with several years experience.
Salary £1,000 per annum.
Reply to 19, Cavendish Square, London, W.1. S9526

ARCHITECTURAL ASSISTANT required for permanent position in Architect's Department of progressive East Coast Brewery Company. Sound training and experience together with an interest in interior design essential. The Company operates a Pension Scheme with substantial benefits. Five-day week. Write giving age, salary required and full details of training and experience to Box S9528.

INTERMEDIATE or SENIOR ASSISTANTS required for office with varied practice. Write W. F. Howard, F.R.I.B.A., 35 Thurloe Street, South Kensington, S.W.7. S9530

EXPERIENCED ASSISTANT, not necessarily qualified, required for small progressive office in Hammersmith. Salary by arrangement. Ring RIV 8201 or write Norman Starrett, 269, King Street, W.6. S9521

AN ARCHITECT is required to take charge of the Architects' Department of a major Building Company based upon Liverpool. The successful applicant will take charge of an office responsible for the design and development of Offices, Flats, Housing, Shops and Industrial Building. Apply, giving full particulars to Box G 303, Lee & Nightingale, Liverpool, 2. S9545

HANDISYDE & TAYLOR require a good, qualified, JUNIOR ASSISTANT for varied work. Salary and bonus system according to experience. Apply in writing with particulars and salary required. 68, Great Russell Street, W.C.1. 9552

PRACTICE FOR SALE in South Midlands market town but with commissioned work on a national basis. A long schedule of modern varied work ahead. Personal income approximately £3,000 per annum over last five years. Box 9533.

NORWICH Office urgently needs qualified or unqualified ASSISTANT to work on school and housing projects. Salary according to experience. Enthusiastic types preferred with administrative and design ability. Fletcher Watson & Partner, Pulls Ferry, 25, The Close, Norwich. 9539

ERIC LYONS has place for experienced ASSISTANT ARCHITECT who wants responsibility and opportunities. Brief particulars to: Mill House, Bridge Road, Hampton Court, Surrey. TC9542

DEVELOPMENT GROUP
ARCHITECTS of various grades are required in private office to join group engaged in interesting development programme of non-traditional systems. Interest and enthusiasm in this field of work is the essential qualification. Successful applicants will be required to work in the Midlands. Good salaries, superannuation, pleasant conditions, possible housing assistance. Box 9508.

ASSISTANT ARCHITECTS who like to preserve their own identity in their work are required urgently for rapidly expanding London practice. Salary £1,000 to £1,200. Write with full details to Guy Biscoe, 5 and 6, Staple Inn, Holborn, W.C.2. 9495

ARCHITECTURAL JOURNALIST or Architect with literary flair required to collaborate part-time with Private Architect in production of technical articles, brochures, etc. Keen interest in contemporary design and pre-fabrication essential. Periodic attendance in Midlands and London required. Payment by arrangement. Box 9507

WALTON-ON-THAMES. ARCHITECT required for private practice, £1,200—£1,500. INTERMEDIATE ASSISTANT, £900—£1,200. Also PRE-INTERMEDIATE ASSISTANT, for work on flats, housing and industrial schemes. Patrick Lister & Associates, 79, High Street, Walton-on-Thames. Phone 23380. 9496

RESPONSIBLE older type of ASSISTANT required, experienced in large buildings. Excellent salary and conditions. Kensington area. Box S9499.

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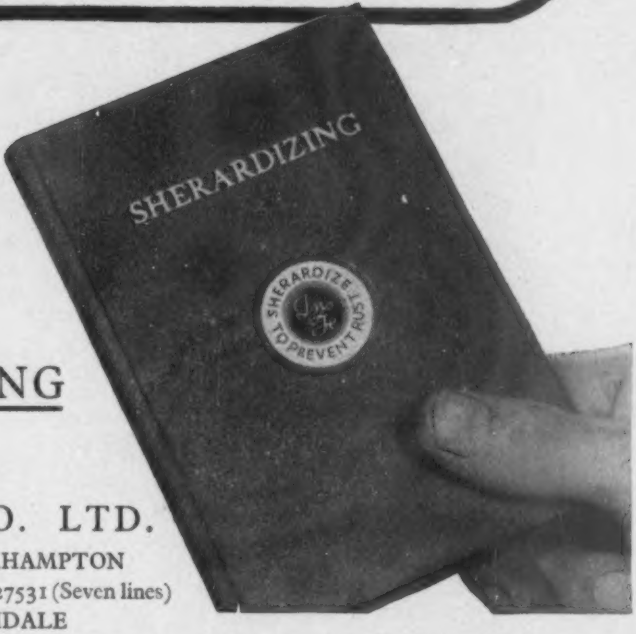

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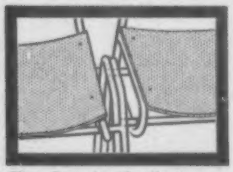

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