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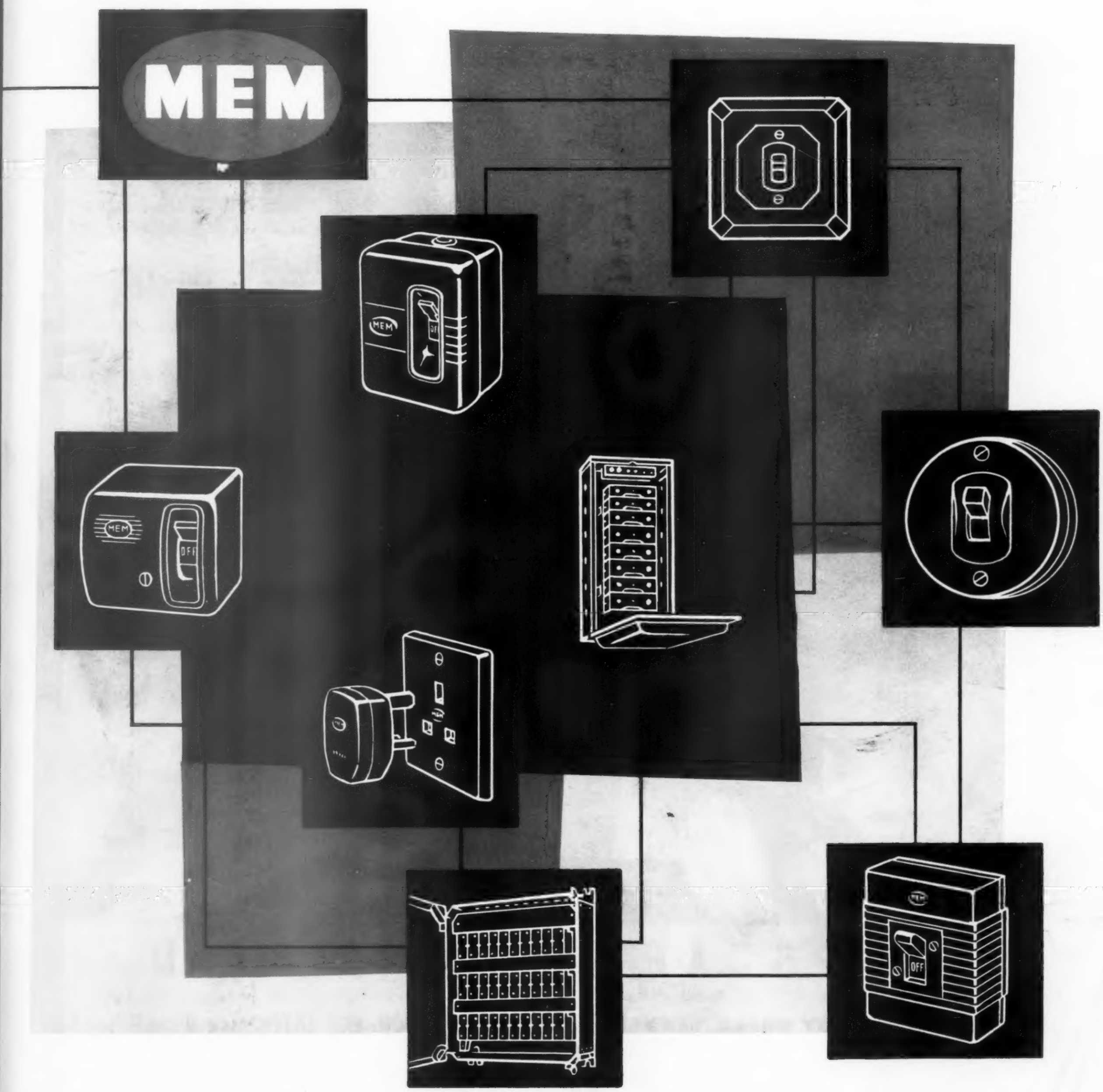
THE ARCHITECTS' JOURNAL

ELECTRICAL INSTALLATIONS



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INSULATING BOARD FOR CEILINGS AND WALLS

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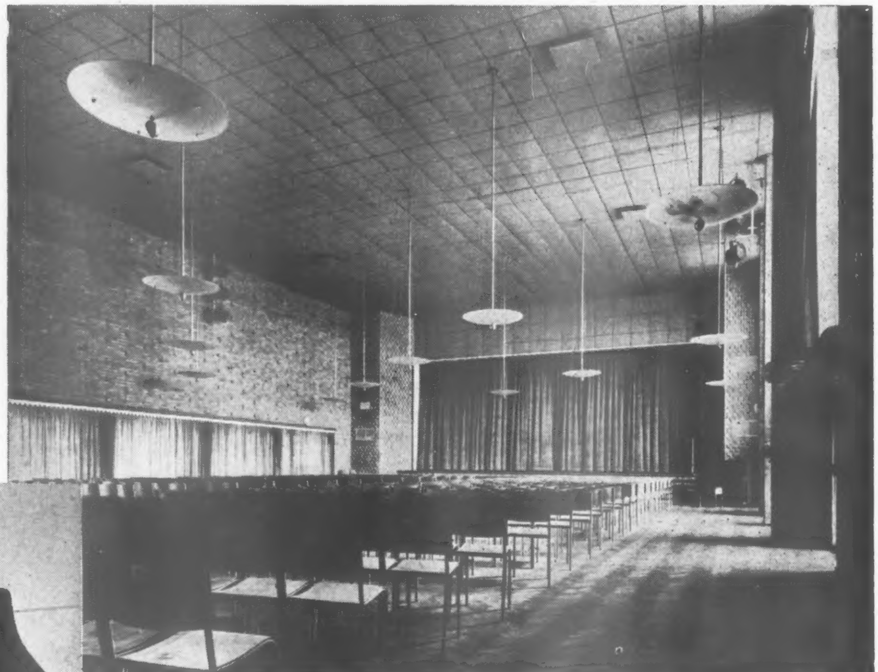

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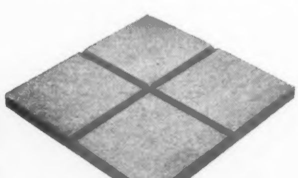
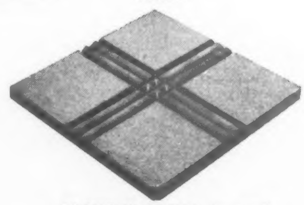
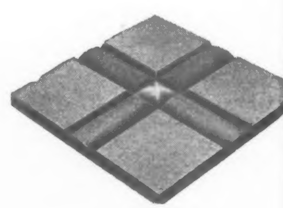


VL500

VL502A



VL502B (As VL502A, but with three instead of two beads)



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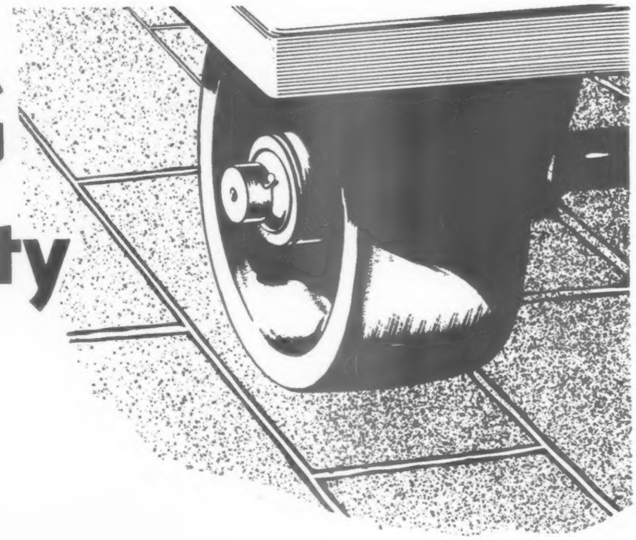

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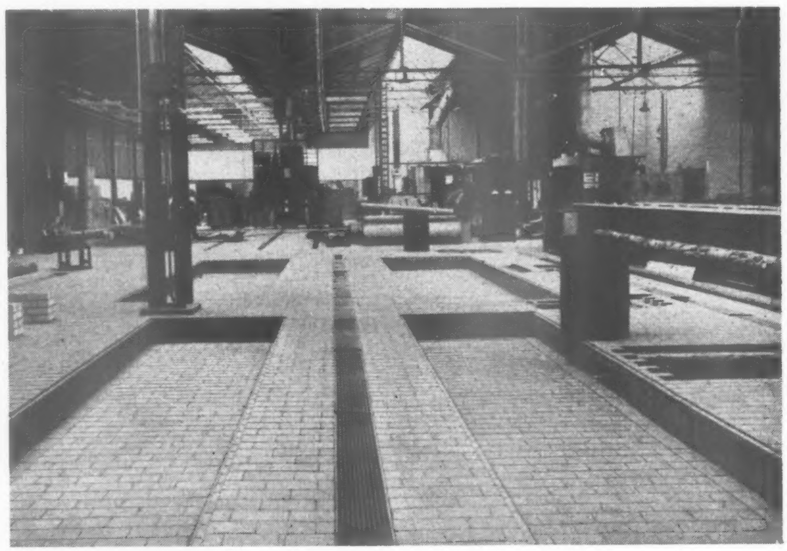

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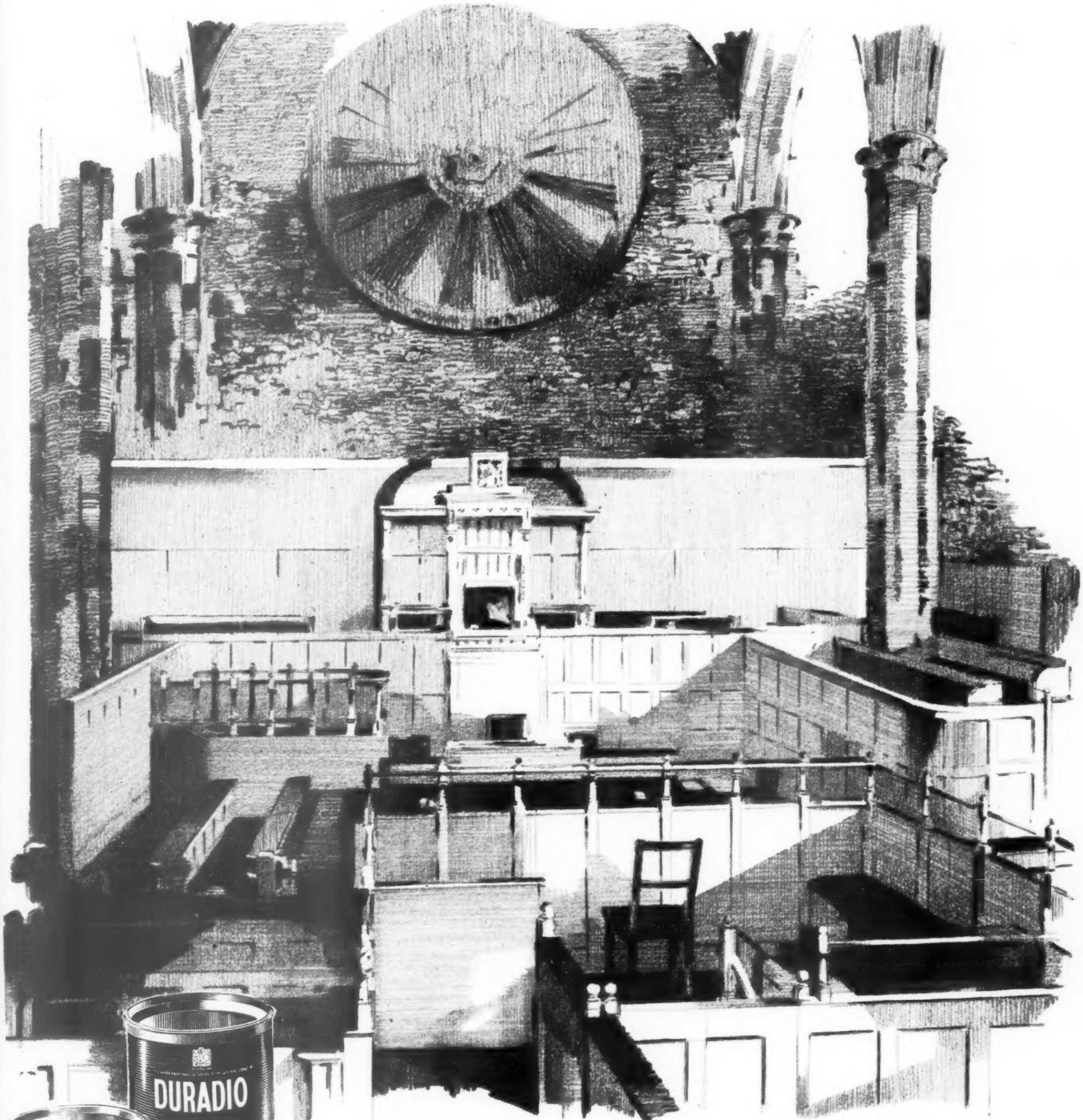


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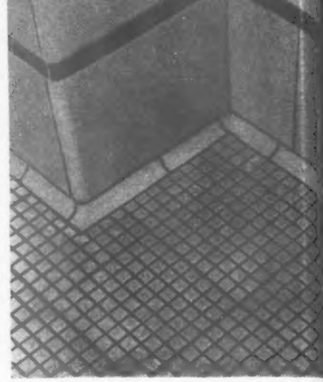

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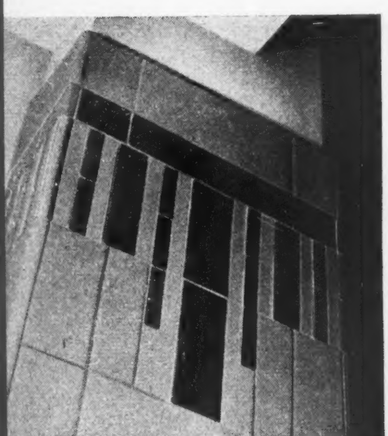

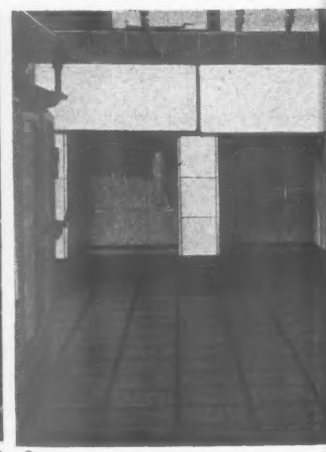

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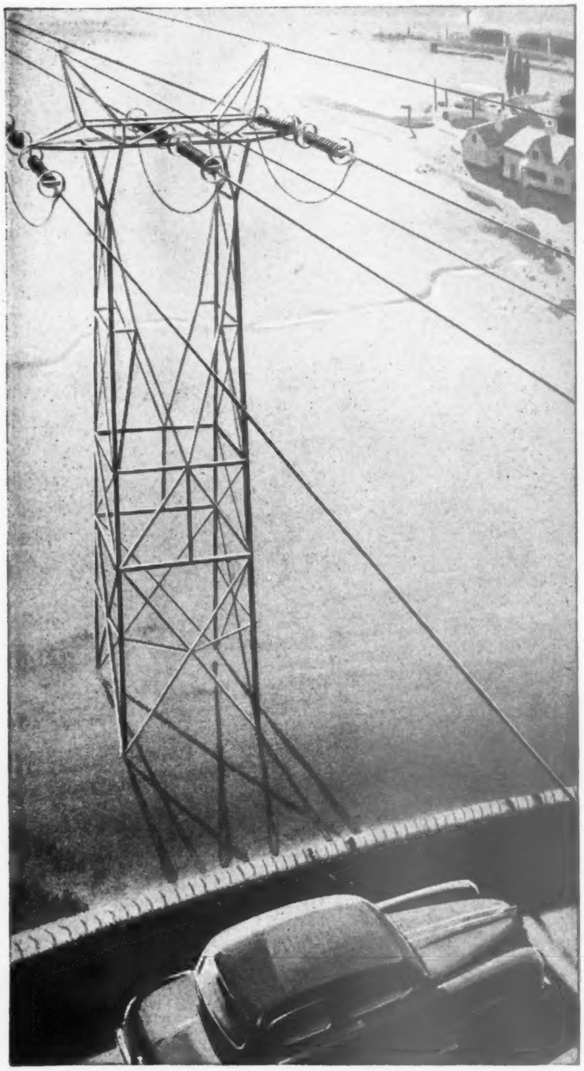

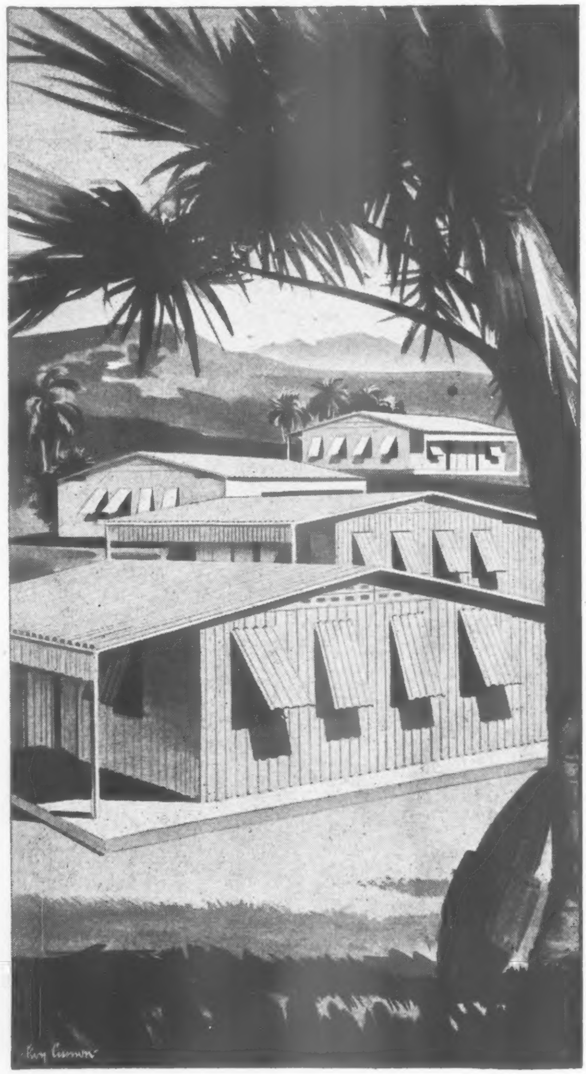

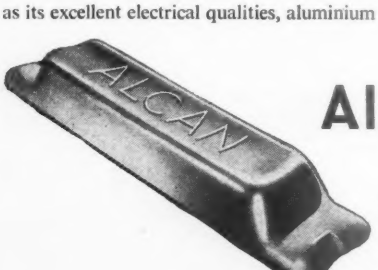
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(By courtesy of the Proprietors, Messrs. Mecca, Ltd.)

—AT THE 'CAFE de PARIS' LONDON

This attractive new cocktail bar, recently installed at the famous Cafe de Paris, Coventry Street, London, has a maroon Formica counter top, with the counter-front in veneered walnut and bird's eye maple. A feature is the illuminated reeded glass panelling with wrought iron scrolls. The mirrored back-fitting is sycamore framed with gold finished plaster decorations.

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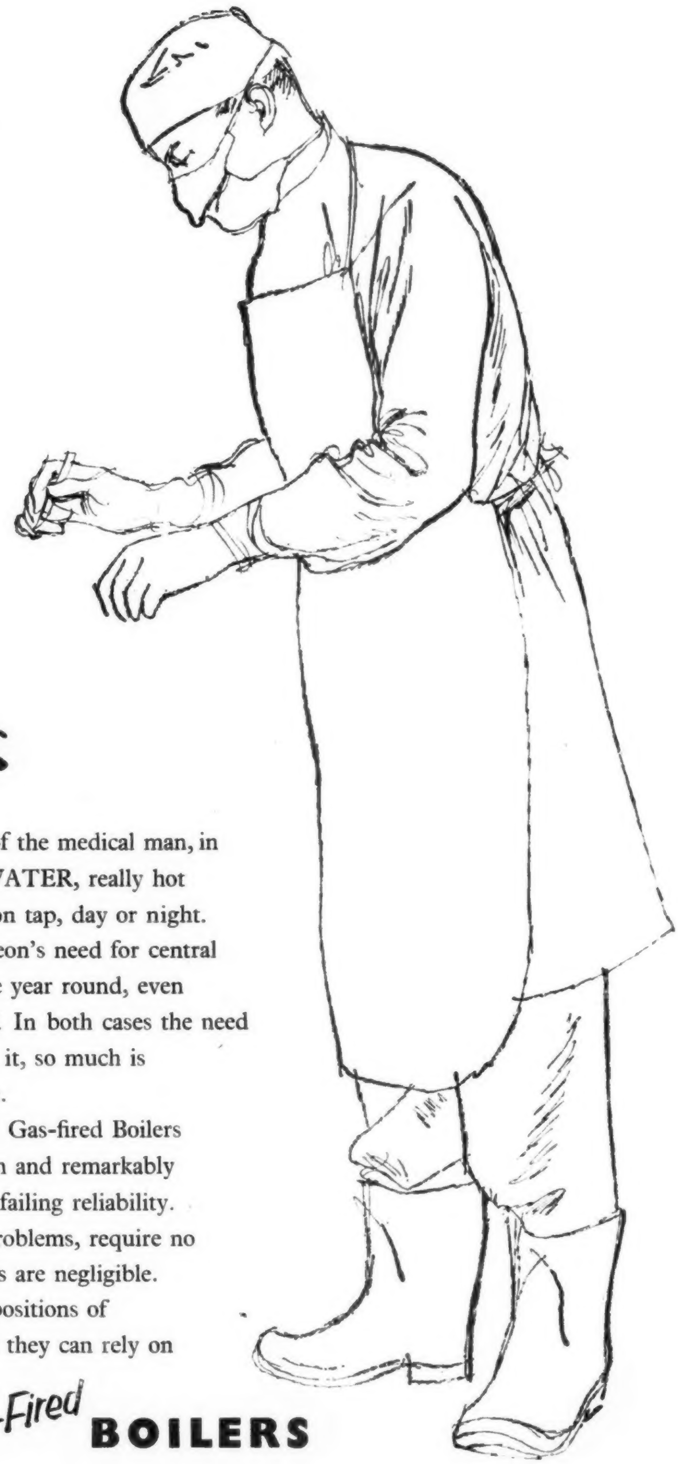
This is the man who relies on Potterton Boilers



The traditional requirement of the medical man, in fiction and in fact, is HOT WATER, really hot water in abundance—always on tap, day or night. No less important is the surgeon's need for central heating in the theatre—all the year round, even when the main boilers are off. In both cases the need is vital—so much depends on it, so much is at stake, failure is unthinkable.

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POTTERTON *Gas-Fired* BOILERS

POTTERTON GAS FIRED BOILERS MADE BY DE LA RUE

THOMAS DE LA RUE & CO. LTD. (GAS DIVISION) Imperial House, 84/86 Regent Street, London, W.1

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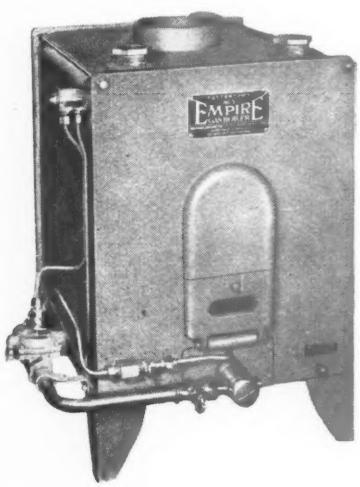
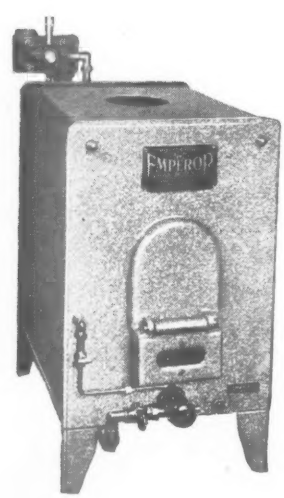
These boilers are particularly suitable for direct hot-water supply systems where headroom is restricted, as the low return (7½ in. floor to centre) enables the cylinder to be fitted at a minimum height above the boiler. The two sizes (with rated outputs of 22,500 and 30,000 B.Th.U. per hour) can be supplied for installation in hard or soft water areas either in grey painted finish or in grey mottled vitreous enamel. A flame failure device and direct-acting thermostat are fitted as standard. Two central heating boilers with similar outputs are available in this range.



Designed for direct hot water supply in conjunction with an insulated storage cylinder, these boilers are available in three sizes with rated outputs of 22,500, 30,000 and 45,000 B.Th.U. per hour. The two smaller sizes are supplied with a bi-metal direct-acting thermostat and the No. 3 size has an immersion thermostat operating on a control valve. There is also another boiler in this range, the 3H, which is available for central heating. All boilers in this range are supplied in a grey painted finish.



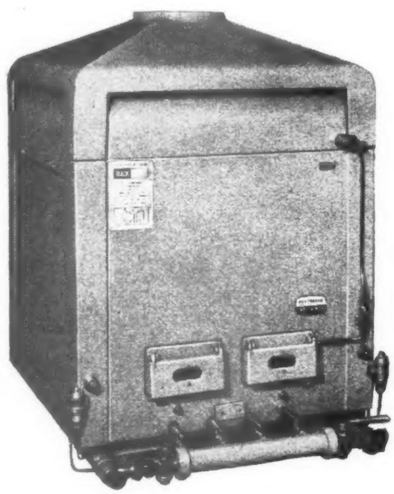
These boilers are available in three sizes with rated outputs and capacities similar to the "Empire" boilers but have an insulated casing and are finished externally in grey mottled vitreous enamel. There is also a larger boiler in this range, the 3H, for central heating. Both "Empire" and "Emperor" boilers for use with soft water are bower-barffed and have non-ferrous pipe connections.

For more detailed specifications, write to: **THOMAS DE LA RUE & ., LT**

ne famous Pottertons

No. 1 SERIES

The boilers in this series are for central heating and are of cast iron sectional construction with an insulated casing and are supplied with either a grey painted or grey mottled vitreous enamel finish. There are five sizes with rated outputs from 65,000 to 198,000 B.Th.U. per hour, and standard equipment includes gas pressure governor, adjustable thermostat and the "Perfecta" combined flame failure and pressure cut-off double duty device. Another range of boilers with similar outputs, known as D series, is available for direct hot water supply.

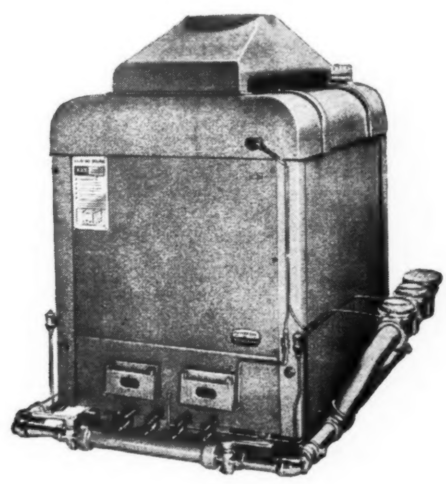


No. 2 SERIES

These boilers are for central heating or indirect hot water supply and are available in five sizes giving outputs from 216,000 to 504,000 B.Th.U. per hour. The waterways are normally sent in two halves for assembly on site, the headers and platework being crated separately. Like all "Rex" boilers they have an insulated casing with removable front and rear panels and integral draught diverter, and are fitted with gas pressure governor, adjustable thermostat and the "Perfecta" combined flame failure and pressure cut off double duty device. The boilers are supplied with grey painted or grey mottled vitreous enamel finish.

No. 3 SERIES

The design and construction of this series is similar to that of the No. 2 series boilers except that they are despatched unassembled and erected on site by our own skilled fitters. Six sizes are available with rated outputs from 625,000 to 1,250,000 B.Th.U. per hour. Standard equipment comprises gas pressure governor, adjustable thermostat and the "Perfecta" combined flame failure and pressure cut off double duty device. The boilers are available with grey painted or grey mottled vitreous enamel finish.



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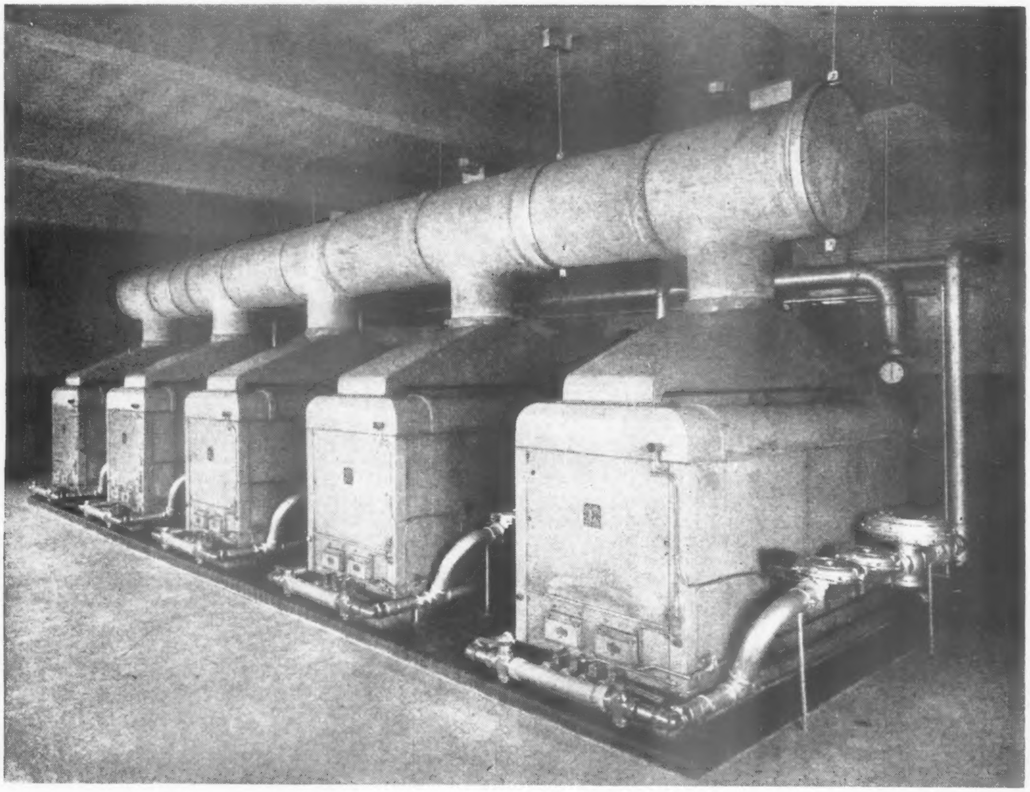

(By courtesy of A. H. F. Jiggens Esq., A.M.I.C.E., A.M.I.Mun.E., A.R.I.C.S., A.M.R.T.I., City Engineer and Surveyor, Chester. Heating Contractors: Robert Walsh Ltd., Bolton.)

This is Potterton at work

Overleigh School, Handbridge, is one of the new schools that are the pride of Britain's educational system. Its design embodies many of the very latest building techniques. One of the most interesting is the completely automatic central heating system provided by Potterton Gas-Fired Boilers.

The five 3-series, 10 section 'Rex' Boilers are regulated by a combination of thermostatic and clock control. The time-clocks turn the boilers on and off, making due allowance for weekends. Adjustments to maintain a constant even temperature throughout the school are made by the thermostats.

Each group of classrooms is individually controlled by thermostats and is also linked into a general zone control system. Additional thermostatic controls are provided in all classrooms facing south to allow for the effects of the sun.

Flexibility in operation is a well-known feature of Potterton Boilers. But of course they have many other advantages; cleanliness, compact construction and absolute reliability. It's wise to specify Potterton.

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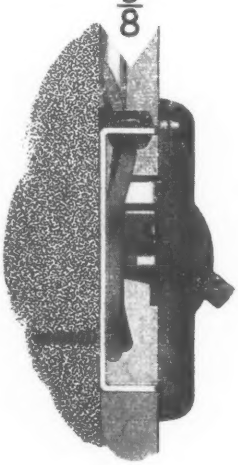
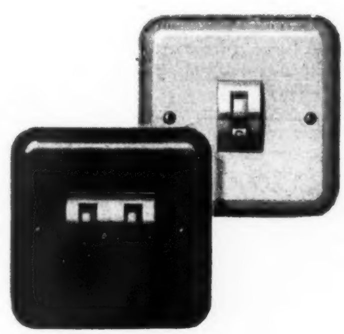


* *See British Standard Code of Practice CP 211 (1949)*



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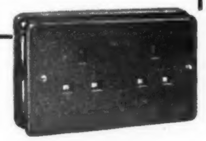

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Surface Pattern.

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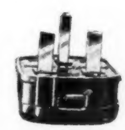
Flush Metal Covered Pattern.

Switched Surface Pattern.

★ Switched Flush Pattern.



Fused Plug.

★ Available in Brown or Cream.

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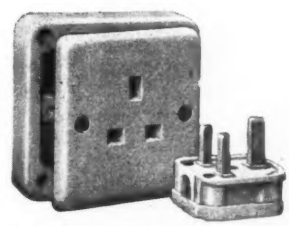

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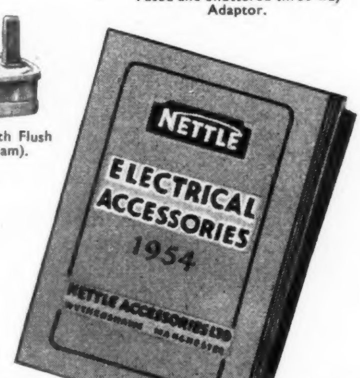

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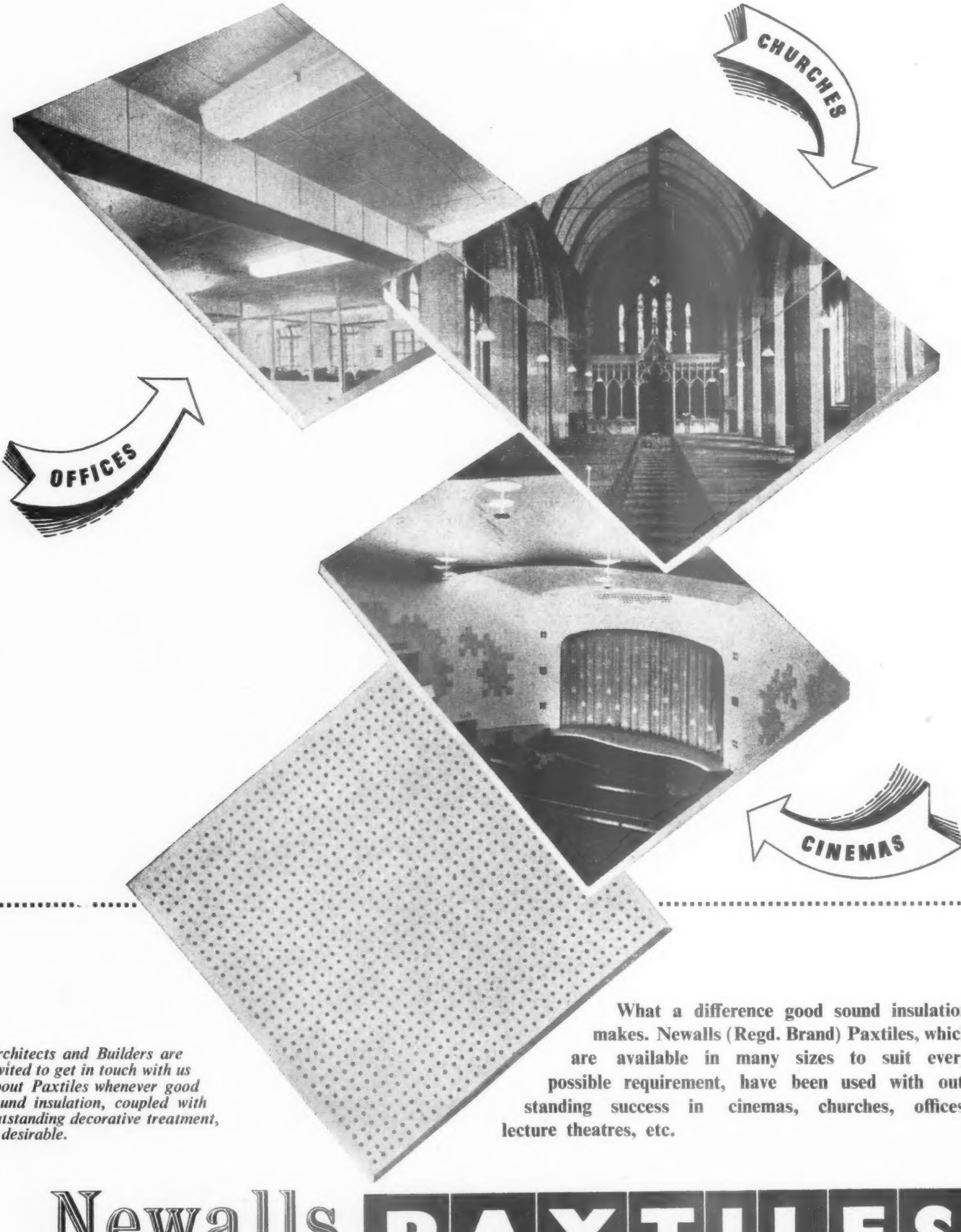
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— every panel bonded with waterproof glue!

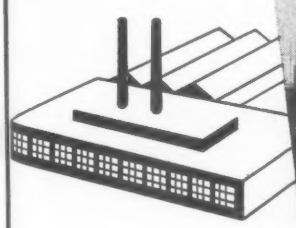
for Flooring

Engineers, architects, contractors and master builders who have once used waterproof Douglas Fir Plywood continue to specify and buy this versatile material. Standard 8′ x 4′ panels are available in grades and thicknesses suitable for most applications—special sizes can be supplied to your order.

An excellent flooring and ideal base for linoleum or carpet. A single panel covers 32 square feet—requires less nailing—less handling.

Its high strength/weight ratio and diaphragm action will add strength and rigidity to the structure you are building.

Properly designed Douglas Fir Plywood concrete shuttering produces superior concrete finishes and can be used over and over again.



for Shuttering

for Roof Sheathing

Canadian Douglas Fir Plywood is:

Easy to handle ***Speedy to use***

Split-proof ***Waterproof glue***

Dimensionally stable

FOR FURTHER INFORMATION concerning Canadian woods contact The Commercial Secretary (Timber), Canada House, Trafalgar Sq., London.

This advertisement is one of a series featuring Canadian Spruce, White Pine, Western Red Cedar, Red Pine and Pacific Coast Hemlock.

the trend is to Fuel Oil

More and more architects are specifying oil firing for central heating plants in blocks of flats, hotels, offices and similar large buildings.

The unique flexibility of oil firing is such that heat can be instantly, automatically and accurately controlled through the widest variations to meet peak loads. Outstanding cleanliness in use, high burning efficiency, negligible ash content . . . all lead to economies in handling costs, storage space and ash disposal.

Esso Fuel Oil—delivered to your premises from distribution points located throughout the country—may well be the answer to *your* heating problem.

It pays to say **ESSO FUEL OILS**

FOR ALL HEATING APPLICATIONS

● *For interesting and informative literature on this subject write to*
Esso Petroleum Company, Ltd., 36, Queen Anne's Gate, London, S.W.1.

C

An Architect's answer

TO AN URGENT PROBLEM

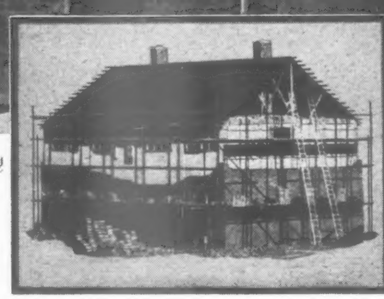
HOUSES HALF-BUILT IN THE FACTORY

Hawksley S.G.S. houses are based on principles developed by G. Schindler, Dipl.Arch., E.T.H., S.I.A., and look traditional in every way—yet they are largely made in the factory. The inner shell, of cast plaster panels, complete with doors and windows fully glazed and materials for electric and plumbing services, floor units, stairs and roof trusses are all delivered to the site ready for immediate erection.

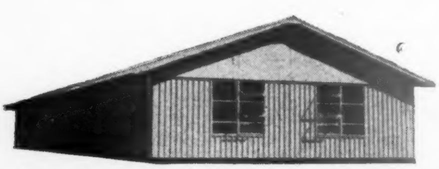
MINIMUM OF SIX COMPLETED WEEKLY

Interior decorations, electrical and plumbing installations are completed while the external cladding of 4½in. brickwork (or alternative) and conventional roof tiling are in progress. The result is a 50 per cent. saving of man-hours on site; the first house is ready for occupation four months after possession of the site and houses are completed, thereafter at a minimum rate of six per week. Hawksley S.G.S. houses are designed for construction in pairs or terraces, stepped in plan or elevation as required. Send for full details.

HAWKSLEY S.G.S NEW-TRADITIONAL HOUSES



AND THE ANSWER TO THE EDUCATIONAL PROBLEM



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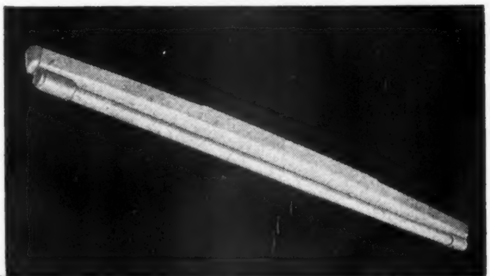
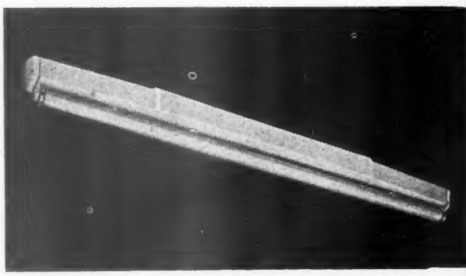
HAWKSLEY CONSTRUCTIONS (Member of the Hawker Siddeley Group Ltd.) **BENTHAM · GLOUCESTER** *Tel.: WITCOMBE 3251*

three Mazda fittings

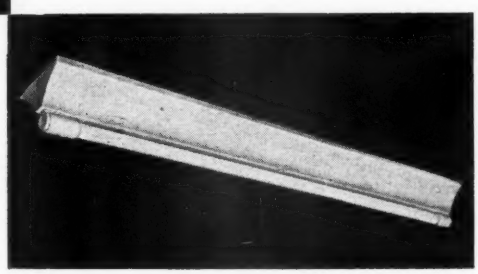
Quickly installed, easily maintained



The MONOLUX (F1004)
One five-foot fluorescent lamp (80 watts).



The MONOLUX (F1004) Junior
One four-foot fluorescent lamp (40 watts).



The SEAGULL (F1080)
One five-foot fluorescent lamp (80 watts).
A twin lamp model is available.

Mazda

fluorescent lamps stay brighter longer

THE BRITISH THOMSON-HOUSTON CO. LTD.
Crown House, Aldwych, London, W.C.2.

B T-H

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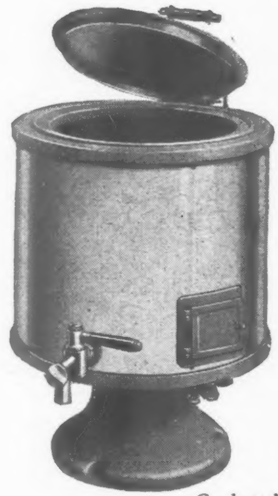
All three fittings have these important features;

- BTH 'Pendicone' fixing cuts installation costs.
- Switch-start or Instant-start lamp auxiliary gear.
- 'Either hand, either end' lamping speeds maintenance.
- Clean lines, functional design.
- The new BTH cartoning for easy handling and stocking.

(Member of the A.E.I. Group of Companies)

Boiling Pans with the accent on hygiene and easy cleaning



Gas heated boiling pan.

Here is a selection from the extensive MAIN range of gas and steam operated Boiling Pans. The complete range offers a wide choice of designs in a variety of sizes from 15 gallons to 80 gallons capacity. The boilers are highly efficient in use, strongly constructed of durable material and are available in a variety of finishes. Surfaces are easy to clean and interiors have been designed to avoid joints where objectionable matter can collect.

our "Planned Kitchencraft" Department is at your service

If you have a catering problem consult R. & A. Main Limited. Our organisation, backed by years of experience in planning and equipping kitchens of all sizes, will gladly work with you in developing your own ideas or submit plans for your kitchen.

Dual Purpose Pan, with 22 gallon removable interior container, and 30 gallon boiling pan.

Steam jacketed boiling pan, available in range of sizes from 15 to 80 gallons capacity.

MAIN

Gas and Steam

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Steamers	Boiling Pans	Gas Ranges
Hot Closets	Roasting Ovens	Fish Fryers

R. & A. MAIN LTD., LONDON and FALKIRK

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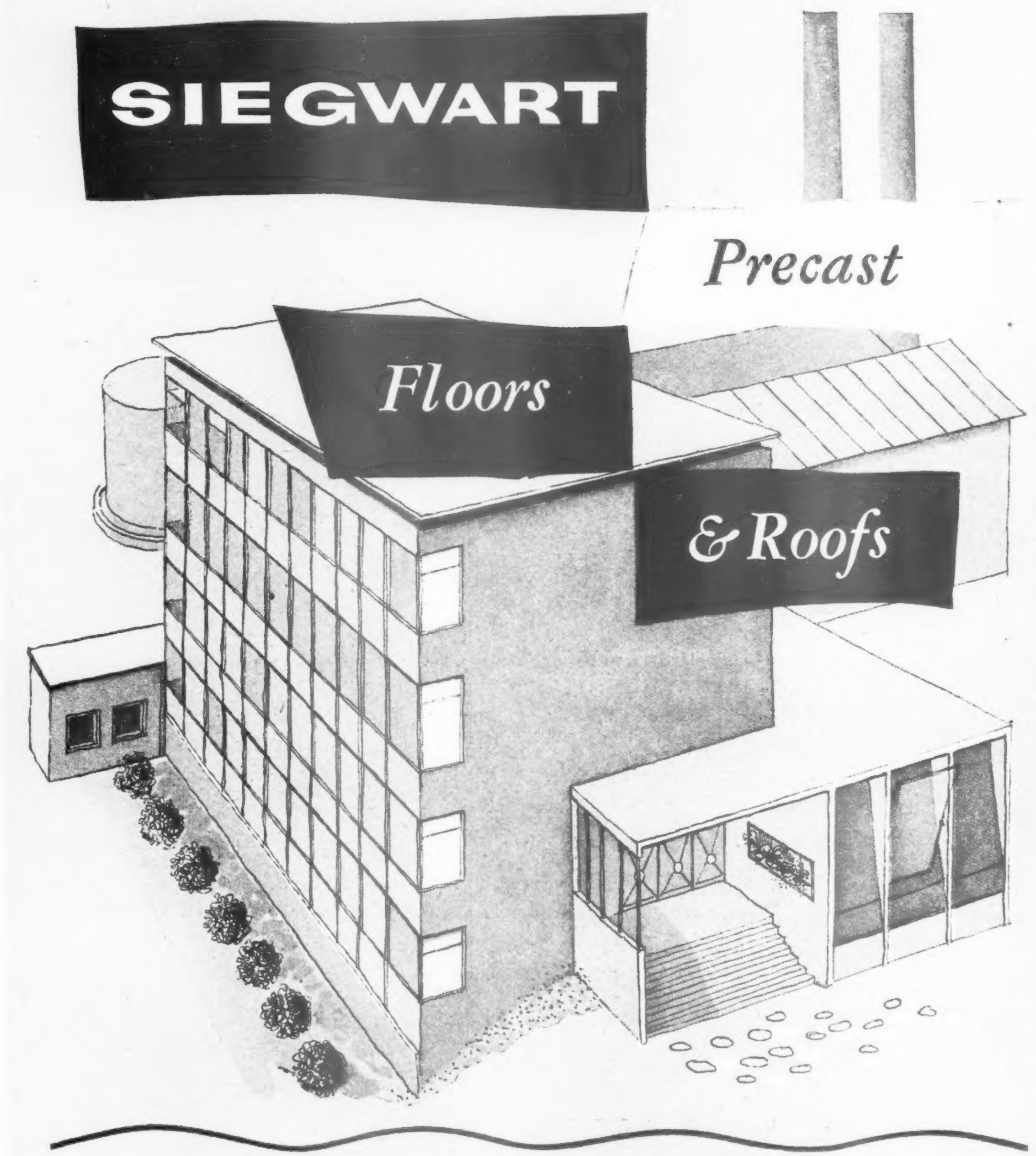
SIEGWART
Precast
Floors
& Roofs


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SCHOOLS
Multicompartment Skirting Trunking
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PLAN AHEAD
for Electrical Energy 'ON TAP'
Flexibility is the Keynote of "Walsall" Trunking and Ducting Systems whether Overhead, Wall, Skirting, Floor or Underfloor. These systems enable the Architect and Consulting Engineer to plan the electrical installation in advance without regard to the position of fixtures, furniture and equipment, providing for immediate requirements and future extensions, and eliminating the objectionable practice of trailing cables.
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CABLE TRUNKING
Walsall
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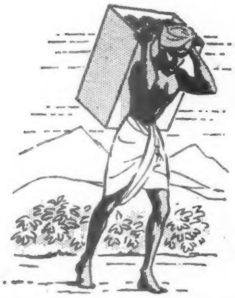


"From India's Coral Strand to Greenland's Icy Mountains"

The first large-scale use of plywood was for chests for the Indian tea trade. It is still accepted as the best material for the job.

Halfway across the world from India, it saw service with the British North Greenland Expedition. Cabins for the expedition's "Weasels" had to be made of a material that was a good insulator against the cold, and that was light in weight yet strong enough to protect men and equipment under the most severe conditions. Only one material met the requirements—exterior grade plywood. In this country, where conditions are less extreme than in either India or Greenland, plywood is today finding an increasing number of applications in every branch of industry, including farming, shipbuilding, housing, packaging, engineering and transport, while for the home handyman it has endless uses.

Plywood is a real *outdoor* material—well worth considering for your next project.

There's nothing like WOOD

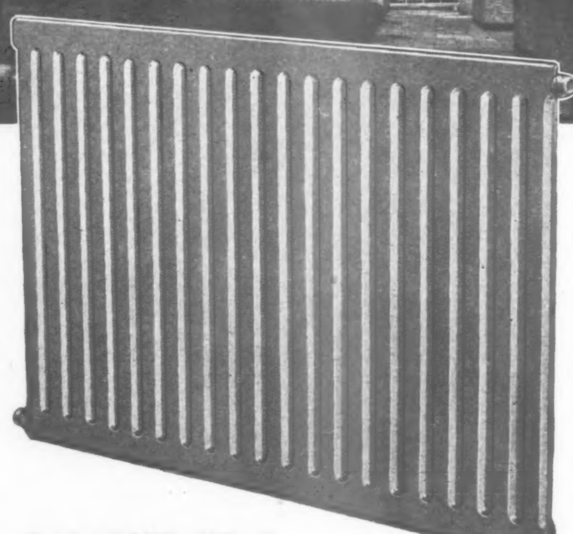
ISSUED BY THE TIMBER DEVELOPMENT ASSOCIATION LIMITED, 21 COLLEGE HILL, LONDON, E.C.4

and branches throughout the country

TD57

London County Council have installed GULF long life Radiators in their New Secondary School at KIDBROOKE

Photo by courtesy of L.C.C.



Consultants for Heating, Mechanical and Electrical Services:
Edward A. Pearce & Partners.
Architects: Slater, Uren & Pike.

LIGHT IN WEIGHT
(Ideal for wall fixing)
EASY TO PAINT, CLEAN AND KEEP CLEAN
COST LESS
ECONOMICAL TO FIX
FROST PROOF
MORE RESPONSIVE TO THERMOSTATIC CONTROL

Gulf long life Radiators are available in a wide range of Column and Wall Panel types, in any length and in curved and angled form. Gulf specialise in producing radiators for unusual and exacting requirements. Gulf are installed throughout the country and in the largest building built since the war.

BALANCED HEAT

Gulf Panel Radiators provide the perfect balance of radiation and convection to ensure the highest standard of heat comfort coupled with efficiency of operation and maximum fuel economy.

GULF RADIATORS

INSTALL **GULF** *LONG LIFE* **RADIATORS**

GULF RADIATORS LIMITED, PENARTH RD., CARDIFF. *Tel:* **20591/2**

London Office and Showrooms:
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RICHAFIX
for FASTER FIXING
SPREAD THE RICHAFIX
WHEN 'TACKY', FIX TILES IN POSITION
GROUT AS USUAL
Please ask for booklet R.F.1 which explains the subject fully and gives detailed fixing instructions
London Showrooms, Grand Buildings, Trafalgar Square, W.C.2. Phone: Whitehall 2488 & 8063
RICHARDS TILES LTD · TUNSTALL · STOKE-ON-TRENT

Another Reason why it's to your advantage to use a . . .

The bright beauty and easy-clean properties of Semastic Decorative Tiles make them particularly suitable for use in this STUTTGART self-service store.

comprehensive flooring service

Semtex service starts in the laboratories at Fort Dunlop and Semtex House, where research and development work is constantly in progress on tomorrow's flooring materials. It was this work that perfected the highly attractive Semtex floors that are coming increasingly into use all over the world.

The Semtex Company gives advice on any flooring problem. It will design floors for any purpose. And specialised operatives will lay the floor expertly. But the Semtex service does not end even there. A maintenance department exists for the benefit of clients who wish to have their floors *kept* perfect, under contract. These are the advantages of a comprehensive flooring service. May we tell you more about it?

SEMTEX

INTERNATIONAL FLOORING SERVICE

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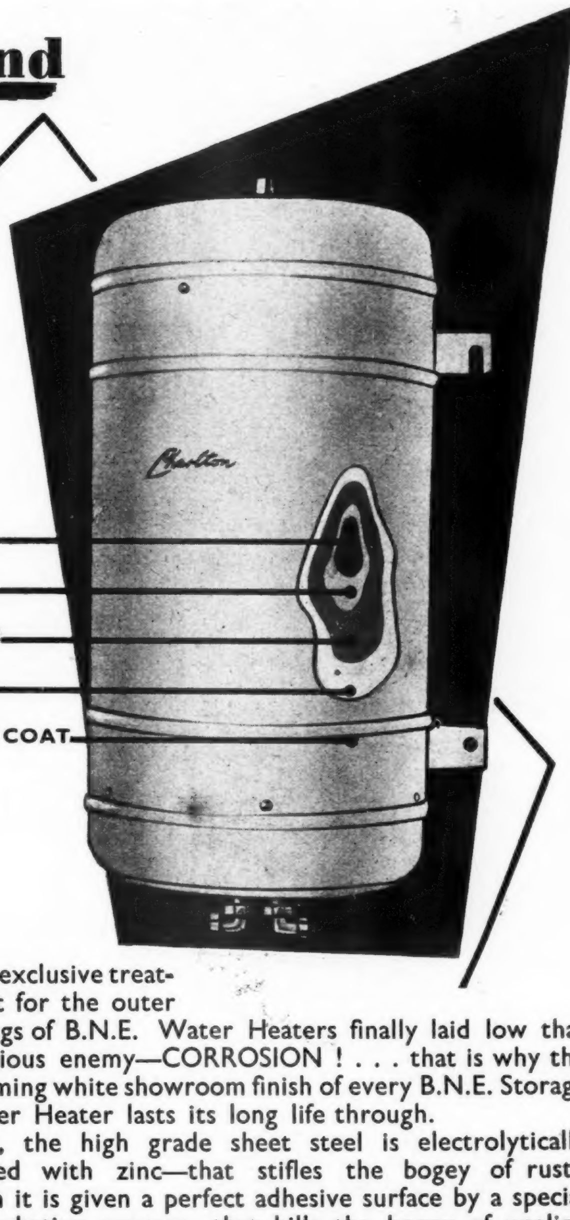
The Finish to end Corrosion



★ SHEET STEEL OUTER CASING

★ ELECTROLYTIC ZINC DEPOSIT

★ PHOSPHATED ADHESIVE SURFACE

★ SEALING UNDERCOAT

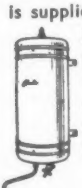
★ HIGH GLOSS ENAMEL FINISHING COAT

finally dried by

MODERN INFRA-RED METHODS

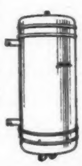
NON-PRESSURE TYPE

Installed over sink, bath or handbasin, this one point type is supplied in varying sizes to provide a ready supply of scalding hot water



PRESSURE TYPE

With capacities ranging from 5 to 30 gallons this heater will supply several points with abundant hot water Especially suitable for factories and schools

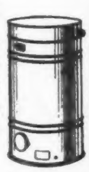


" CHARLTON " TWIN TYPES

A multi-point pressure model designed for the modern house. Very economical in running cost. 6 gallons always available and bulk quantities heated as required

CISTERN TYPE

Can be connected direct to main water supply. 20 to 30 gallon capacities. Especially suitable for flats or bungalows as no cold water cistern is required



This exclusive treatment for the outer casings of B.N.E. Water Heaters finally laid low that insidious enemy—CORROSION ! . . . that is why the gleaming white showroom finish of every B.N.E. Storage Water Heater lasts its long life through.

First, the high grade sheet steel is electrolytically coated with zinc—that stifles the bogey of rust! Then it is given a perfect adhesive surface by a special phosphating process—that kills the bogey of peeling paint !

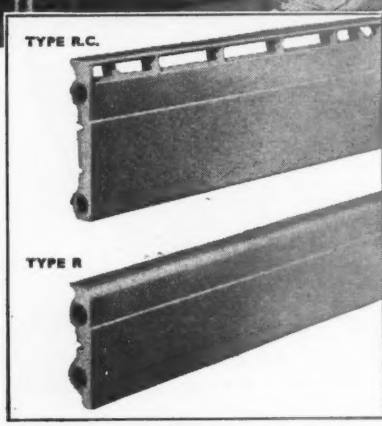
Finally, two coats of paint are applied and dried by modern infra-red methods—for good.

BRITISH NATIONAL ELECTRICS LIMITED

The Domestic Appliance Section of JOHNSON & PHILLIPS LTD.

NEWARK HILL · MOTHERWELL · SCOTLAND

The Crane skirting heating system



The main illustration shows both types of Crane Skirting Heating installed. The 9″ type 'RC' is particularly suitable for use under large windows with low sills. Also for public buildings such as libraries and art galleries, etc. Manufactured in 2′ lengths only. The 6″ type 'R'—for flats and houses—is also manufactured in 2′ lengths. On walls where heating is not required, matching wood skirting can easily be included for continuity. Both types are normally delivered unassembled unless otherwise instructed. Standard pipe connections ¾″—both types. Crane Skirting Heating is primarily designed for inclusion in buildings in the course of construction, but can also be installed in existing property.

Invisible warmth— unlimited scope for planning

CRANE Cast Iron Skirting Heating is virtually invisible—yet it distributes warmth evenly *to every point in the room!* It simply takes the place of normal wooden skirting, leaving the entire floor space of the room free from obstruction, and can be finished in any colour to fit in with decorative schemes. Here indeed is a heating system that gives unlimited scope for 'free' architectural planning and interior decoration.

There are two types of Crane Skirting Heating—'RC' (combined Radiant and Convection) and 'R' (Radiant). Both ensure that there are no 'cold spots' or 'hot spots' *anywhere* in the room. Furthermore, the temperature gradient for type 'R' is only one or two degrees Fahrenheit—and for type 'RC' no more than two or three. Crane Skirting Heating can be used on hot water or low pressure steam systems. *Write to the address below for a copy of our free booklet giving full details of the Crane Skirting Heating System.*

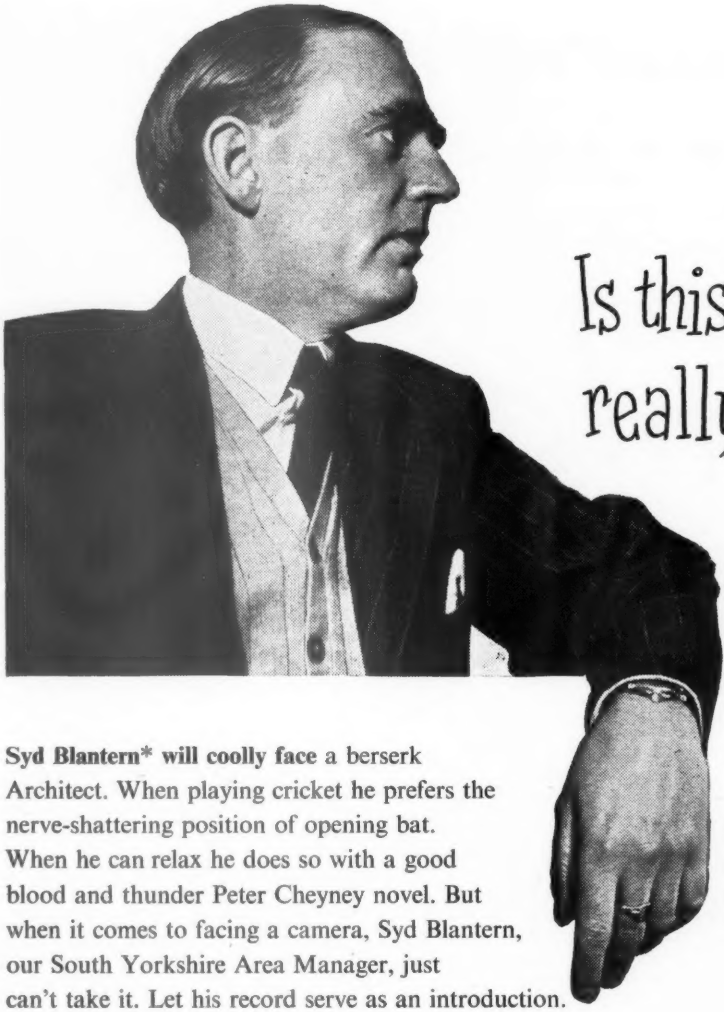
Outputs in B.Th.U.'s per hour per linear foot.

Mean water temp. in heater	160°F				170°F				180°F				190°F			
Room Temp.	55°	60°	65°	70°	55°	60°	65°	70°	55°	60°	65°	70°	55°	60°	65°	70°
6″ high Type R	200	185	175	165	225	210	200	185	250	235	220	205	275	260	250	235
9″ high Type RC	510	470	450	420	570	530	510	470	630	600	570	530	690	660	630	600

These figures were achieved in conjunction with a Crane Boiler

CRANE BOILERS AND HEATING EQUIPMENT

CRANE LTD., DEPT. J.3., 45-51 LEMAN STREET, LONDON, E.1. *Branches: Birmingham, Brentford, Bristol, Glasgow, Manchester*
London Showrooms: 118 Wigmore Street, London, W.1



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Plan for Linoleum for good looks and long life

We present Linoleum in action, at the Bond Street offices of *K.L.M-Royal Dutch Airlines, in London.* Notice how skilfully the architect has selected from linoleum's wide range a contemporary pattern muted in tone to accentuate his decorative theme. But good looks and versatility are only half the story. Linoleum, more successfully than any other modern flooring, provides long life and resistance to wear, coupled with quietness of tread, which a busy office demands.

Acknowledgements to K.L.M-Royal Dutch Airlines
Architect: J. Stroud Foster, A.R.I.B.A.
Linoleum installation: Cellulin Flooring Co., Ltd.

FOR LONGEST WEAR EVERYWHERE

LINOLEUM

THELMA

"THELMA" stands for The Linoleum Manufacturers' Association, 127 Victoria Street, London, S.W.1.
For further information write to the Association or to any of the following members :—
BARRY OSTLERE & SHEPHERD LTD., KIRKCALDY · DUNDEE LINOLEUM CO. LTD., DUNDEE · LINOLEUM MANUFACTURING CO. LTD., 6 OLD BAILEY, LONDON, E.C.4 · MICHAEL NAIRN & CO. LTD., KIRKCALDY · NORTH BRITISH LINOLEUM CO. LTD., DUNDEE SCOTTISH CO-OPERATIVE WHOLESALE SOCIETY LTD., FALKLAND, FIFE · JAS. WILLIAMSON & SON LTD., LANCASTER

15

MARLEY

YEOMAN TILES

Quickly and easily laid

Light in weight

Economise timber

TECHNICAL DATA							
Gauge	Lap	No. of Tiles		Feet Run of Batten		Approx. Weight of Tiling in lb.	
		per sq.	per sq. yard	per sq.	per sq. yard	per sq.	per sq. yard
13¼"	3"	92.5	8.3	90	8.1	1,000	90
12¼"	4"	100	9.0	98	8.8	1,100	99
11¼"	5"	109	9.8	107	9.6	1,200	108

Yeoman tiles have a variable gauge which should be utilised to avoid cutting tiles at top courses.

Send for full details and specifications.

All Marley tiles are surfaced with coloured mineral granules which ensure natural weathering and beauty. And all Marley tiles are covered by the Marley dual guarantee: (1) That Marley tiles will not laminate or decay for 50 years. (2) Free maintenance of roof tiling fixed by Marley craftsmen for ten years.

"Not for an age—but for all time"

The Marley Tile Company Ltd., Riverhead, Sevenoaks, Kent. Sevenoaks 2251-6 *MARLEY*

Scotland: *Bishopbriggs 1093* **Wales:** *Pencoed 376* **Northern Ireland:** *Belfast 24447* **Eire:** *Dublin 51794*

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THE ARCHITECTS' JOURNAL

9, 11 & 13, Queen Anne's Gate, Westminster, London, S.W.1 Whitehall 0611

No. 3116 November 18, 1954 VOL. 120

Subscription rates: by post in the U.K. or abroad, £2 10s. 0d. per annum. Single copies, 1s.; post free, 1s. 3d. Special numbers are included in Subscriptions; single copies 2s. post free 2s. 3d. Back numbers more than 12 months old (when available), double price. Half yearly volumes can be bound complete with index in cloth cases for 25s. 0d.; carriage, 1s. extra.

JAM TOMORROW?

Sir John Elliot's suggestion that private cars will sooner or later have to be banned from Central London has produced, as one might expect, a denial from the motoring organizations. Both sides can be accused of special pleading, for a higher average speed would mean fewer buses and no trouble from lack of crews: it might even mean a better service for the travelling public, though that argument doesn't seem to mean much nowadays.

*

Buses obviously add severely to congestion, but the chaos was worse during the strike, when there were far more private cars. A few underground garages, parking streets and meters can only nibble at the very fringe of the trouble. And it is no longer worth pretending we can ever afford the fantastic compensation sums for widening main streets. So far the central area hasn't even a roundabout which allows traffic to circulate without a lot of control lights. (Sloane Square is one, but that is too far out to count.)

*

Surely the only solution to this traffic problem is a really drastic one-way-street scheme, whether the shopkeepers like it or not. If that only worked for a few years then the private car ban would have to follow. Business people would complain, but half the cars are run on firm's expenses, so it would just be a question of charging for taxis instead.

SAD FOR STRAP-HANGERS

Before we leave London's transport let me shed a tear in print for the jolly red trains on the Underground which soon will be no more. They are to be replaced, in three years time, by silvery light-alloy trains. No doubt these will be faster and cheaper to run, and will have many other virtues, but they sound just as improbable as silvery pillar-boxes, green fire-engines or perspex coats for Chelsea Pensioners.

INAUGURAL ADDRESS

No one could be less professional in his manner than Sir Hugh Casson, but the number of amusing stories in his inaugural lecture as Professor of Interior Design at the Royal College of Art, given last week at the Royal Society of Arts, and the rapture with which they were received by a packed and highly appreciative audience, must not be allowed to give the impression that he had not serious things to say, well worth the attention of serious men.

*

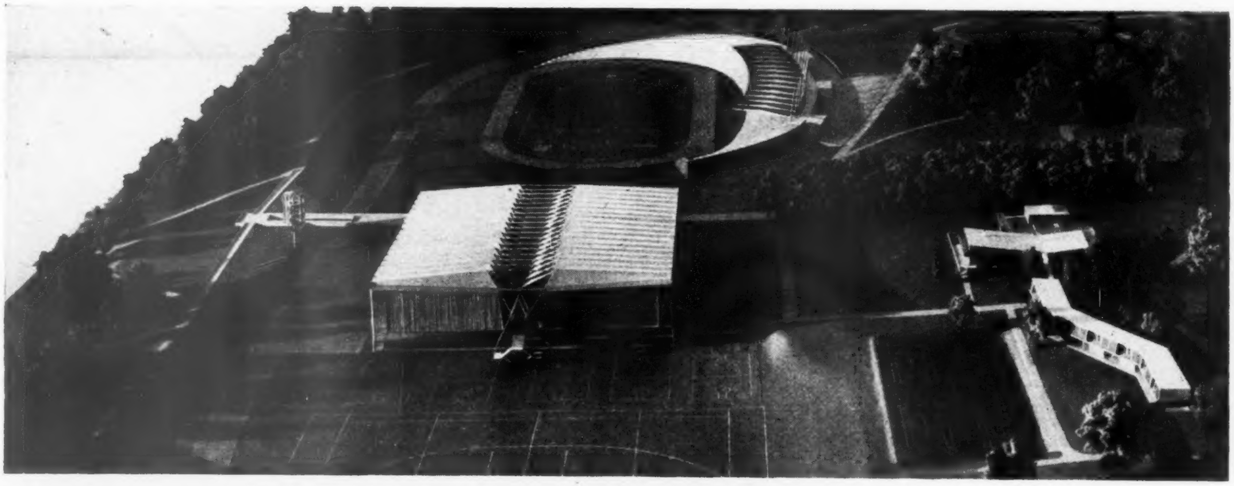
He will have no easy task in persuading people to regard interior design as being concerned with something more than the fashionable decorator's box of tricks, without making them feel there is anything unworthy about the richness and even the fantasy that is part of its function. In his lecture Casson showed he had thought deeply about the proper role of the interior designer. Don't fail to read it when it is published later in the JOURNAL.

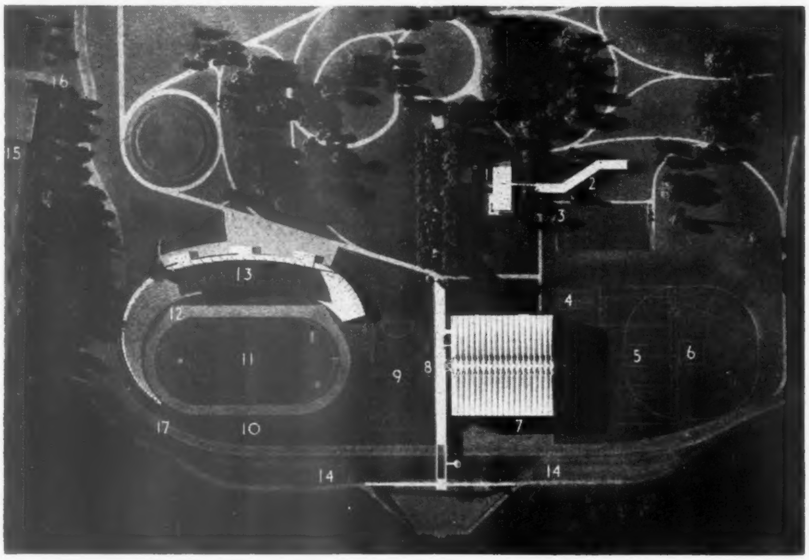
THE CRYSTAL PALACE SCHEME

There can be no doubt that Dr. Martin and his architects' department at the LCC have given the brooding ruination of the Crystal Palace site a powerful shot in the arm with their new plan for a sports centre there. Not much has happened to stir the drooping leaves of the hardy subtropicals—apart from the six-times-yearly purrage of racing cars, and the consequent streams of abuse from the locals—since the fire of '36. But now we are to have quite an extensive group of buildings on the meadow at the bottom of the site—a stadium, a hostel, a big sports hall and all the consequent pitches, practice areas and whatnot that go with them.

*

The re-animation of a historic site is a good thing in itself, but what seems to ASTRAGAL even more praiseworthy is the kind of architecture which is proposed, which really does seem to promise—at oh-so-long-last—sports buildings (and park buildings)





KEY
1. Hostel.
2. Dormitory (140).
3. Tennis.
4. Tennis, netball, basket ball.
5. Rugby.
6. Cricket.
7. Sports Hall.
8. Bridge over running track.
9. Hockey.
10. Field events.
11. Arena.
12. Running track.
13. Stadium (12,000).
14. Viewing stands (12,000).
15. Crystal Palace station.
16. Entrance.

The LCC proposes to develop part of the Crystal Palace grounds as a national youth and sports centre at a cost of £1,797,000. The scheme, for which Dr. J. L. Martin, architect to the council, prepared the layout and the design of the buildings, is shown here in photographs of a model. The council's chief consultant on the development and use of the whole site is Sir Gerald Barry. ASTRAGAL *comments on page* 601 *on the proposals. They will be fully described and illustrated in the* JOURNAL *for December* 2.

which are not inflated Tudor or stretched Cotswold, but comparable with the best contemporary work abroad (see photos above). The scheme will, I am told, be fully described and illustrated in the JOURNAL in a coming issue.

SPENCE SPARED

The number of talks by Basil Spence on his design for Coventry Cathedral must now run into the hundreds. Certainly his performance at the RAC club last week was most polished—a polish due, one must hastily add, to a great flair for public speaking, great sincerity, and great enthusiasm for his subject, as well as to some little practice.

*

It would not be maligning the RAC to suggest that they were a fairly hard-boiled audience. Largely business and professional men who have—don't they?—low aesthetic quotients, they might have been thought to be a tough audience. However, as Wilde—wasn't it?—once wrote: "The bull-necked type, my dear, are almost invariably a disappointment": to ASTRAGAL'S surprise, no savage mauling of the frail aesthete took place. His remarks were so amusing, and so obviously sincerely meant, that, at the end, those clubmen who were not crowding like schoolboys round the suddenly-revealed model of the cathedral were queueing up to shake Spence's hand. The RAC deserve to be congratulated on introducing architecture as a subject for their monthly talk. Let's hope the next time the same subject comes up they can find as good a speaker.

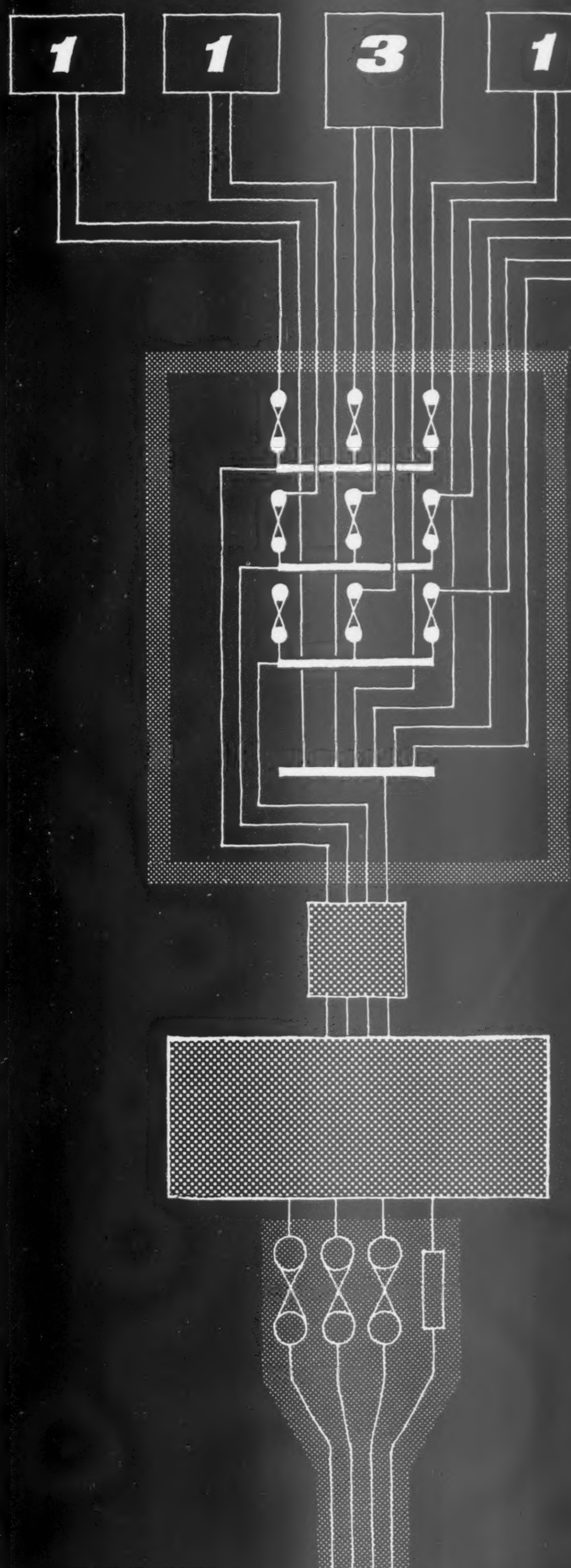
CHEMICALS ON THE SLATE

How long will stone slates last in the London atmosphere? Sir Giles Scott has used them—and very attractive they look—on the restored roof of Guildhall, illustrated in last week's issue. An article in the *City Press* gives these Collyweston slates a life of 600 years and Sir Giles, when asked, pointed out that they had lasted "several centuries" on Lincolnshire buildings. Nevertheless the slates are of limestone, and as anyone who has examined a limestone coping in London will agree they are liable to be attacked by a sulphur-polluted atmosphere.

*

It would be nice to know BRS's opinion. The possibility of heavy maintenance on this pretty roof in a few decades may, of course, be the final straw which will force the authorities to expand smokeless zones in the London area, in which case it would be an ill wind, etc. . . .

ASTRAGAL



electrical theory

protection

service to buildings

the ring circuit

installation

for lighting

for heating

for telephones

switchgear

regulations

glossary of terms

Of all the branches of building technology that the architect has to co-ordinate, electrical work is, from his point of view, the least well documented. There is no lack of information about electricity published for electricians; but this is of no use to the architect, partly because he does not easily understand electrical matters but also because electrical publications do not deal with those aspects of electricity which most interest him.

The lack of technical information has made it difficult for the architect even to *discuss* electrical matters fruitfully with the electrical engineer, let alone to contribute towards specific solutions. And the absence of the architect from discussions about electricity has meant a general impoverishment of those discussions.

It is not possible in a single issue of the JOURNAL to give the architect all the information he has so long required. We do not pretend to give a complete coverage to so vast a subject. Nor do we attempt to give the architect the kind of knowledge which might make him feel he could do without the electrical engineer. For our chief aim is to make the architect feel the need to call in the specialist earlier and more frequently.

We have tried to make all descriptive material clear, but the nature of electrical energy prevents us from making it simple. As always when we publish a special issue on a technical subject, we welcome further contributions—in the form either of questions for our specialists or of further information.

We acknowledge our debt to those who have helped to compile this issue—particularly to E. Jacobi, of Troughton and Young, and Brian Grant, who have both contributed and served as editorial advisors; to J. I. Bernard of BEDA for his editorial advice and to his team of contributors W. Robinson, E. M. Ackerley and Philip Honey; and to J. L. Belk of the G.P.O. Engineering Department.

ELECTRICAL INSTALLATIONS

introduction It is not so very long ago that the electrical installation of a building comprised a single lighting point in each room with a 60-watt bulb, and in very special rooms one lighting socket outlet. Power sockets were practically unknown.

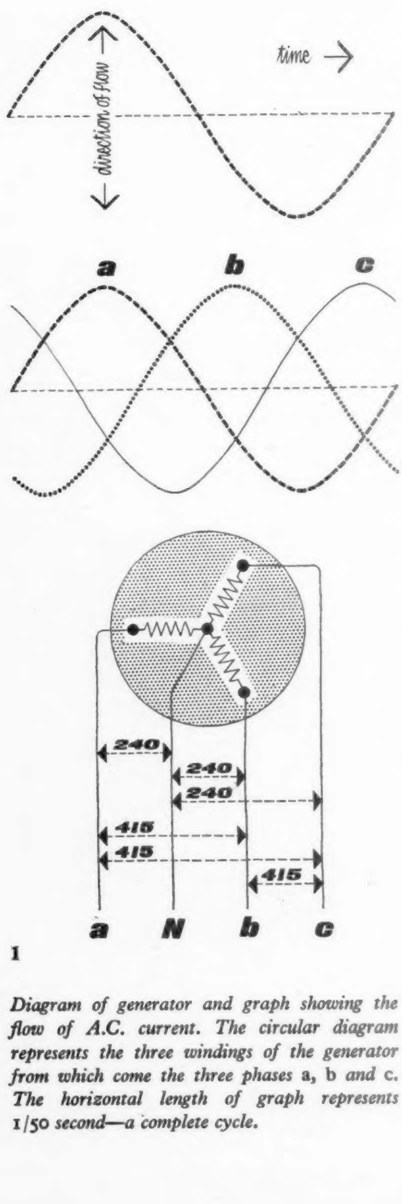
Within the last few years we have seen a spectacular increase in the electrical requirements. The number of outlets and the lighting intensities now regarded as normal are many times those then considered adequate. Socket outlets are required for many items of equipment not even thought of twenty years ago. One room alone can contain a radio, television, hot plate, lighting standards, fan, kettle, clock, telephone, bell, fire alarm push, heaters, thermostats, and so on; all of which require an electrical connection.

Moreover, it is rare in any room or office for the arrangement of furniture and equipment to remain static. Likewise the design of the apparatus itself alters continually.

It is difficult to imagine the further impact of the next ten or twenty years; yet the average electrical installation, once it has been provided, is considered to have a life far beyond this figure.
In the light of this, it is clearly of prime importance to provide an adequate electrical installation for the uses which can be foreseen, and it is equally important to provide an installation which has facilities for extension and alteration to provide for uses which are certain to arise in the course of its life.
The design of electrical installations in buildings not only requires consideration from the user's point of view, but has to take into account technical requirements and the nature of the structure of the building. Where these fundamental points are not recognized, serious difficulties may occur when services have to be provided.

ELECTRICAL THEORY

A full account of the nature and properties of electrical energy would be beyond the scope of this issue. Nor would such knowledge be necessary for the kind of grasp of electrical work that the architect needs to have. In what follows then we give only those facts and definitions needed for an understanding of the installation problems and possibilities dealt with in other sections.



1

Diagram of generator and graph showing the flow of A.C. current. The circular diagram represents the three windings of the generator from which come the three phases a, b *and* c. *The horizontal length of graph represents 1/50 second—a complete cycle.*

The general terms used in describing the property of electricity are as follows:
Ampere: The unit of electric current.
Volt: The unit of electric pressure.
Ohm: The unit of electrical resistance.
The above three terms are related in the famous Ohm's Law which states that the flow of current in a circuit (and hence the energy conveyed) is directly proportional to the pressure of supply and inversely proportional to the resistance of the circuit.
The power conveyed in a circuit is obtained by multiplying the current and the pressure; the unit of power—the watt—is the equivalent of one ampere multiplied by one volt. One thousand watts is known as a kilowatt and one million watts as a megawatt.
When the pressure is substantially constant, as it is under the practical conditions of electricity supply, the power conveyed is proportional to the current. If, for example, the pressure of supply is 240-volts and a current of 10-amperes is flowing, the power conveyed will be 2,400 watts; and if a piece of apparatus consumes this power, it may be said to have a loading of 2,400-watts, or alternatively—taking the standard pressure for granted—as being rated at 10-amperes.
The total amount of energy consumed in a circuit is found by multiplying the watts by the period of time during which it flows, the unit being the watt-hour. One thousand watt-hours are known as a kilowatt-hour; this represents the amount of energy consumed by a load of one kilowatt in operation for one hour. It is the standard " unit " one refers to when dealing with the Electricity Boards.

Alternating Current

The standard electricity supply in this country is alternating current; other supplies exist but are being changed over as rapidly as circumstances permit.
The term " alternating current " refers to an electrical system in which the flow of current is continually reversed (for reasons outside the scope of these notes); the rate of reversal is known as the periodicity of the supply or number of cycles (Fig. 1).
The special property of alternating current, so far as the electric supply industry is concerned, is the ease with which it can be conveyed over long distances, by being transformed to high voltage, and thereby distributed in bulk at minimum loss of power.
The supply from the generating plant at the power station may thus be stepped up to high voltage for such transmission, and then stepped down again for use by consumers.
This principle has been adopted in linking power stations throughout the country by means of the Grid and has great advantages in giving continuity of supply and affording alternative supplies, in spreading the load and avoiding peaks, i.e. over-loads, at particular times or positions.
The normal characteristics of an alternating current supply are three-phase, four-wire, fifty-cycles 415/240-volts.
The expression " three-phase " refers to a particular method of distribution, and, put simply, implies that instead of a plain lead and return circuit, the system has three leads or phases and one common return lead or neutral. The alternations of the current and voltage do not occur simultaneously in each of the three-phase leads, but are one third of a cycle apart and when the load is equally balanced over the three phases the sum total of the three sets of current in the return lead is mathematically zero. Hence it is usual to design a three-phase distribution system with the return lead smaller in size than the three-phase leads.
Not only does three-phase distribution make for economy in cable and equipment, but it is also more suitable than other methods for various forms of power operation.
The term "four-wire" is the technical description of the three-phase leads and the one return lead referred to. The figures 415/240-volts denote that the voltage between phases is 415, and between any one phase and the neutral

is 240. The latter figure is derived from the former by dividing by the square root of three. The interested reader may care to consider that this is analogous to the mechanical problem of a triangle of forces, the relation being that between the sides of a equilateral triangle with angles of 120°, 30°, and 30°.

Usually the phases are described as red, white, and blue respectively, and these colours, together with green for the neutral, are used on equipment to indicate the method of connecting.

Power Factor

Alternating current circuits are affected by a phenomenon known as " power factor."

For technical reasons, which are outside the scope of this article, the voltage and the current in a circuit become slightly out of step. As when two men rowing a boat are slightly out of step there is a loss of power. The difference between the power that should be delivered and the power that is actually delivered is the power factor and is usually expressed as a percentage.

Normally the name kilowatt is shortened to kW. but where power factor is concerned, the expression kVA. (kilo-volt-ampere) is used to signify that power factor has not been taken into consideration. The relationship may be expressed: kW. = kVA. × P.F.

Voltage Drop

One of the characteristics of a circuit conveying current is the " voltage drop " and this may be simply explained: when current has traversed a length of cable it loses a small part of its voltage in overcoming the resistance of the conductor; thus a supply starting out at a pressure of, say, 240 volts, may arrive at the further end of the circuit where it is to operate some equipment with a pressure of, say, 237 volts. The Electricity Board are obliged by regulation to provide a supply at the consumer's terminals within a small margin of the declared pressure, and the Regulations issued by the Institution of Electrical Engineers (to which further reference is made later) give further figures for the maximum voltage drop that may occur within the building itself.

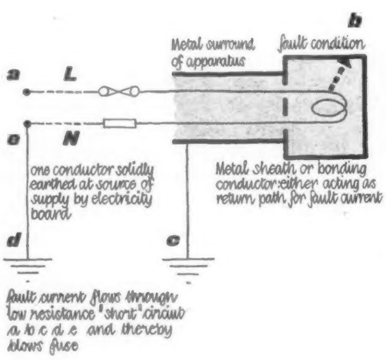
There are two methods of avoiding excessive voltage drop: (1) the use of conductors of larger cross-sectional area, and (2) the limiting of the conductor's length of run. While these two methods are used in a well-designed installation, they may be ignored in a poorer type of installation to save money.

Standard Voltage

In some continental countries and generally in America, the normal supply voltage is much lower than it is in England. The lower voltage (mostly half the English voltage) has the advantage of reducing shock risk. But although the voltage may be halved, the current for a given load is doubled and the size of cables and equipment must be correspondingly increased. The standard pressure in this country (240 volts) was determined after careful consideration had been given to the various factors involved.

PROTECTION

The precautions that must be taken in designing an installation are mechanical and electrical. Mechanical protection must cover risks incident in the building structure at the time of installation and the possibility of damage by accident or negligence at any time throughout the life of the installation.



2

The flow of electrical energy under fault conditions in an earthed circuit.

The electrical precautions to be taken concern overload and fault conditions. Equipment must be provided which will automatically disconnect the supply in the event of overload which would cause damage to cables or apparatus. Normally fuses or circuit breakers are used for this purpose.

Fault conditions may, however, arise in which the insulation breaks down, and live conductors are no longer protected and are liable to produce shock risk.

Before dealing with methods of prevention, it must be explained that it is usual for the return circuit (neutral) of an electricity supply to be connected to the general body of earth by the Electricity Supply Authorities. This ensures that it will always be at zero potential and gives the base line from which the voltage of the circuit is measured. It can thus be said to be 240-volts (or any other figure) " above earth potential."

A shock risk does not exist where no return circuit is available; a man standing on an insulator can touch a live conductor with impunity; such a situation is known as " earth free " but it does not often occur in normal conditions. A man in a bath forms a return path of very low resistance indeed and the slightest contact with a live bare conductor may have fatal results. For protection against this class of fault in which a live conductor or piece of apparatus may be exposed, it is necessary to ensure that any fault currents which may flow are conveyed to earth through an earthing (or bonding conductor,) thus causing their own short circuit and blowing a fuse or operating a circuit breaker. This result is normally achieved either by using a metal surround of the cable as the earthing conductor, or alternatively by providing a special earth wire along the length of the cable; the wire being connected to earth at a suitable position. (Fig. 2).

As all points connected to earth must necessarily be at the same potential, i.e., zero, a faulty conductor surrounded by earthed metal must necessarily operate the protective device before it can cause any damage.

Where non-metallic sheathing is used for cables, or insulating material for the housing of equipment, a special earth bonding wire must be run to any position at which live conditions may exist, the principle being simply that it is better for a fault current to run to earth through an earth wire than through someone's body.

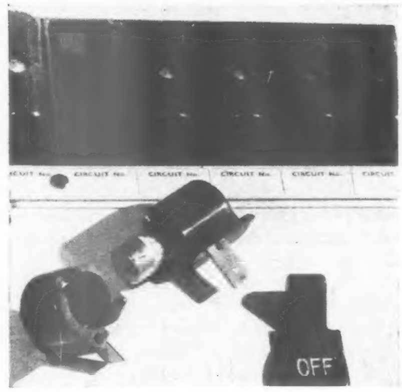
Where a metal sheathed system, e.g., conduit, is used, it is normal for the system itself to be earthed, and to this end all parts of the system have to be carefully bonded (i.e. connected) together to ensure an electric path to earth. Hence a conduit system has the two functions, of giving electrical as well as mechanical protection.

Earthing

The earthing conductors and metal sheaths of cables are usually brought to a central position

namely the switchboard controlling the installation, and at this point are connected together and thence connected to earth.
Usual methods for obtaining the earth connection may be the sheathing of the Electricity Board's service cable, or the pipe work of a main water supply. These methods are, however, not always available, as for various reasons both the Electricity Board and the Water Board may not allow their equipment to be used for this purpose (it may be added that with the increasing use of asbestos pipe, water mains are often not in metallic contact with earth at all).
It therefore becomes necessary to provide an earth connection independent of the water or electricity supplies, and the normal procedure is to install one or more earth rods or earth plates. A rod would be 6 ft. or more in length and must be driven into soil which maintains a reasonable degree of moisture; alternatively an earth plate, usually 2-ft. to 3-ft. square, must be buried at a depth of 6 ft., and should be surrounded by charcoal or similar substance to retain moisture.
In certain districts the sub-soil is not an effective conductor and may consist of rock or shale or similar insulating material. In these cases automatic circuit breakers commonly called earth leakage trips must be employed which act upon the out of balance current in the main conductors due to a leakage in one conductor, and thus automatically interrupt the supply.

Fuses and Circuit-breakers
For some time, small circuit breakers have been available as an alternative to fuses. Fuses act thermally by the melting of a fuse element under overload or short circuiting conditions, thus causing an interruption of the circuit.
Circuit breakers act automatically by means of a mechanism which may be operated by thermal or magnetic equipment; they have the following advantages:
(*a*) The breaking characteristics are constant and not subject to the variation which in the case of a fuse could be caused by replacement of a failed fuse element by one having different characteristics, or by simple deterioration of the fuse element in course of time.
(*b*) They can be switched on again after operation and will remain on if the fault has cleared itself, or will cut out again instantaneously if the fault has not cleared; whereas fuses involve removal of the carrier, replacement of the fuse element, and refitting the carrier, even though the fault may have been of a temporary nature.
The disadvantages of circuit breakers are increase in cost compared with fuses, and the possibility that under conditions of long use without maintenance, they may depreciate and cease to act when they should do so.
Similar considerations may apply to the use of large circuit breakers in place of switch fuses at main control positions, but the points mentioned in the preceding paragraph have generally precluded the widespread adoption of circuit breakers in this country both in respect of main control and circuit control and protection.
Fuses themselves may be divided into two classes.
First, the rewireable type; second, the cartridge type.
In the rewireable type the fuse element is a length of wire and can be replaced when blown by anyone with wire which may not be of the correct size or material. The classic expression is " hairpins " and the risk is that a fuse wire may be more substantial than the cables and equipment it is supposed to protect.
Nevertheless the vast majority of fuses are of this type and in general they operate satisfactorily.
The other class of fuse is the cartridge type in which the element is embedded in an insulating powder, the whole being housed in a cartridge case. Once one of these fuses blows, it must be discarded and a new fuse installed. Usually fuses of different current carrying capacities are of different dimensions and only the correct size of fuse cartridge will fit into the fuse carrier.
Cartridge fuses themselves may be divided into two classes, the ordinary cartridge and the high rupturing capacity type (H.R.C.) respectively.
The provision of large power stations and transformers gives immense energy to short circuit currents should they occur near to the supply point. The H.R.C. cartridge takes care of this energy and is designed satisfactorily to clear the circuit under the worst fault conditions. It is, therefore, usual to provide high rupturing capacity fuses at those positions on the consumer's installation which are nearest to the Electricity Board's service terminals, and to use ordinary cartridge or rewireable fuses at other positions on the installation.



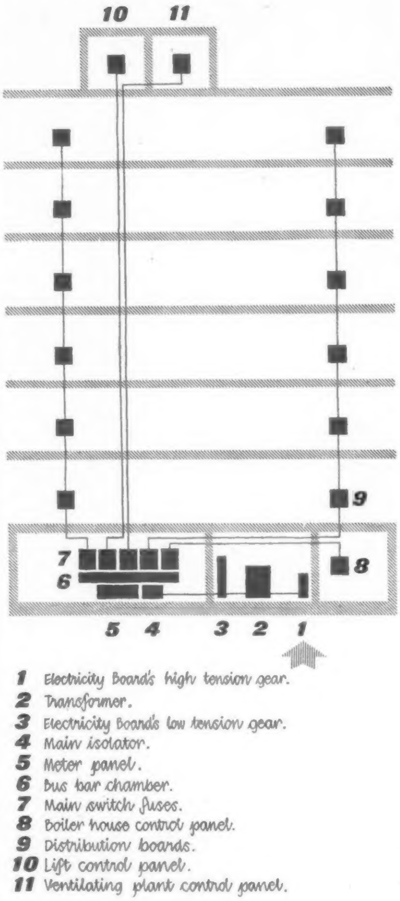
3. *A typical cartridge fuse and carrier.*

SERVICE TO BUILDINGS

Under this heading an account is given of the manner in which electricity is controlled, metered and distributed from the point of entry into the building, to the outlets from which appliances are fed.

4. ***A combined main switch with fuses for 5-, 10- and 15-amp. circuits. The switch dolly is recessed flush to avoid accidental switching.***

As the normal distribution in bulk is at high voltage, transformers have to be installed to reduce the voltage to that required by the consumer.
For small installations, e.g. private houses and the like, a transformer would be provided in the street as part of the main network of distribution, and cables conveying current at standard voltage would radiate to the various individual premises.
Where buildings are very large or where heavy loads are required, the Electricity Board may ask for the use of part of the premises to house the transformer equipment in order to enable them to give the supply required.
The provision of a transformer chamber in a building may use valuable space and may present structural difficulties; and every case must be considered in conjunction with the Electricity Board.
It is essential that the transformer chamber should have direct access to the roadway to enable the equipment to be changed in case of breakdown, and it must also be adequately ventilated. The size of chamber required is usually of the order of two hundred to three hundred square feet, and eight feet of head room should be allowed.
In certain areas the Electricity Boards have generally standardized transformers at 500-



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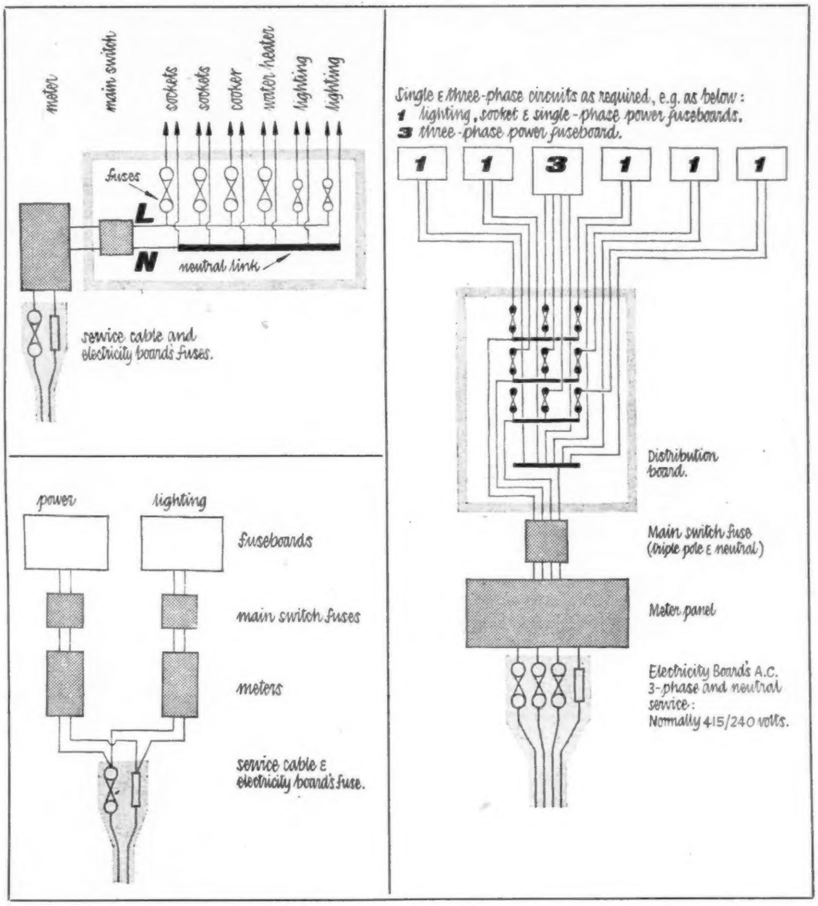
Schematic illustration of the main distribution and principal items of equipment usually needed in a multi-storey building.



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Schematic illustration of electrical distribution from the service intake point. Top, a domestic installation. Above left, an installation for small premises. Right, a relatively large installation.

kVA. and it is for this reason that there is never very much variation in the size of transformer room required, whatever the size of the building.

Where very large buildings indeed are concerned, room may be required for a second transformer, or, more commonly, two transformer stations would be built.

Where the loading of 500-kVA. is in excess of that required for the building, the Electricity Board may arrange for the transformer to supply other buildings in the vicinity.

Normally, the transformer chamber must remain under the complete control of the Electricity Board and they will require the sole right of access at any time. It is, therefore, necessary to provide a separate room in which to house the equipment required by the consumer for the control and protection of his installation. This room is usually known as the switch room and will vary in size according to the building it serves; in all cases it should possess one clear wall against which switchgear can be mounted, and should be of sufficient width to enable adequate clearance to be given. The minimum size of switch room for a large building would be of the order of 12 ft. by 8 ft. In a small building or a private dwelling, however, a switch room as such is not usually required, and a convenient position can be found on the wall of a suitable passage or lobby on which switchgear may be mounted.

In all cases switchgear should occupy a position as near to the centre of the electrical load as possible; it is obviously economical to use the shortest possible runs of heavy cable.

Metering

An important consideration in the design of an installation is the type of tariff on which electricity will be purchased. At one time it was very common for commercial buildings to be supplied at two different flat rates per unit according to whether the electricity was to be used for lighting or for heating and power purposes. For example, lighting might be supplied at 5d. per unit and heating at 2d. per unit. This method of charge was most suitable when the consumption, particularly for heating, was not expected to be very large.

On the other hand, taking supplies of electricity on two different flat rates meant that in practice there had to be two meters and two different and distinct wiring installations, which not only increased the first cost but also caused inconvenience in use since lighting, e.g. a portable lamp, could not be connected to a heating circuit or socket-outlet.

In order to overcome these objections Electricity Boards have introduced other types of tariff which can be generally classified as "single meter" tariffs. There are two principal types: first, a block tariff under which blocks of units are charged at reduced prices for larger quantities. The first block may consist of a certain number of units charged at a primary rate of say 5d. per unit, a second block will consist of further units charged at a secondary rate, say 2d. per unit, and all units in excess are charged at a final rate, say 1½d. per unit. The number of units in the first and second blocks is usually based on the floor area of the building or the number of lamps installed.

The other common type of single-meter tariff is the two-part tariff in which the first part is a fixed charge payable each quarter, regardless of the electricity consumption, and the second part a running rate per unit of electricity used for any purpose. In practice, the fixed charge generally depends on the size of the building or the number of lamps installed or the maximum power required. As the fixed charge covers the overhead costs of the Electricity Board the running rate per unit is a low figure of say 0·6d. plus an additional amount depending on the cost of coal delivered to the power station.

The choice between one type of tariff or another can best be made after discussion with the Electricity Board who will be pleased to advise intending users which tariff will suit them best having regard to their proposed usage.

Distribution System

The distribution system of an installation covers the cable and equipment used to divide, control, and protect an installation between the service, the main switchboard and the final outlet points. It comprises main and sub-main cables, switch and fusegear, and the local fuseboards from which circuits are run to the required final positions.

At the service position, the first division of the installation takes place in a switchboard where switch and fusegear may be provided for the control of outgoing feeder cables for various services and various parts of the building.

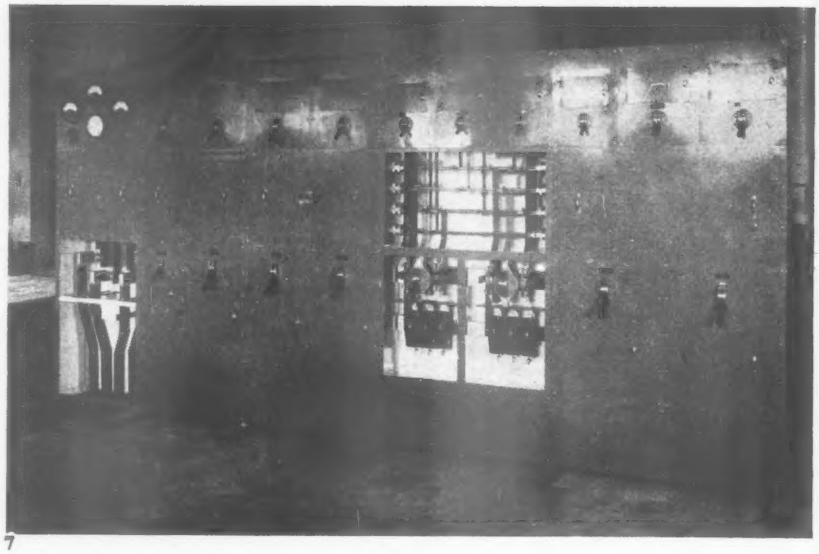
It is usual for the switchboard to be ironclad, and modern practice inclines towards the cubicle type of equipment in which the component parts of the board are built into a neat cubicle assembly, as distinct from the usual type of board in which the component parts are fitted on to a framework and connected together by means of odd lengths of interconnections. The cubicle board may save valuable space.

Switchboards, especially the cubicle type referred to, may be furnished with built-in meter panels so that the whole assembly of equipment in the switch room is self-contained and readily accessible.

Cables may be lateral, or vertical, according to the type of building served, and should be designed to feed centres of distribution so arranged as to ensure that no outlet point is more than about 50 ft. from a fuseboard. In multi-storey buildings of large extent, it is necessary to provide rising main cupboards on each floor, and from experience it is found that these should be located not more than 100 ft. apart.

The vertical cables pass upwards through switch cupboards linking at each floor into the control equipment for that floor in that area. Vertical ducts are thus required to house the cables between floors; the essential features of both the vertical ducts and the rising main cupboards are that they should possess clear wall space on to which the cable and the equipment can be fixed, together with an enclosure for protection. If the enclosure over the rising main cupboard is fitted with doors to open the full width and height, the depth of the cupboard need only be such as to accommodate the depth of the equipment; 18 in. to 2 ft. should be adequate. The size of the switch cupboard depends on the type of installation and on the requirements of the building, but for a fairly large multi-storey office building may be of the order of 5 ft. to 6 ft. wide, and, say, 7 ft. high. The rising duct itself between floors may need to be only one or two feet wide by a few inches deep, and as access between floors is not normally required, a protective shield for the cables is all that is needed. The apertures through the floors must be sealed under fire regulations.

The fuseboards feeding the final outlet points may be housed in the main switch cupboards, or it may be desirable further to extend the distribution cables and install fuseboards at positions remote from the rising main cupboards at convenient positions for the points they control.



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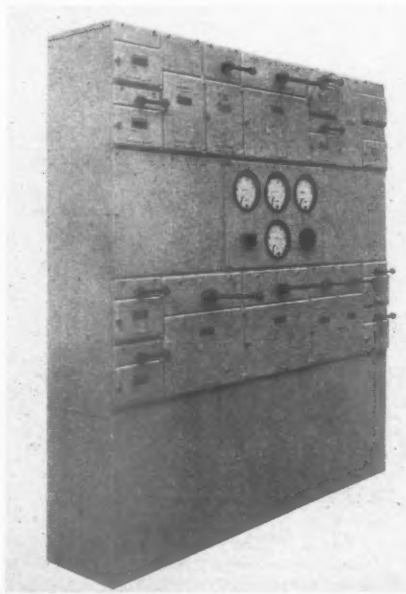

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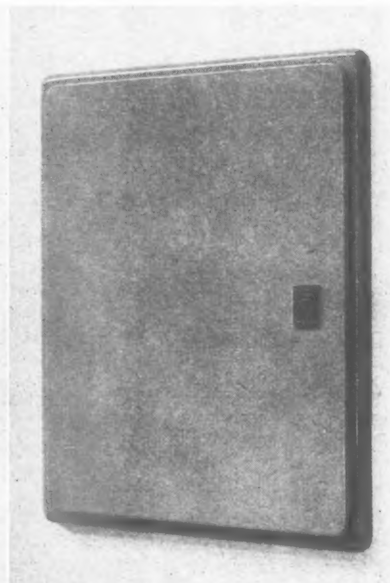

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Switch and fuseboards. 7, a cubicle-type switchboard during course of manufacture. 8, a unit-type switchboard with in-built meter panel, showing how switchgear in unit sizes can be added to as required. 9, a metal fuseboard for fixing in a 4½-in. recess. The door and frame are fitted after plastering, with screws which allow for different plaster thicknesses. The board is available in various sizes.

In multi-storey factory buildings, somewhat similar conditions apply except that lateral feeders may be taken from the rising duct to fuseboards situated at any positions which are convenient for the electrical requirements of the building. In single storey factory buildings, somewhat different conditions obtain, and it is usual to run feeder cables to a central point in each shop where the fuseboards can be placed, or if the shop is very large, from where further sub feeders can be run to the fuseboards.

In blocks of flats, the vertical distribution system with rising main cupboards is normal, but local distribution in each flat is from a suitable control unit in the flat, the unit being fed by a lateral cable from the rising main cupboard.

Circuits

Circuits comprise the final wiring from distribution centres or fuseboards to the outlet points.

Circuits should be designed to limit the extent of failure of points in an area in the event of fault, and it is not usual, therefore, to connect more than six or seven lighting points to one circuit.

Technical considerations in regard to the capacity of cable and the voltage drop that may occur in long runs of inadequately sized cable, also affect the circuiting arrangements.

Power outlets are normally connected separately, each outlet to one circuit, but in the ring main system of connection, which is described in detail on page 612, the number of points connected to a circuit is governed not so much by the possible individual load of each outlet but by the possible load that may have to be dealt with in the whole area covered by the ring. As in this system each plug head is separately fused, a fault should only affect the particular item of apparatus on which it occurs.

Lighting and Switching

Insufficient attention is often paid to the provision of adequate switching for lighting and certainly not enough regard is paid to the availability of two-way and intermediate switching. It should be possible to obtain light by switching from any door into a room, and at least a proportion of the lighting points should be controlled two-way from door to door.

Large areas may be controlled by groups of switches situated at strategic positions, but it is a matter of individual consideration as to whether each point should have its own switch (which makes for economy in use of current) or whether a number of points should be controlled by one switch (which makes for quick convenience).

In areas where group switching is undesirable and where partitions or corridors are not available, ceiling pull switches may be installed although maintenance costs on this particular type of equipment are somewhat heavy.

Modern types of switches allow great flexibility in operation. For example, master control can be given so that all lights over a given area can be put on irrespective of the position of local switches, or all lights can be switched off, again irrespective of the position of local switches.

Contactor control for heavily loaded apparatus can also be used, with push buttons controlling the contactors situated wherever they are needed.

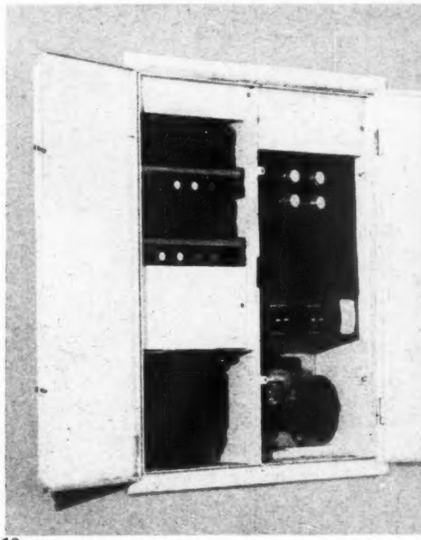
Pilot lighting and night watchmen's lighting are other uses for which special arrangements are desirable.

Prefabricated Wiring

Attempts have been made to design prefabricated wiring systems, but in practice they can only be used in mass-produced buildings which, preferably, are single storey.

Prefabricated wiring installations have usually taken the form either of a central connecting box from which cables of the correct length, suitably connected, may radiate to points and switches; the box may be fitted in the roof space and the cables laid out to their correct positions. Alternatively the whole of the wiring may be made up in the form of a harness and fitted into position.

The nearest approach to electrical prefabrication that can be made in an ordinary building is to ensure that all outlet points are at the same distance from each other and from the structural features of the building, so that lengths of conduit or cable may be factory cut and assembled in position on site; these conditions, however, very rarely arise, even when the building is designed on a constant module.



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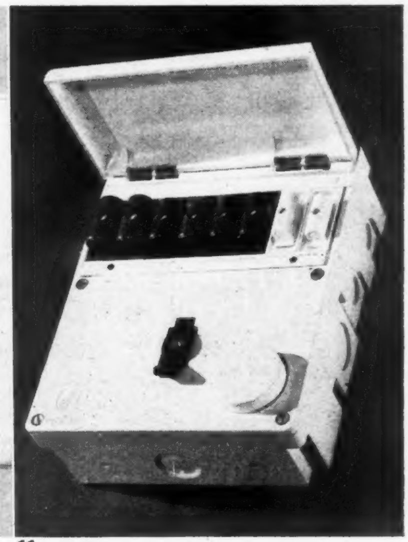

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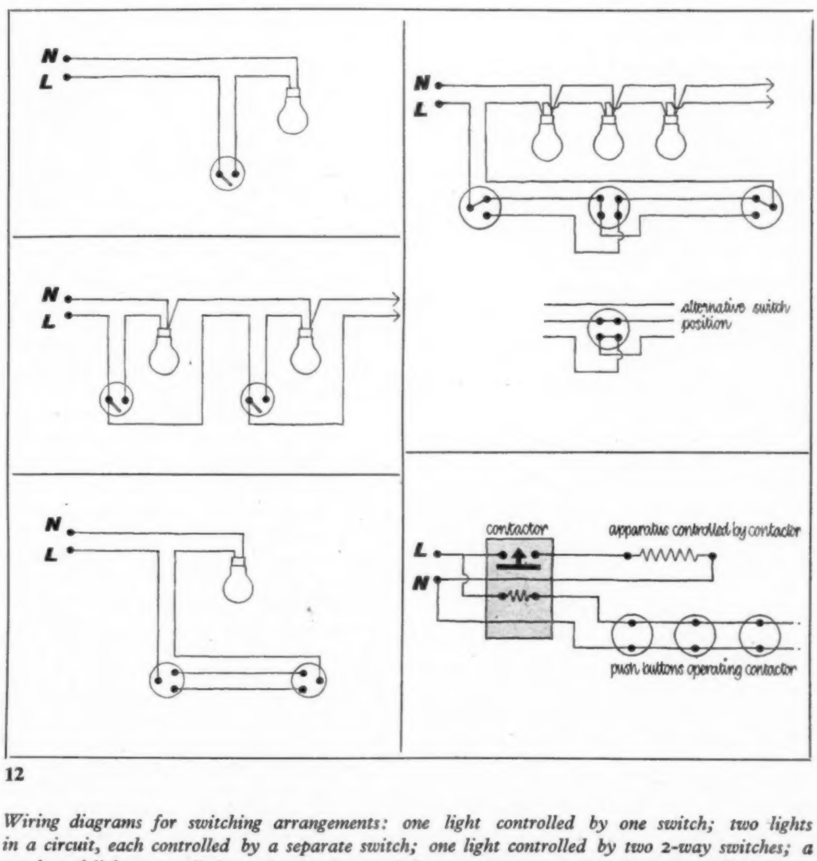
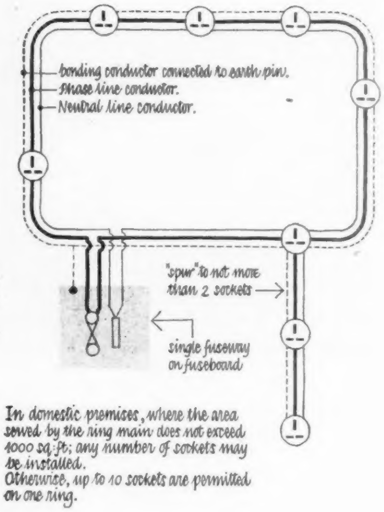
10, a flush sunk consumer control unit as used for houses at Crawley new town. 11, a fuse box assembly suitable for houses or flats. This would be mounted with the Electricity Board's fuse and the consumer's meter.



12

Wiring diagrams for switching arrangements: one light controlled by one switch; two lights in a circuit, each controlled by a separate switch; one light controlled by two 2-way switches; a number of lights controlled together by three switches; contactor control (where the loading is too heavy to be carried by the push button switches, these operate a contactor—by means of a coil—which completes the circuit through the apparatus).

THE RING CIRCUIT



13

Schematic illustration of the ring circuit.

The most important post-war development, especially with reference to domestic wiring, is the 3-pin 13-ampere socket made in accordance with British Standard 1363, used in association with the ring-main system of wiring. It may be assumed that this socket will ultimately displace the many other existing types. Various factors led to its introduction.

There had been previously a number of different standards for socket sizes, among the more important of which were the 2-ampere for lighting, the 5-ampere for small power, and the 15-ampere for normal power requirements.
The I.E.E. Regulations specify the number of sockets that can be connected on a circuit, and in the case of the 15-ampere power socket, each outlet has to be on a separate circuit. These arrangements are related to the size of the socket itself. It is not, however, possible to foretell the nature of the apparatus that will be plugged in, and the 15-ampere socket might, on occasion, be used to feed a small piece of apparatus having a loading of a fraction of an ampere. As the circuit would be protected by a 15-ampere fuse, the result might be that if a fault developed, the current would not be heavy enough to blow the fuse.

On the other hand, there was nothing to prevent a consumer overloading the smaller size of socket with heavy apparatus.

Two other factors arise; the first is that if for the sake of convenience two or three sockets are required (although only one might be used at the time) the Regulations can make no discrimination and wiring has to be provided as if all the sockets might be in use simultaneously.

The second factor is a lack of convenience due to the fact that if sockets of different sizes are installed in a room, only the size appropriate to the plug-head can be used for any one appliance; from which it follows that although several sockets might be installed, only one could be used for a particular piece of apparatus.

The new socket is intended to be used universally so that any apparatus can be plugged into any socket. The plugs (i.e. the plug-heads that are inserted into the sockets) are fitted with cartridge fuses of a size which relates to the apparatus to which they are connected and not to the rating of the socket.

The general method of connecting these sockets is on the ring main principle. The ring main is designed to give facility for the maximum loading which can occur in the area of the building which it serves. The maximum loading may be taken to represent the maximum amount of heating that can be used (put simply, this means that in a room which a two-bar electric fire would make comfortably warm, no greater load can be used however many socket outlets are installed).

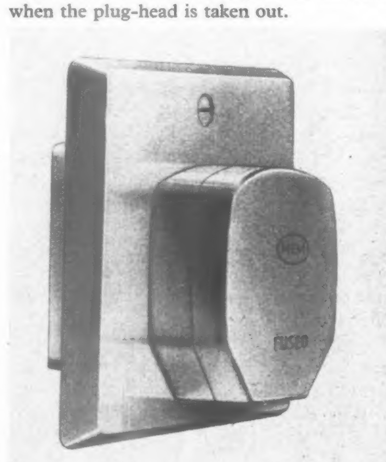
Thus the size of the circuit is related to the conditions of use rather than to the somewhat hypothetical rating of the socket outlets.

In a small house, the I.E.E. Regulations allow an indefinite number of 13-ampere socket outlets to be connected to each ring main. In other buildings, certain limits are provided, but these are still based upon the above considerations.

It has already been stated that if a number of 13-ampere sockets are installed in a room, any piece of apparatus can be used at any outlet, but perhaps the most important point, which may easily be lost sight of, is that once the ring main is established, the cost of additional socket outlets does not go up in proportion to the number installed; the cost is in fact very much less and no serious expense is, therefore, incurred by the addition of socket outlets for convenience purposes. In considering domestic interiors, there is no doubt that a minimum of four socket outlets should be provided as standard in any reception room, and at least three in any bedroom.

It may be noted that the sockets themselves have a rating of 13 amperes as representing a capacity of three kilowatts at the then standard supply of 230 volts alternating current. Although the standard has been subsequently altered to 240 volts, the rating is to all intents and purposes the same.

With regard to the design of the socket, as it is vital that only fused plugs should be used, it was essential to ensure that plug-heads of a different standard could not be used. It was, therefore, decided to provide rectangular pins and thus form a completely new standard. It was also decided that all sockets should be shuttered to shield all live parts of the outlet when the plug-head is taken out.



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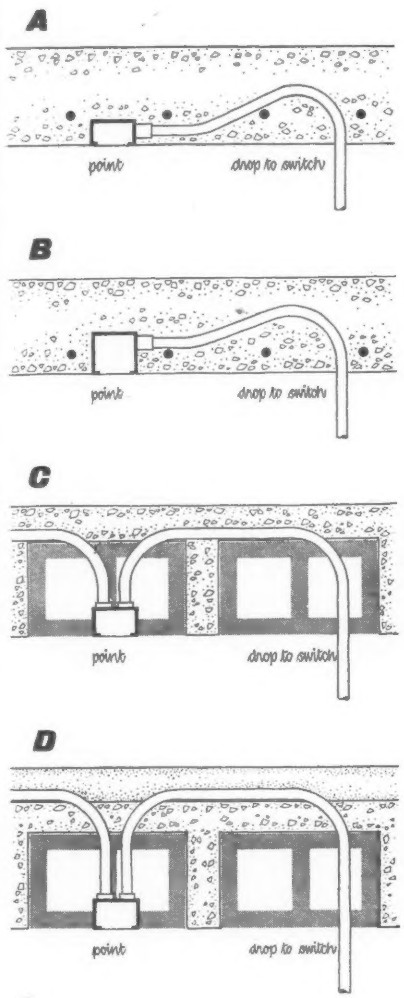
Typical 13-ampere socket and fused plug.

INSTALLATION



15

Different ways of arranging conduit in pre-cast or " pot " and in situ floors. See page 614 ; bottom of column.

What follows is divided into four sections. The first three deal with installation for: Lighting, Heating and other equipment and Telephone systems. The last section is a review of switches and electrical accessories for special purposes. The four sections are introduced by an account of installation methods for present-day building construction, in general terms.

Choice of Installation Materials

The range of cables and conduits now available to the electrical engineer is far too wide to be reviewed in detail here but they all fall into one or other of two classes described below. First, the main varieties are tabulated and commented upon briefly as follows :

Steel conduit. May be heavy or light gauge, solid drawn, welded, brazed or close jointed, and used (according to system) with screwed or grip accessories. Conduit of material other than steel, including copper, rubber type, and plastic: rigid or flexible.	In all conduit systems, the conduit itself acts as a mechanical protection as well as the "pathway" for the wires conveying the current from one part of the installation to another.
Lead covered cables. Mineral insulated copper covered cables. Tough rubber-sheathed cables. Plastic insulated cables.	All of these types of cable have a closely fitting sheath which protects the insulation of the cable.
Paper, bitumen, or cambric insulated cables, lead sheathed with or without wire armouring.	These cables are usually employed for heavy distribution, especially when underground, the lead sheathing acting as a seal as well as a mechanical protection, and the steel armouring acting as a further mechanical protection where required.
Duct systems.	In which purpose-made ducts on the ceiling or walls or under the floors are built into the structure to carry insulated cables.
Copper bars.	A system in which the copper conductors are not themselves insulated but are supported on insulators and enclosed in a metal or other enclosure, and from which connections can be tapped off at convenient positions on the run.
Grid system of cabling.	Cables are made up on a steel straining wire, which may be stretched across large areas of buildings with minimum of suspension.

There are of course many sub-divisions of the above types but the headings given cover the most important.

It will, however, be seen that, diverse though the various types are, they fall into two general categories, those systems in which a *pathway* is formed in a building by means of conduit or duct through which wires can be drawn in at any time during the life of the installation, and those systems in which the cable is covered by means of a protective sheath, the sheath and the cable forming a complete integral assembly. Usually the " pathway " systems are used for concealed work and especially in solid construction buildings, whilst it is normal for the closely sheathed cables to be used on the surface of walls and ceilings either in new or old buildings.

Under certain conditions, however, some of the closely sheathed cables may be buried in the structure, although it is not regarded as good practice to do so, as once installed the cables cannot be reached in the event of breakdown without cutting away the structure even if the position at which the breakdown has occurred can be traced.

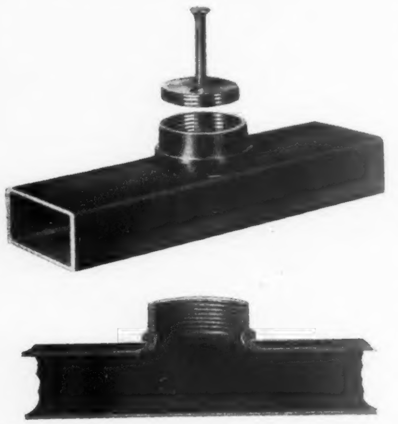
Having in mind the foregoing general considerations, they may be applied under the following headings:

1. The wiring installation chosen must be such as to enable it to withstand mechanical damage, during installation and under conditions of use.
2. The wiring should be capable of being replaced at some time in the future should this be required for any reason, without undue disturbance to the building.
3. It should be capable of taking a larger load in the future without extravagance at the time of installation.
4. It should be capable of being extended or modified neatly and without serious disturbance to the building.
5. It must not be affected by the materials of which the building is made or by processes that may occur in the building, e.g., chemical, thermal etc.

It has been customary in this country to consider heavy gauge screwed steel conduit as the normal standard by which other types of installation are judged, but sufficient has been said above to indicate that other systems may be regarded as just as satisfactory if the conditions justify their use.

Much trouble and ultimate expense can be saved if these points are given full consideration at the very earliest stage in the building design. By means of consultation between the architect and the electrical engineer at this point, recommendations can be made regarding the type of installation most suitable for the particular construction; and the construction can be so arranged as to accommodate the type of installation chosen.

As conditions are so diverse, it is not feasible to give general examples of the detailed relationship between the building and the type of equipment to be chosen for the electrical



16

Section of metal underfloor duct with outlet and screwed brass plug.

requirements, but the following general suggestions may be helpful:

(*a*) If the wiring material has to be exposed to atmospheric conditions, all ferrous metal work of the installation should be galvanised or otherwise protected.

(*b*) If the nature of the structural elements of the building is inimical to certain metals, as, for example, may occur with various plasters or special floor coverings, the use of such metals should be avoided.

(*c*) Where frequent changes may be expected in the use to which a building is put, particularly under factory conditions, the whole of the installation should be accessible, i.e., it should be run on the surface; the particular requirements for the wiring installation may then be related to the processes that will occur in the particular factory or building.

Installation of Conduits

The installation of conduit in modern buildings of concrete construction presents a number of difficulties and problems which can be overcome more easily in the design stage of the building than if left to the time of its actual construction.

It is essential to be able to withdraw and draw-in cables in the conduit system without disturbance to the structure, and the method used is to run the conduit from outlet point to outlet point, and from outlet point to switch outlet, using these outlets as the positions from which wiring can be drawn. In rare instances the distance between outlets may be excessive and it then becomes necessary to install draw boxes to which permanent access must be obtained either from traps in the floor or from covers in the wall, both methods being undesirable.

The installation should therefore be designed so that the length of run from outlet to outlet does not exceed 20-30 ft. The conduit between outlet and outlet should be as straight as possible.

In running from ceiling point to ceiling point, the conduit may in pre-cast or " pot " floors, be installed as shown on page 613.

In example (*a*), the conduit is laid on the shuttering, avoiding reinforcing rods by being bent slightly over or under them.

In examples (*b*) and (*c*), the boxes are placed on the shuttering and the conduit is run between them before the concrete is poured, being taken vertically out of the back of the boxes to lift it to the height required, and thence bent round to its horizontal run.

In example (*d*), holes have to be left in the concrete slab while it is being cast and the conduits are then laid after the concrete has set, being run on the upper surface of the concrete and bent down to the conduit boxes which are inserted into the holes so provided. Under this system it is necessary to mark the positions of the holes on the shuttering and at that stage in the building they have to be related to features then existing, such as the stanchions or main walls. Care has then to be taken that the moulds forming the holes (which may comprise cardboard rolls, length of scaffold pole, or portions of pots), are placed in the right positions and held very firmly while the concrete is being poured.

To house the conduit in the screed, the latter must be at least 1¼ in. thick, apart from the depth of floor finish.

For the provision of switch drops, the conduits under any of the three systems described have to be continued forward in the slab structure to points above the future partitions, where they are bent down and left in readiness to be picked up at a later date when the shuttering has been removed and the partitions are being built.

To accommodate the conduits, partitions must be grooved or chased and such grooves should normally be an inch deep to ensure that the level of the conduit is flush with the partition material. If it projects, there will be a thinning of the plaster along the line of the conduit, which might give rise to cracking at a later date.

Conduit runs for low level points (usually referred to as skirting points, although the outlets may in fact be installed above the skirting) are normally run on the upper surface of the concrete slab in the depth of screed. In these circumstances they may cross any conduits installed in the screed for the ceiling points below, but the installation can be designed to ensure that the conduits cross immediately above the ceiling outlet points and pass through the space between the bending down of the conduits to the outlet boxes.

It is essential that all conduits should terminate in boxes, and to ensure effective bonding they must be joined to the boxes by screwed connections very carefully tightened.

It may be noted that the usual size of conduit employed for circuit wiring of this sort is ¾ in. outside diameter (1 in. outside diameter at the sockets joining consecutive lengths), but in some cases ⅝-in. conduit may be used. This leads to some constriction of wiring space and is not advised.

For heavier cables, 1-in. conduit or more may be necessary; the largest conduit in normal use is 2 in. in diameter.

Modern Construction

The details given above apply to the types of concrete construction in general use, but the modern constructional forms now being designed are causing difficulties in respect of the installation of services, and special methods have to be considered in each case. Three characteristic difficulties may be listed as follows :

(1) The presence of prestressed steel wires precludes the possibility of knocking holes in the structure.

(2) The concrete floor construction, instead of being cast *in situ*, is in precast units laid into position.

(3) The amount of screed above, or ceiling finish below, is reduced to a minimum which will not accommodate the thickness of conduits.

For these new methods of concrete construction, no general rules can be stated as each design must be treated on its merits. In such cases the best course is for the architect and structural engineer to collaborate with the electrical engineer in the working out of precise installation drawings. Thus chases and holes may be incorporated in the structural units during manufacture.

If the design of the structure is such that the outlets required bear continuous relation to the building features, it may be possible to standardize the hole requirements in each ceiling block.

In detailed pre-planning of this kind it is necessary to allow for bends at changes in direction of the conductor; these are:

Mineral insulated copper covered cables	Approximately own radius
Rubber or lead sheathed cables	Approximately own radius
Heavy gauge screwed conduit	To a radius approximately six times the diameter of the conduit
Light gauge conduit	If brazed or welded, can be bent by machine by careful handling, to the same radius as heavy gauge conduit
Lead covered mains cable	To a radius approximately twenty-four times the diameter of the cable
Armoured cable	To a radius approximately twenty-four times the diameter of the cable

These figures are important under the following considerations :

(*a*) Where conduit is being used, especially where it has to be bent through the thickness of the structural slab, the minimum depth required for the bend is 4 in. plus.

(*b*) Where mains cables are being used, a considerable amount of room must be available for the sweep of the cable wherever it has to change direction.

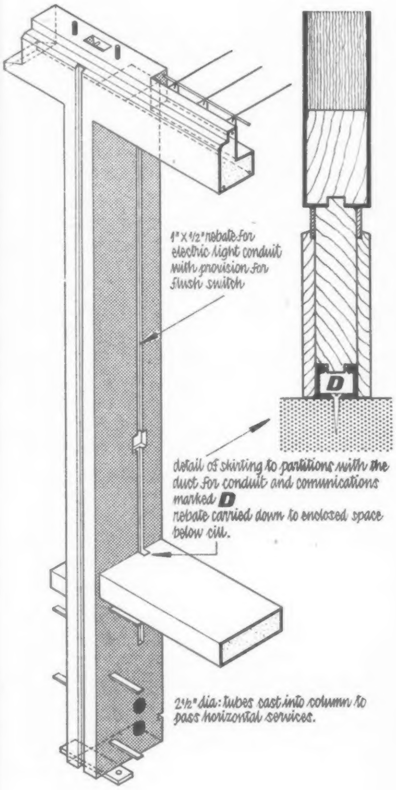
Provision for the Future

The various pieces of equipment to which reference has already been made, and the uses to which a building may be put, may cause changing conditions not once but many times during the life of the building and the installation.

It is, therefore, necessary to consider what can be done to provide facilities for alterations and adequacy for future requirements without an inordinate initial expenditure.

The answer to this problem lies in the design of the installation and may be summarized as follows :

(*a*) All equipment, cable and apparatus, should have a reasonable margin for an increase in load. This does not mean that materials should be chosen extravagantly but it is usually sufficient to go to the next higher standard size of cable or equipment after giving full consideration to the maximum load that may occur under the conditions for which the installation is initially designed.



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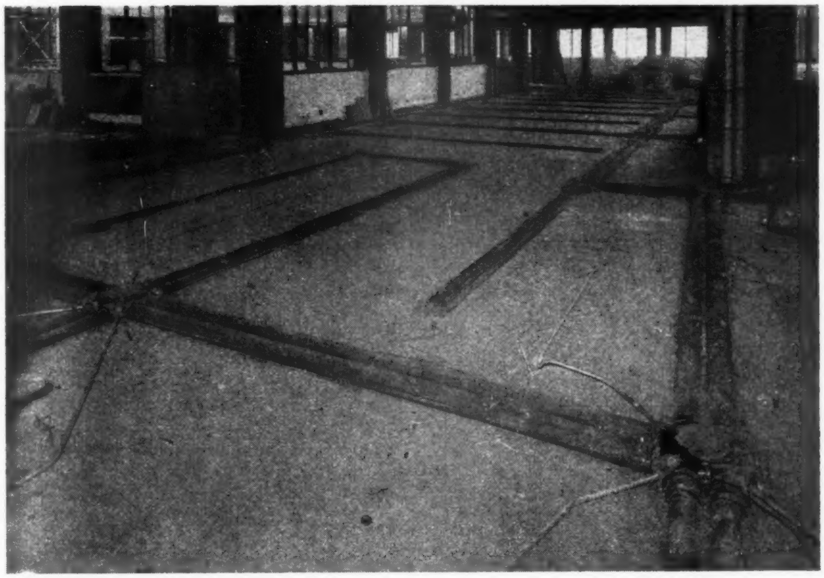

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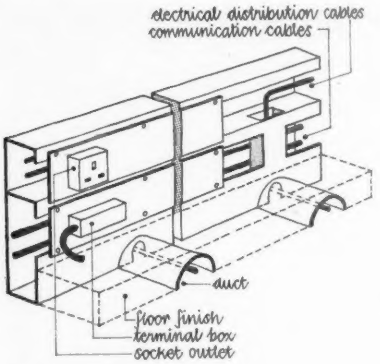
17, the perimeter cabling system at Fielden House (architect, John Lacey, engineer, F. J. Samuely). Holes were cast into the p.c. concrete frames of the external wall for the perimeter cables, and chases into sides of vertical members to reach switch positions. 18, fibre insulated duct of h.r. section showing coverage to permit access from the finished floor surface along lines at approximately 5-ft. centres. 19, metal underfloor duct system being laid. The duct is of three sections to accommodate 230-v. wiring, GPO telephone, and other communication systems. Note the floor outlets, the feeder conduit boxes and the cross-over boxes. 20, typical false ceiling construction, showing space available for later alterations to ceiling outlets.

(*b*) Space should be allowed for the addition in the future of cables and equipment. On the switchboard, for example, there should be space for extension. Where cables are being run, room should be left both in the structure of the building and on any racks or shelving that may be used, for further cables to be added. Spare ways should be provided on fuseboards to allow extra circuits to be added.

(*c*) All outlet boxes to have spare spouts or holes and all fuseboards and similar equipment to have spare holes to take the conduits that may be required at a later date.

(*d*) In the design of the structure itself, allowance should be made for the possibility of extending wiring from outlet points already provided, to additional points without the necessity either of damaging the structure or of running obtrusive wiring material on the surface.

This point is very difficult to achieve as far as the ceiling structure of modern buildings is



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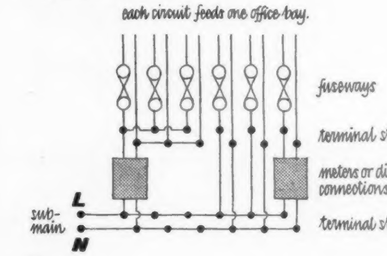
One alternative to conduit. A metal or plastic skirting divided to separate electrical from telephone services.



22

Linking arrangements for office buildings. Each fuse feeds one bay of the building, and the terminal studs may be connected for any number of bays to be fed through one meter. Alternatively, each bay may be separately metered, according to the tenancy arrangements.

concerned, unless false ceilings are extensively used, but fortunately most of the electrical services in a building (with the one important exception of general lighting) are run in the floor.

The modern way of providing facilities for extensions and alterations is, therefore, the use of underfloor ducting; this is incorporated in the floor structure and outlets may be taken either directly from the duct or by means of extensions from the duct to outlets on adjacent walls.

Underfloor ducts are invariably divided into compartments, one section being suitable for the comparatively high voltage requirement of lighting and power, and the other section for the comparatively low voltage requirements of the various communication systems, for example, G.P.O. or internal telephones.

Underfloor ducts may be made of a number of materials, metal or non-metal, and to house the duct a depth of screed is required over the structural floor; since it is only possible to give the facilities required in a large building by means of underfloor ducts, the depth of screed required should be considered at the earliest possible stage in the planning of the building. To house the duct, 2½ in. may be regarded as the absolute minimum space required between the structural floor and the finished floor surface (wood blocks, linoleum or other floor finish, being included as part of the 2½ in.), but 3 in. is preferable and enables a larger section of duct to be used.

The ducts require draw-in positions at distances of 25 ft. apart and it is usual to fit an adjustable tray over the outlet boxes at these positions, the tray being itself filled with the flooring material.

If outlets for points are taken direct from the duct itself, they may be of two forms. The first method is for permanent outlets (indicated on the floor surface by removable brass plugs) to be provided every few feet; and the second method is to cut through the floor screed into the duct whenever an outler is required and to insert a connector piece. In either case suitable boxes are used above floor level to house the socket, or piece of apparatus required.

Change of Tenancy

One of the problems of modern office buildings is to cater for change of tenancy and it is usual to provide panels in the rising main cupboards in which linking arrangements are designed to enable any single office or group of offices to be individually controlled and metered.

Every building has its own special requirements in this direction but the panels should comprise :

(*a*) Link connections from the rising main cables to give the capacity and number of phase connections required. (Fig. 22)

(*b*) A main control switch or fuse.

(*c*) A linking device to enable connections to be taken to as many meters as required and as many fuse ways as are necessary.

(*d*) Fuse ways to feed circuits, each circuit feeding the points within one bay of the building; it being assumed that a bay is the smallest unit which can be let separately.

If panels as described above are not used, it is found very difficult indeed to separate out the metering and fusing requirements of individual offices when tenancies are changed.

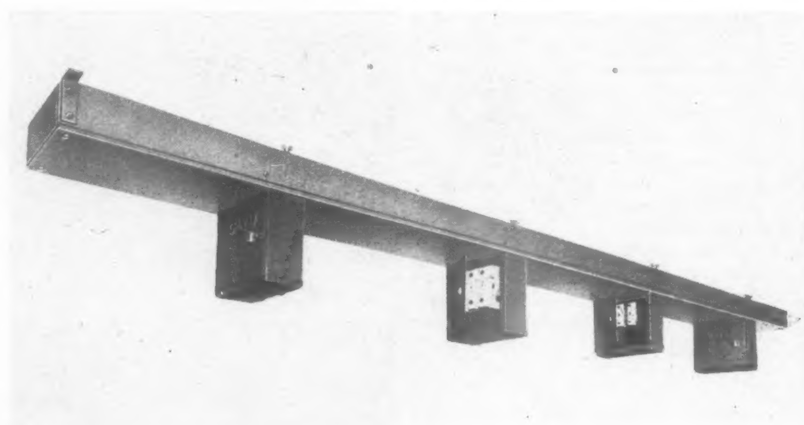
Change of tenancy may often involve change of partitions. It is, therefore, desirable to incorporate conduit outlets at natural partition lines whether the partitions are being erected or not in the first instance, so that extensions can be taken on to partitions and thence to switches or other outlets without difficulty.

Factory Installations

The general principles on which factory installations are designed are similar to those already described except that it is desirable for all work to be installed on the surface in view of the frequent modifications that will usually occur. Even apart from this consideration, the structure of factory buildings does not normally lend itself to the concealment of the installation.

In factories, therefore, ease of addition or replacement of wiring and equipment is the essential factor and this may most satisfactorily be achieved by the use of trunking systems with copper bars or by lines of ducts in which cables may be run. In both cases tap-off connections can be taken from any point in the run of the duct to the machines.

The former system is economic for the larger sizes of equipment and should be used where loads of 100 h.p. or above have to be catered for. The duct system is more suitable where smaller loads are used.



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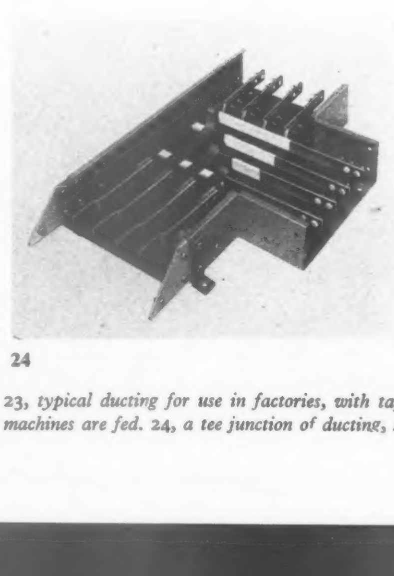

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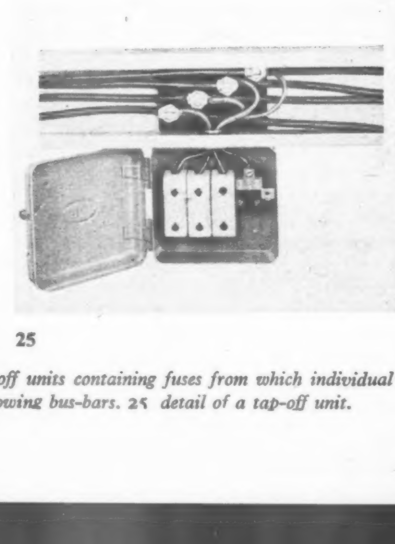

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23, typical ducting for use in factories, with tap-off units containing fuses from which individual machines are fed. 24, a tee junction of ducting, showing bus-bars. 25 detail of a tap-off unit.

As far as possible, lines of duct or trunking should be installed at truss level above lines of machines. In the trunking system each tapping will be controlled by its own fuse unit fixed to the trunking, but in the case of the duct system, fuseboards should be installed at convenient intervals and the circuit wiring run through the duct and thence to the machines. Under-floor ducting may be used in machine shops but has certain disadvantages in that holding-down bolts must avoid the line of duct and liquid may penetrate into the duct.

INSTALLATION FOR LIGHTING

The wiring requirements for interior lighting may be very simple or very complex according to the nature of the lighting required. Great advances have been made in recent years in artificial lighting both in the illumination considered adequate and in the variety of techniques and lighting equipment used. The full possibilities of interior lighting require, for their realisation, a wiring installation which is tailored to a detailed design as distinct from the routine provision of symmetrically disposed ceiling points. In the ideal case the lighting design will proceed concurrently with the building design and a detailed lighting specification will be available from which the precise wiring requirements can be determined. This is not always possible, however, and even when it is, the architect may require a close estimate of his likely wiring commitments at an early stage both for estimating purposes and for design of mains services, control room space etc. The following notes are intended as a guide to the assessment of the wiring requirements for interior lighting in premises of various kinds.

Illumination Requirements

Table I gives recommended illumination values* which are considered to be the minimum adequate for various interiors and occupations.

Light Sources

Most commercial and domestic lighting is by tungsten filament (incandescent) or tubular fluorescent lamps and the wiring requirements will differ considerably according to the choice of lamp. Fluorescent lighting is now very extensively used, one of its merits being that it requires approximately one third of the wattage of filament lamps for the same amount of light from the lamps. The wiring capacity required is thus reduced considerably and this fact will be reflected in savings both in services, rising mains and even in switchgear and the switch room. Although this saving may be very substantial, and may well prove a decisive factor in the choice of fluorescent lighting, consideration must be given to the following modifying factors:

1. Allowance must be made for circuit losses in fluorescent control equipment; it is usual to assume a gross load of 100 w. for the 5 ft. 80 w. Fluorescent lamp and proportionately for other sizes.
2. Due to the current surge caused by the control gear on switching, the total rated wattage of lamps permissible on any final sub-circuit is only half that which is permissible for tungsten filament lamps. For instance it is permissible on a 5 amp, 240 volt sub-circuit to have $5 \times 240 \times 1{,}200$ watts of tungsten filament lamps or 600 watts of fluorescent lighting.
3. The power factor* of the lamps is below unity even when corrected by the addition of a capacitor, and this involves adding approximately 20 per cent. to the capacity of the wiring to allow for the "idle" current component.
4. It is usual to design for a higher illumination level from fluorescent lamps in the colder colours since the similarity to natural daylight increases as the illumination provided increases.

It should be emphasised that, although fluorescent lamps will operate without power factor correcting capacitors, this will almost nullify the potential saving in wiring capacity and will incur a penalty on certain types of electricity tariffs. Most fluorescent fittings are sold with control gear ready wired, including a capacitor for power factor correction.

Another fundamental difference between fluorescent and filament lamps is that the lamps are not available in high wattages with the result that more outlets may be required to produce a given value of illumination than with high wattage filament lamps. It has also to be remembered that fluorescent lamps of different wattage are normally not interchangeable in fittings so that it is not possible to make good any insufficiency of light by increasing the wattage of lamps.

The foregoing features of fluorescent lighting indicate the need for considerable precision in design and in the wiring.

A. Locations	Illumination Foot-candles	Remarks
Corridors and Stairs	3	
Hospitals:		
Laboratories ..	20	
Operating rooms ..	30	
Operating tables ..	300	Special local lighting.
Private rooms and wards	3	Bed lighting extra in wards.
Receiving and waiting rooms	7	
Hotels:		
Bakeries	10	
Bedrooms	5	Bed and mirror lighing extra.
Dining rooms, lounges, writing rooms	7	Reading lights extra.
Office Buildings:		
General offices ..	20	
Private offices ..	15	
Drawing offices		
Boards	30	
General	10	
Enquiry offices, Waiting and reception rooms	7	
Public Buildings:		
Churches		
Interiors	5	Increase for altars, chancels, choirs.
Church halls ..	7	
Libraries		
Book and reading rooms	7	Reading table lighting extra.
Backs of books ..	3	
Museums	7	Showcase, etc., lighting extra.
Public halls, general	7	
Schools:		
Lecture theatres, assembly halls, gymnasium, staff rooms	7	
Dressing and wash rooms and toilet	5	
Class rooms, laboratories	15	This value also normal to the blackboard.
Shops, Stores, Restaurants:		
Dressing, toilet and wash rooms	5	
Shop and store interiors	15	Plus display and special lighting.
Restaurant and refreshment rooms	7	
B. Occupation		
Reading:		
Casual	7	
Sustained ..	15	
Sewing	20	Increased for sustained work on dark material.
Rough work ..	7	
Ordinary bench and machine work	10	
Fairly small work ..	20	Includes typing, book-keeping and office machine work.
Small work	50	
Very small work ..	100	Includes most precision work.
Minute work ..	200	e.g., Watch and instrument making.

TABLE I

Minimum recommended illumination for various interiors. This may be used in the estimation of total wattage (see p. 619).

* The foot-candle, or lumen per square foot, is the unit of illumination, and enables illumination to be specified quantitatively just as room temperatures are usually specified in degrees fahrenheit.

* Unity power factor is the condition when voltage and current are "in phase." The presence of the choke causes the current to "lag" behind the voltage hence reducing the power factor. The capacitor on the other hand causes the current to "lead" the voltage and hence tends to correct the power factor.

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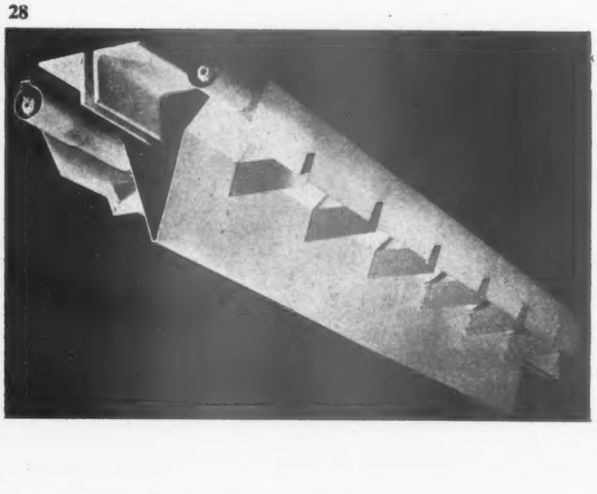
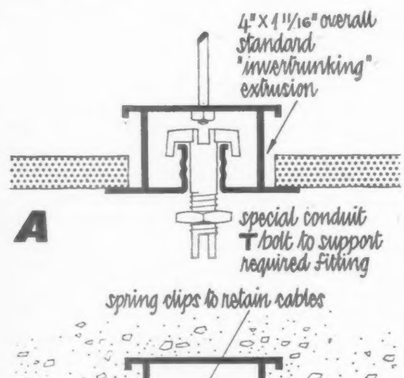


26, lighting in a general office where the distribution conduit has been made part of the arrangement. (Architect, Dennis Lennon.) 27, a translucent plastic ceiling. (Architect, E. E. Somake.) The spacing and height above the surface of the lamps are critical for even illumination of the ceiling. 28, a twin tube fluorescent fitting developed by the BRS.

Method of Lighting	Distribution of Light from Fittings	Approximate Total Lamp Wattage per 100 sq. ft. of floor area to give 1 foot-candle in service	
		Tungsten Filament Lamps	Fluorescent Lamps
Direct ..	All light downwards	20	7
Semi-Direct	More than 50 per cent. downwards. Remainder upwards	23	8
General Diffusing	Light emitted uniformly in all directions	25	9
Semi-Indirect	More than 50 per cent. upwards. Remainder downwards	30	10
Indirect	All light upwards		
	(*a*) from pendant fittings	33	11
	(*b*) from cornices, coves, coffers, and wall brackets	60	20

TABLE 2

Approximate wattage requirements for various types of lighting.



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29, A proprietary form of small metal trunking. (a) As an integral part of a suspended ceiling. (b) Cast in floor slab in situ, (c) fixed under slab. (d) integral part of " vaulted " plaster ceiling.

Special and High-intensity Lighting Installations

The introduction of fluorescent lighting has greatly enlarged the scope of artificial lighting, and freed it from many of its former limitations. Fully louvred suspended ceilings, large laylights, or suspended diffusing ceilings are now being used to a considerable extent. The wiring requirements for these are stringent since such lighting involves the use of relatively large numbers of lamps whose minimum spacing is a function of the suspension depth of the louvre or diffusion section. In these installations the conduit is normally concealed by the false ceiling, the main problem being the provision of sufficient outlets with reasonable economy. Fittings with provision for looping* from one to another may be used to reduce the extent of fixed wiring. In some high intensity or inbuilt lighting installations it is necessary to operate the lamps by control gear remote from them. This practice is usually avoided on grounds of wiring complication but where it is necessary provision must be made for housing the chokes and for relating them to the lamps they control. Starter switches should always accompany the lamps. Ventilation problems may arise when fluorescent lamps and chokes are confined in a small space, due to the need to dissipate heat convected from the lamps and generated by the chokes, which may otherwise cause the choke filling compound to melt.

Indirect and Cornice Lighting

When indirect lighting is proposed, wiring provision must be made for relatively high wattages (see Table 2) and the number and position of outlets must be precisely determined since even slight errors in spacing will give rise to patchiness.

Fluorescent lamps have stimulated the use of cornice lighting due to their very convenient form. It is usual to overlap the lamp ends in narrow cornices to avoid patchiness and the wiring must make allowance for this. Even though the wiring may be invisible in the cornice it should be neatly fixed so that dusting of the cornice will not dislodge the wiring and cause broken connections. Lamps should preferably not be laid directly on the cornice but supported slightly above to leave an air space.

Portable and Local Lighting

There are few commercial interiors which do not require lighting additional to the fixed overhead lighting and the provision of socket outlets for these is of great importance. It is usually impossible to determine in advance the precise position of portable lamps and it is advisable to allow for as many as possible, spaced so as to enable the maximum freedom in the use of such lamps. This can be achieved by using floor and wall outlets preferably on a ring circuit. They are necessary in offices and restaurants for table and desk lamps, in shops for counter and display lighting and in any large interior where wall outlets alone would seriously restrict the use of portable lamps.

Fixed local lighting involves careful wiring planning. This applies particularly to hospital wards in which the bed lighting is now tending also to fulfil the purpose of general ward lighting. Similarly, in libraries, local lighting of the book racks is all-important and is tending to take over the entire lighting duty. In museums, also, the provision of facilities for the local lighting of cases and exhibits is becoming a major consideration.

Estimating Lighting Wattage Required

Standard tables of data are available for detailed lighting calculations but it is often convenient to be able to estimate broadly the lighting wattage required for various lighting treatments either for the purpose of arriving at a prime cost figure or as a means of narrowing down the various lighting possibilities. Table 2 is intended to enable such a preliminary estimate to be made, the procedure being as follows :

(i) Decide on illumination required (see Table I as a guide).

(ii) For the type of lamp and lighting in question read off the wattage required to give one foot-candle per 100 sq. ft. of floor area.

Then the estimated wattage required =

$$\frac{\text{Illumination required (foot-candle)} \times \text{Wattage shown in Table 2} \times 100}{\text{Floor area in sq. ft.}}$$

* It is common practice to supply a number of fittings controlled by one switch from a single pair of wires by wiring directly from one fitting to the next. This system is known as "looping."

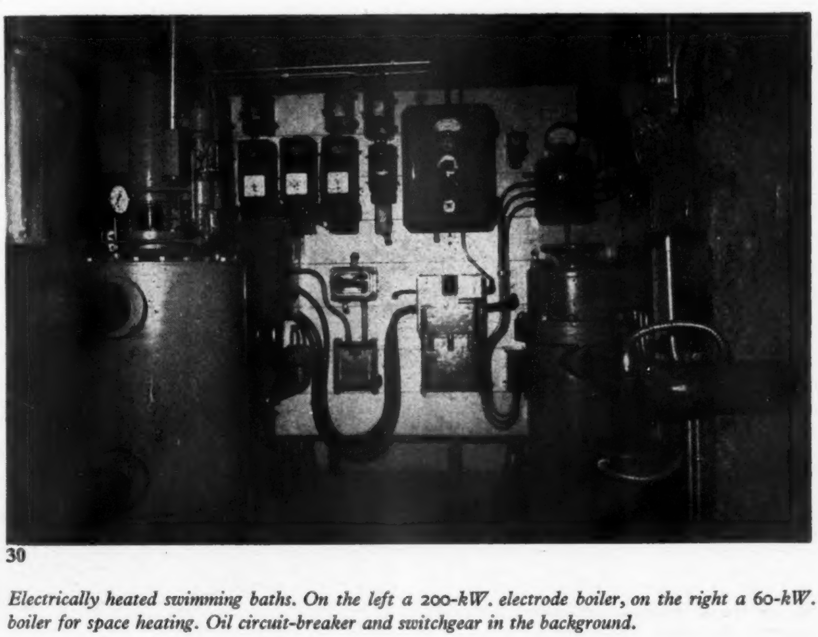
INSTALLATION FOR HEATING

Space Heating Equipment

Electric equipment for heating buildings, as distinct from personal warming by electric fires, takes many forms including (i) tubular heaters, convectors, liquid-filled radiators, wall, floor and ceiling panels, all working at relatively low temperatures and giving varying proportions of radiation and convection, (ii) unit heaters generally fixed overhead to heat large spaces such as factories and (iii) high temperature panels fixed overhead on walls or suspended from ceilings. All these types can be classified as *direct* heaters in contrast to an electric boiler which may be used to provide heat *indirectly* through the medium of a conventional hot water radiator or panel heating system.

The wiring for an electric boiler consists of a main power connection either at high or medium voltage from the Electricity Board's terminal point to a boiler circuit-breaker and thence to the boiler itself, auxiliary wiring being required to the various automatic controls and for the circulating pump motors. In some cases, depending upon the size of the plant, there may be additional wiring from an external thermostat or from thermostats in individual rooms or serving sections of the building, to electrically operated valves in the boiler house or control room. Finally there may be a system of distance thermometers to enable temperature of various parts of the building to be read from the control room and this will require wiring between the measuring points and the indicating instrument. Electric boilers are usually operated during the night when there is a reduced rate for current so that supply to the boiler will be controlled by a time switch and separately metered.

If a building or a section of a building is to be equipped with any of the direct heaters mentioned above, it will usually be best to connect them to separate heating circuits since the amount of current required for heating is greater than for lighting and the heating circuits will have thermostats in them to provide automatic temperature control. In other cases, however, where electric heaters are only re-



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Electrically heated swimming baths. On the left a 200-kW. electrode boiler, on the right a 60-kW. boiler for space heating. Oil circuit-breaker and switchgear in the background.

quired to supplement an existing heating system or where all-electric heating is to be installed in relatively small rooms, the heaters can be supplied by a ring or other circuit also serving socket-outlets for the connection of portable appliances, office machinery and similar equipment. In these cases heaters may have their own local thermostats, either incorporated in the appliance itself, a common practice with convectors, or fixed on the wall nearby.

Another arrangement for electric heating which seems likely to be more commonly used in future, is by means of heaters fitted in the space to be warmed but of the storage type, that is to say, designed to take current at night and store heat for gradual release during the daytime. These heaters take two forms, first the storage block heater which consists of concrete blocks contained in a metal case little larger (but much heavier) than the ordinary convector, and secondly a solid floor in which heating wires are embedded. Since the circuits for these methods of heating will be supplied from an off-peak tariff meter and time switch controlled, they must be separate circuits taken direct from the main distribution centre to the heaters.

Water Heating

Electric water heaters are always of the storage type so that the loading in kW. is not great and they can readily be connected to heating circuits or in smaller sizes to circuits supplying socket-outlets for portable appliances. Standard electric water heaters are loaded according to B.S. 843 as follows:

Rated water capacity, gallons	*Loading, kW.*
1½	0·75
3	1·0
5	1·0
12	1·5
15	1·5
20	2·0
30	3·0
40	3·0
(60)	To be agreed between
(80)	purchaser and manufacturer
(100)	

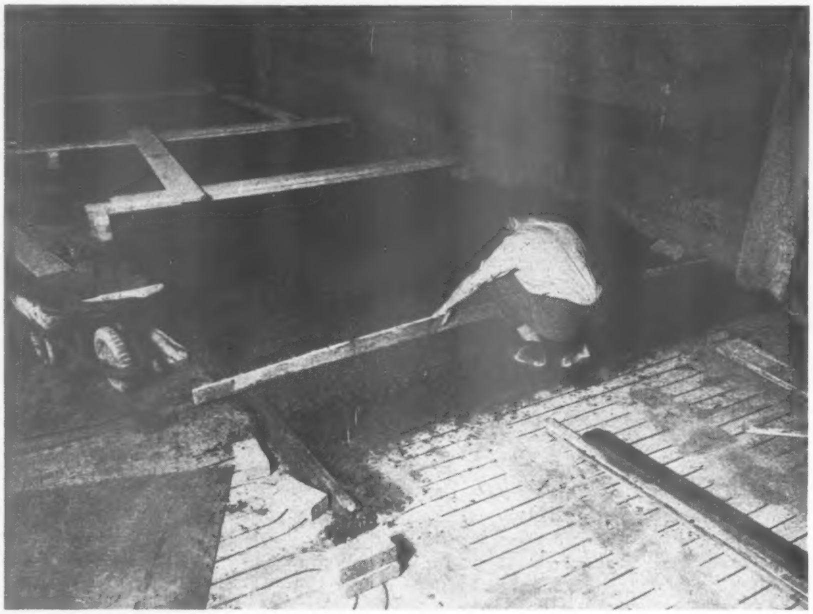
Immersion heaters inserted in storage vessels for domestic hot water supply should always be of the automatic type that is to say with inbuilt thermostat according to B.S. 1555. For larger tanks or cylinders used in commercial and industrial premises one or more immersion heaters of great loading may be used, the total kW.'s depending upon the maximum rate of draw-off and daily hot water consumption. This is a matter on which the advice of the Electricity Board should be obtained.*

Cooking

Electric cooking equipment varies so much in its electric loading that it is difficult to give anything more than a general indication as to its influence on the design of wiring installation. The equipment may vary from a small domestic type cooker in a porter's lodge or hospital ward kitchen to a large assembly of cooking equipment of all types, ranging from hot cupboards to pastry ovens, in the largest canteen or restaurant. For all commercial and industrial electric kitchens the wiring consists of a separate circuit run from the point of supply to distribution switch and fuse-gear fixed close to the kitchen itself, individual circuits being run between the distribution gear and the various ranges, ovens and other appliances; the general practice being to have a separate switch and circuit to each piece of cooking equipment. The reason for having the distribution and fuse gear near the kitchen is to save the cost of running individual circuits

Electric space heating. 31, *the connection box in the floor finish.* 32, *heating elements being installed in a " heat storage " floor which will use night-time off-peak current.* 33, *switch room for the heating of a laboratory building. The glass-fronted case is the off-peak heating control panel, on the right of this are the current transformers, below which are the 415-v. intake and main switch with overload trips. On the right-hand wall is the meter. The gear above, below, and to the left of the glass-fronted case is for battery charging.*

31



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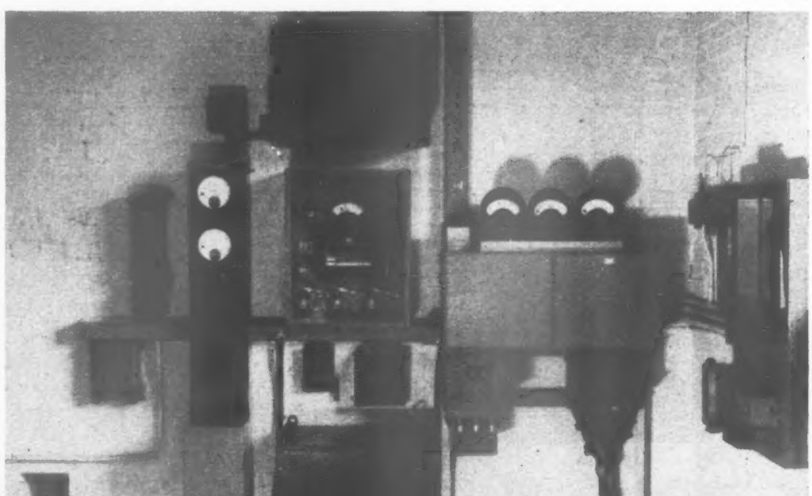

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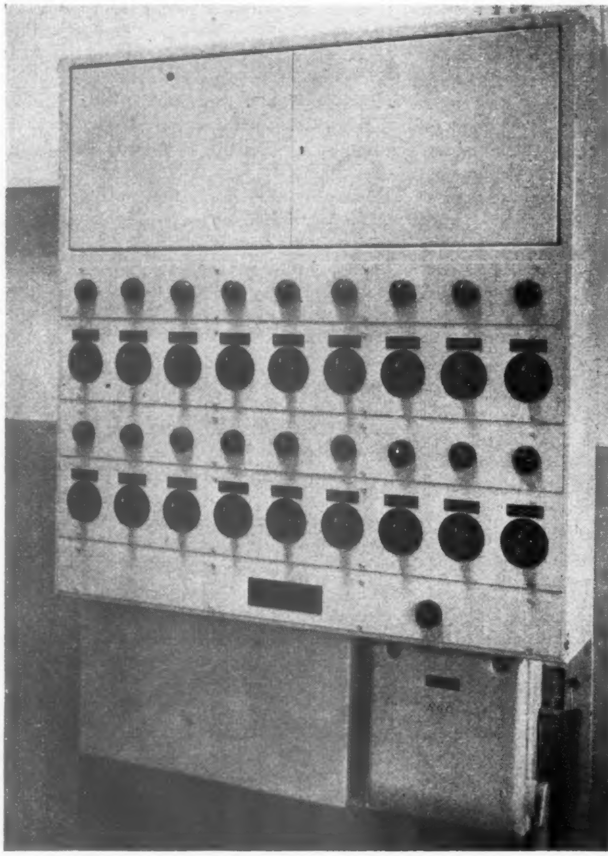
* Further information can also be obtained from "The Electric Water Heating Handbook," published by the British Electrical Development Association, 2, Savoy Hill, London, W.C.2, price 5s.



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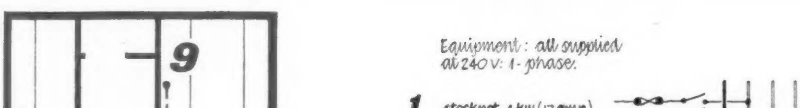
34, control unit specially made for the electrical equipment in a school kitchen. 35, typical distribution switchgear for a large canteen kitchen. The horizontal casings contain the bus-bars from which individual circuits are tapped.



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Plan of electrically equipped kitchen for approximately 200 meals an hour and diagram of the distribution switchgear. Each item of equipment has a separate circuit taken from the bus-bars through a suitably rated switch fuse.

over long distances and to make it easy to isolate any particular circuit for maintenance or repairs on the equipment connected to that circuit.

Ventilation and Air Conditioning

The simplest form of artificial ventilation is the extract fan fitted to an opening in the wall or window of the room to be ventilated. The motors driving such fans will be very small and they can be supplied, through a control switch fixed in a convenient position, from a circuit serving other small appliances.

More elaborate systems will consist of plenum and extract fans with duct-work systems and there may be, in addition, a pump for an air washer and possibly a refrigerating plant for cooling. The motors driving this equipment may be quite large and as they will usually be grouped together in one or more ventilating plant rooms. The wiring should consist, as in the case of the kitchen, of a separate circuit run from the point of supply to distribution switch and fuse-gear fixed in the plant room.

Most small motors fitted to portable appliances are for single-phase supply so that they can be plugged into an ordinary 240-v. socket outlet. Stationary motors of larger size up to 5 h.p. or more can also be obtained for single-phase when this is the only type of supply available which may often be the case on farms and remote country districts. In all commercial and industrial buildings in towns, however, the supply will be three-phase and stationary motors of all sizes will generally be wound for this type of supply.

Three-phase motors are of the induction type and either slip-ring or squirrel-cage pattern. Squirrel-cage motors which are simpler in construction and cheaper to buy are very widely used for all purposes. Slip-ring motors are only employed when some speed variation is required or in order to reduce the current taken at starting to the lowest possible value. With squirrel-cage motors the starting current is kept within reasonable limits by the use of "star-delta" or "auto-transformer" starters and these are generally employed for motors of more than a few horse-power. The governing factor is that the starting current of a motor shall not be so high as to cause the lights to flicker but as this depends on the circumstances of each case, e.g. the total load in the building, size of the motor in relation to the total, the distance from the substation and other factors, it is impossible to lay down any general rule and in case of doubt the advice of the Electricity Board should be obtained.

INSTALLATION FOR TELEPHONES

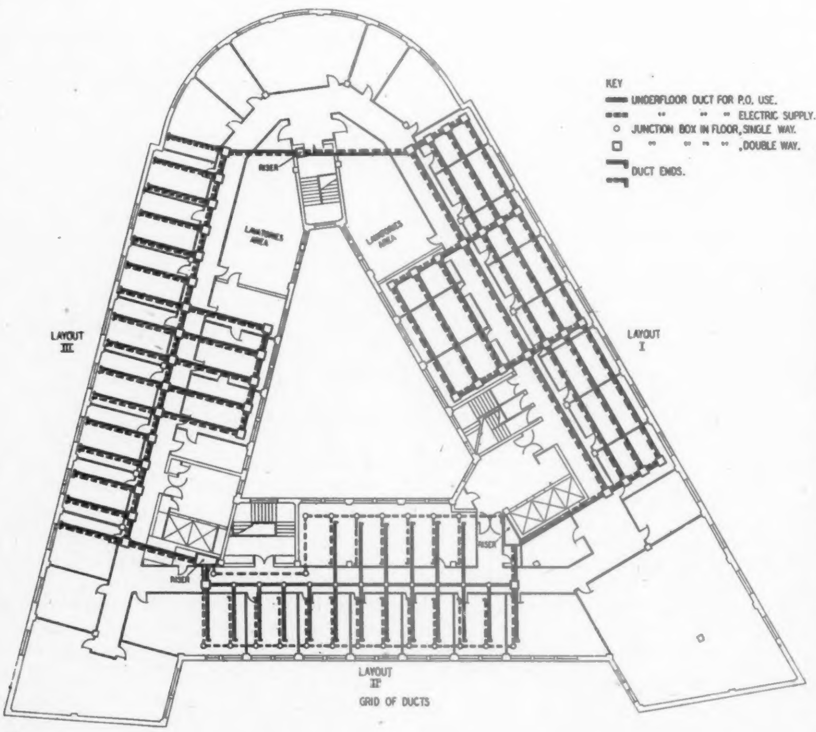
The problem of telephone installation becomes most severe in the large office building, both because of the volume of equipment likely to be wanted and because of the tendency for the requirements to alter with time.

Since, at the time of planning, there is little or no firm information available as to the probable tenancies or type of business that will be carried on ultimately in the building, both architect and owners often have the impression that little advance planning can be done in respect of telephones, an impression which is often coupled with the idea that the telephone service is the personal responsibility of the individual tenants.

Although the demand for telephone service may be the tenant's responsibility, the provision of facilities to hold the cables and equipment is, without doubt, the responsibility of the architect, just as much as the provision of water, electricity, gas, lifts or sanitation is his responsibility. The telephone is a necessity in any office building, and to ignore it at the planning stage usually means that holes have to be cut through walls and cables fixed on the surface after all decoration is complete and the tenant has decided precisely where he requires the telephone instruments. It will be realized that it is almost impossible to install cables throughout the building in such circumstances without spoiling the appearance of the decorations.

Now with any building it is possible to estimate the probable ultimate telephone requirements and provide facilities accordingly. Indeed, this is the only satisfactory way of approaching the problem, as facilities planned only for the initial requirements invariably are inadequate in a very short time, and very often even before the building is occupied. The essentials to be considered are (i) entry of the cable into the building, (ii) means for running cables vertically to each floor and horizontally to the telephones, (iii) accommodation for switchboards and apparatus. In many ways these facilities, which are elaborated in subsequent paragraphs, are similar to those required for other services, notably electricity supply, and it is often possible to provide facilities, such as rising ducts, which are common to two or more services.

As soon as possible, therefore, certainly in the early planning stage, the Telephone Manager in whose area the building is to be erected should be consulted, so that he can arrange for a responsible engineer to discuss the most desirable arrangements suitable for the individual building. The address and telephone number of the Telephone Manager's office will be found in the telephone directory of the area concerned, but in case of difficulty reference may be made to the Engineering Department

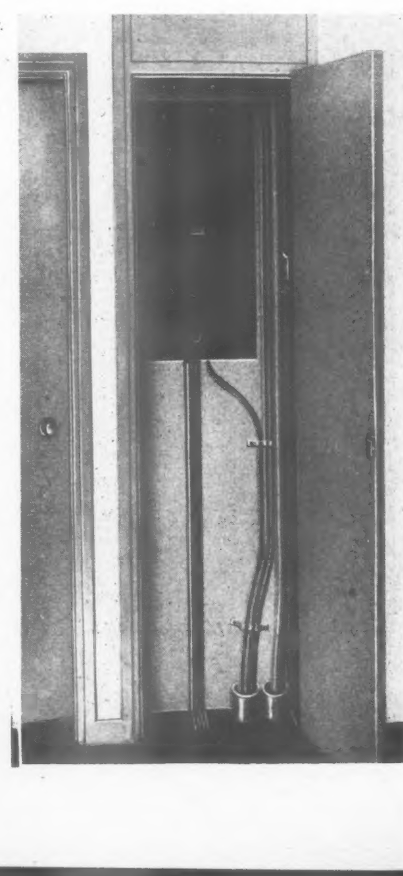


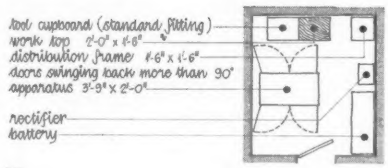
37

Different ways of arranging floor ducts in an office building. In layouts I and III the telephone and electric cables share junction boxes. Layout II shows separated services. One disadvantage of layout I (also true of the perimeter duct) is that it may be necessary to disturb one office in order to make alterations affecting another.

A rising duct cupboard for a telephone installation, showing the distribution case.

38





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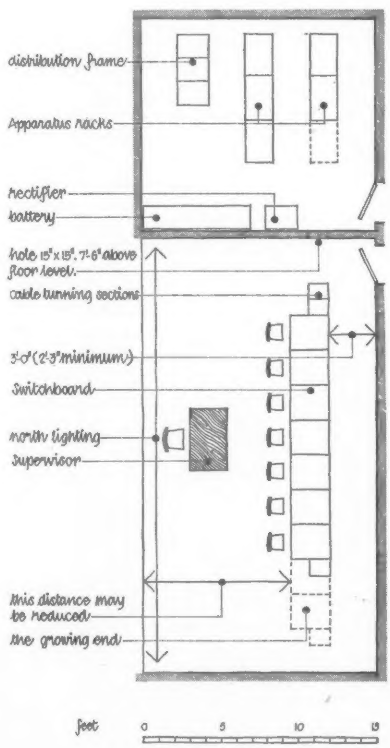
Plans of telephone switchrooms. Above, for a 50-line automatic (PABX) and, below, for a larger installation, manually operated (PMBX) for 300 to 500 lines. A small switchboard associated with the PABX would be installed in an adjacent room.



(S. Branch), General Post Office, Alder House, Aldersgate Street, London, E.C.1.

It should be remembered, however, that Post Office telephones are not the only communication services which are needed in the modern building. There are many private systems, such as house telephones, staff location systems and office bells, which can involve considerable amounts of cabling and which should receive adequate and early consideration.

Short Description of Post-office Cabling Practice

On page 624, Fig. 42 shows a layout of cables and equipment which is often adopted in large buildings provided with suitable cabling facilities. It should be noted that multi-pair cables are used between the lead-in, the switchboard and the distribution cases, and that from the latter to the telephones single-pair cables are used within the horizontal duct system. Thus the larger cables are confined to runs where space restrictions are not severe.

The distribution frame is the central point of the cabling system, and permits circuits in the incoming cable, or from the switchboard, to be routed as desired in any of the cables for distribution inside the building.

Separation of Services

In a planned installation, telecommunication services can be kept separate from other services, principally electricity supply, and the building rendered safer for occupants and maintenance staff. The minimum separation from electrical services should be 2 in. for low and medium voltages (not exceeding 650V.), 12 in. for high voltage multi-core cables (exceeding 650V.), and 18 in. for high voltage single-core cables.

An insulating, or earthed-metal, barrier between the two services is preferable, however, in all cases, to ensure that safe conditions are maintained.

Adequate separation from hot water systems and the like is desirable because the insulating materials of cables normally employed inside buildings deteriorate under the action of heat.

A point which is sometimes raised is the separation of Post Office telephone cables from other telecommunication services such as private telephone installations and staff location systems. A short answer to this question is that, in many cases, separation is not necessary for purely technical considerations but very desirable for a number of other reasons. This is explained as follows.

The general safety requirements of the Post Office will permit any telecommunication circuits to be run together if their voltages do not exceed 100 volts A.C. or 150 volts D.C. There are other technical considerations, however, such as the susceptibility of some circuits, such as amplifier input circuits (e.g. microphone leads), to the influence of electrical interference, and, on the other side of the scale, the interference which some circuits are liable to radiate into neighbouring cables. Then there is the type of service, such as fire alarms and burglar alarms, which obviously needs to be separated from other services to maintain its essential reliability. There are a number of private telephone systems to which none of these technical considerations for separation from Post Office telephone cables applies, and consequently it is permissible on these grounds in some cases to share parts or the whole of a duct system. The sharing of ducts, however, is deprecated by all users much in the same way that two housewives dislike to share a kitchen, and this is particularly so where duct size is restricted and wiring operations frequent, as in an underfloor duct system. Usually the duct space which is necessary to cater adequately for more than one user can be divided conveniently into separate ducts. Separate duct should always be provided for Post Office and for miscellaneous services along the more important cable runs.

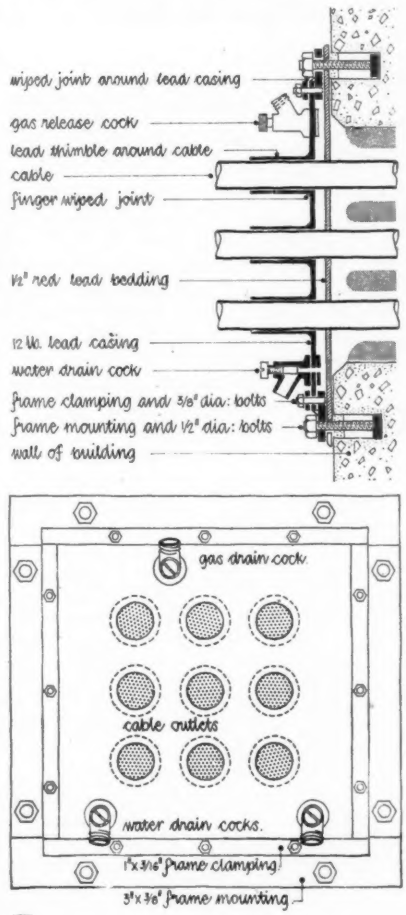
Facilities for Accommodating Cables and Equipment

These facilities may be divided conveniently into the following sections:—

(1) Leading-in and terminating the main cable.

(2) Running cables vertically to the various floors.

(3) Running cables horizontally on the various floors to any required telephone position.



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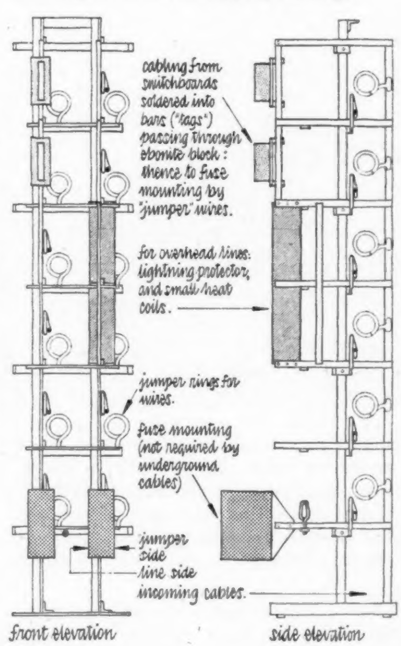
A GPO 9-way standard duct seal for the entry of telephone cables into a building. Overall size of frame: 2 ft. by 2 ft. Other sizes are used according to the size and type of building.



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A standard GPO telephone rack unit, 1 ft. 6 in. square on plan and 6 ft. 10 in. high. These units are put together in rows. See Fig. 39 (PMBX.)

(4) Accommodation for telephone switchboards.

Leading-in and Terminating the Main Cable

The cable from the street will enter the building below pavement level, and the precise position should be arranged with the Post Office engineers, who will also provide a standard P.O. duct to be built into the wall at the appropriate time. This duct will be sealed against the ingress of water after the cables have been drawn in. In the case of single ducts and pipes and two-way ducts, the seal is provided by plugging the aperture with a thermo-plastic compound. If the entry duct contains three or more ways, a sheet of lead is secured over the end of the duct by means of a steel framework fixed to the wall, and the cables are taken through the lead and plumbed to it.

From the lead-in point a suitable cable runway will be required to the space allocated for the distribution frame. The basement is an ideal location in many instances, but in some cases the frame may be placed alongside the switchboard on another floor. No matter which method is employed, however, a cable runway in the form of battening will be needed in the basement for the incoming cable and for the interconnection of risers where more than one riser is necessary.

Running Cables Vertically to the Various Floors

One or more rising ducts, depending on the area and plan shape of the floor, will be needed to carry cables to the different floors. It will be noted that small cables are taken from the rising duct, through the horizontal ducting, to the individual telephones, and it will be readily appreciated that if there are too few risers the horizontal ducts will need to be excessively big or they will become choked with cables. The most suitable distribution area which a riser can serve is taken as that which requires no more than 30 yards of cable to connect any telephone to its distribution case in the riser. This applies to buildings where underfloor ducts are used but for other types of horizontal ducting, this figure should be reduced on account of the more difficult wiring conditions which are usually encountered.

It is usual practice to design the rising ducts so that they will accommodate the rising cables and the distribution cases on each floor. For the cables to pass through the structural floor, a hole of the order of 6 in. × 3 in. is all that is needed, but to hold the distribution cases a minimum cross section of 18 in. × 6 in. is needed, and hence a duct of this size, or larger, is usually taken from floor to ceiling on each floor, except in the basement where access through the ceiling only is required.

These rising ducts should be sited on structural walls to avoid difficulties which may be caused by future re-positioning of partition walls, and access should be provided by a hinged door of normal height on each floor. The illustration on page 622 shows such a riser, which incidentally, is 24 in. by 18 in. clear inside.

Running Cables Horizontally on Each Floor

Of all the cables in a building, those leading to the individual telephone, i.e. the horizontal cables, are the most frequently altered, due to the changing requirements of the subscriber. This section of the cabling is, therefore, the most troublesome from almost all points of view, and special care in the selection or design of cabling facilities is most essential if the changing requirements of the subscriber are to be met unobtrusively *for the lifetime of the building*. It is to be remembered that the majority of cabling facilities necessarily are an integral part of the building, and that to design them for initial telephone requirements only is a policy which will almost certainly be regretted later.

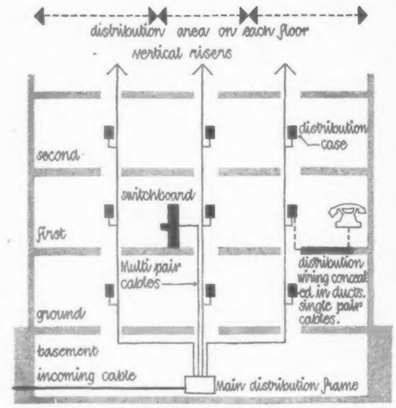
There is a multitude of underfloor duct systems and other forms of ducts, such as skirting ducts and wall ducts, to cater for horizontal cabling, and perhaps the following information will assist in selecting the system best suited to the individual building.

The underfloor duct provides the most successful method of horizontal distribution, partly because it is suited to the conventional construction of buildings, and partly because it provides the best facilities. If it is desired to have telephones on desks which stand away from a wall, the only satisfactory method of feeding cables to the desks is by means of outlets fixed into an underfloor duct. This may be contained within the screed or, where steel decking is used, it may be formed by the decking itself. Apart from serving the isolated desk, the underfloor duct is also very suitable for taking cables to wall positions (Fig. 37), since the main duct runs can be confined to corridors, so avoiding any disturbance of office occupants, other than those requiring the telephone, when providing for alterations in telephone requirements.

Skirting ducts: It is usually possible, with an underfloor duct system, to select a riser position which is centrally situated to serve a particular area, whereas, when using a skirting duct to serve the same area, either a number of underfloor ducts are needed to connect the skirting duct to the central riser, or a number of risers are required on the perimeter walls to serve the duct. Moreover, the perimeter duct is often divided into a number of isolated sections by staircases, lavatories and doorways. The skirting duct also has the disadvantage that where columns castellate the inner surface of the perimeter walls, four right-angle bends must be provided to negotiate each column—a costly procedure with unsatisfactory results. Alternatively, a straight cable run may be formed by sleeving the column or building out the whole wall at skirting level, flush with the face of the column. The skirting duct has the advantage that a telephone may be fixed at almost any point along its length, an advantage that is sometimes outweighed by the obstruction of hot water pipes and the difficulties of wiring through a number of offices to reach the desired position.

Ducts within suspended ceilings are possible, but not very practicable. Outlets from the ducts usually serve to fixed outlets on the floor above, which means that special arrangements must be made for the ground floor if a full area basement is not available. The main runs should follow the corridors, and ducts or trays should be provided throughout to ensure segregation of services. Consideration should also be given to the provision of suitable ceiling access panels which will not be soiled by fairly frequent use.

Present-day experience shows that the underfloor duct system is in most cases to be pre-



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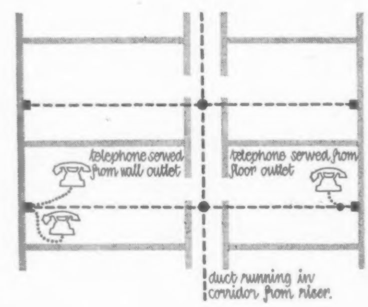
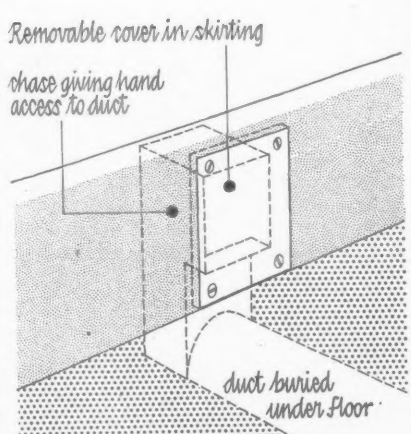
A diagrammatic section through an office building, showing the cable runs.



43

Plan showing a characteristic arrangement of underfloor ducts.



44

A wall outlet for telephone cabling.

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WORKING DETAIL — **ROOFS AND CEILINGS: 18**

CEILING PANELS IN ASSEMBLY HALL: COMPREHENSIVE SCHOOL AT BLACKHEATH, LONDON, S.E. 3

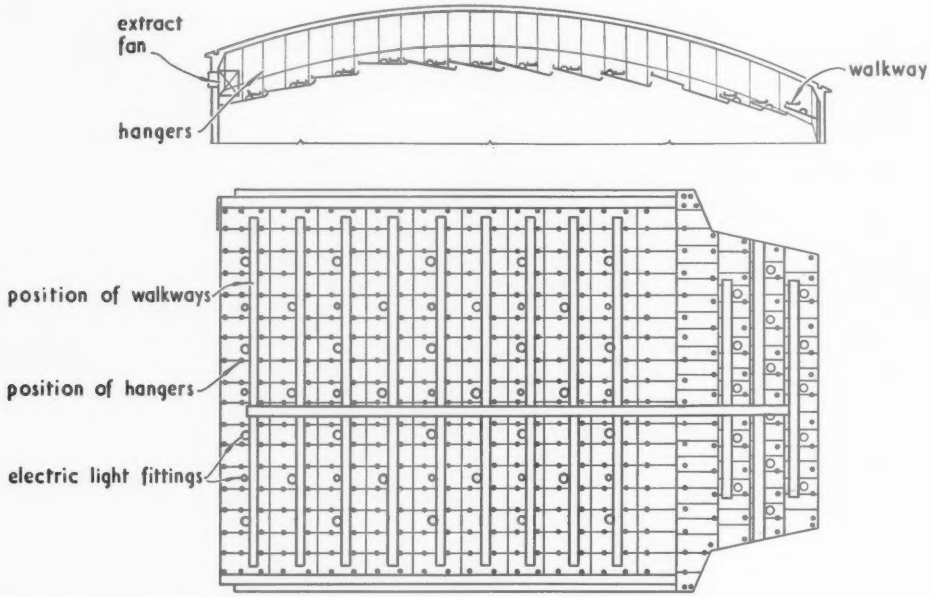
Slater, Uren and Pike, architects

The ceiling panels are supported by hangers cast into the shell roof. Asbestos baffles, set behind the lights near the forward edge of each unit, serve to conceal from the hall the rift between each range of panels and to reflect the light on to the back edge of the adjoining panel. Since there are spaces round the edges of each range of panels, air can be extracted from the space above without the need for trunking. The walkways are reached by ladder from the stage.

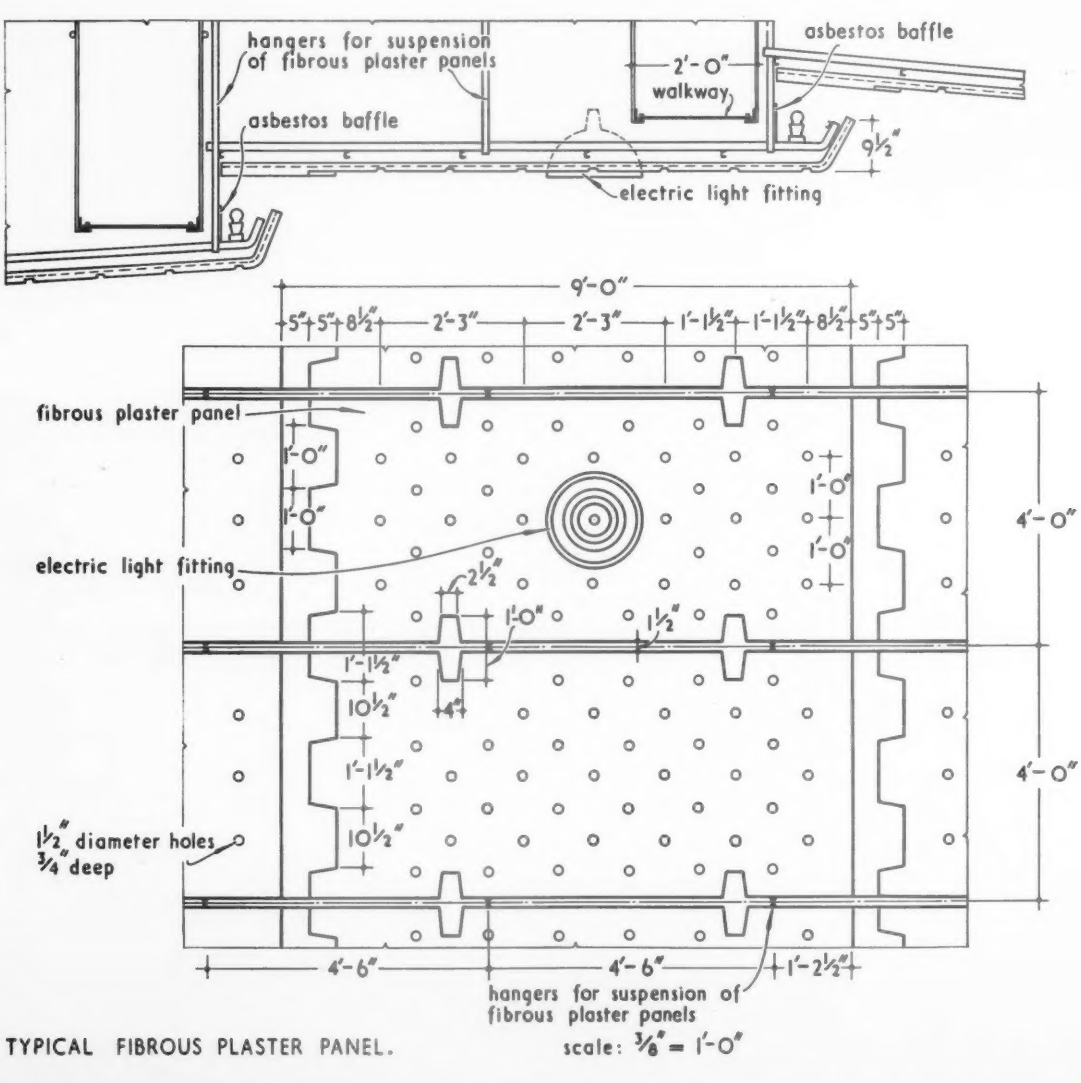
WORKING DETAIL

CEILING PANELS IN ASSEMBLY HALL: COMPREHENSIVE SCHOOL AT BLACKHEATH, LONDON, S.E.3

Slater, Uren and Pike, architects



KEY PLAN AND SECTION OF CEILING. scale 1/32" = 1'-0"



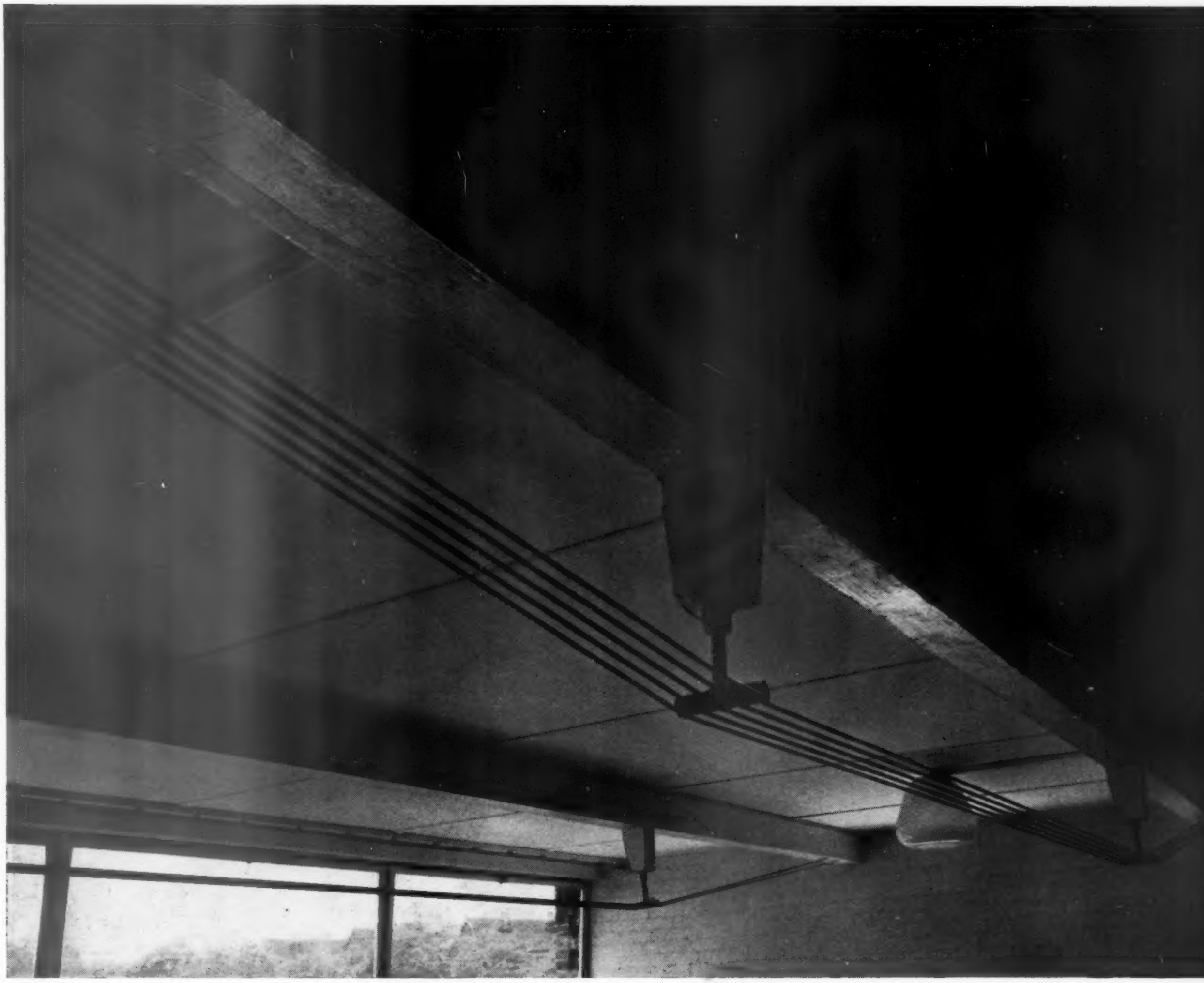
TYPICAL FIBROUS PLASTER PANEL. scale: 3/8" = 1'-0"

WORKING DETAIL

ROOFS AND CEILINGS: 19

TRUSSED BEAM: SCHOOL IN BECKENHAM, KENT

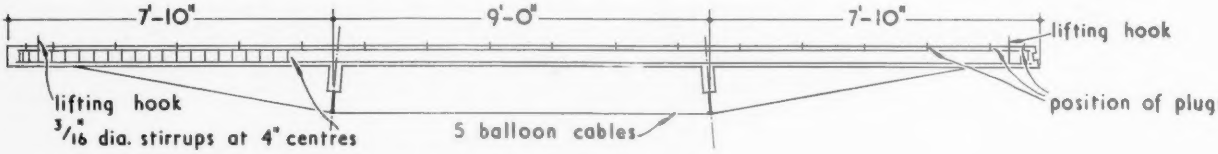
Elie Mayorcas, architect, in collaboration with S. H. Loweth, architect to the Kent County Council: F. J. Samuely, consulting engineer



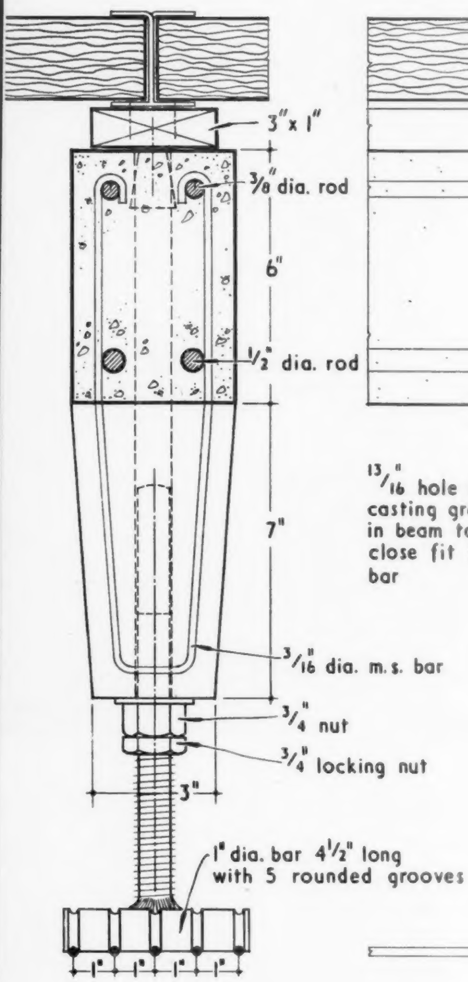
The object of this trussed beam was to provide an economical means of supporting a lightweight roof at a time when steel was in short supply. The struts which project below the beam serve as jacks to the prestressing cables. One end of the group of five cables was cast in with the beam and secured round an anchor bar. The cables were then passed over the jacks and through preformed ducts at the far end of the beam, where they were secured by means of the anchor end units. A partial prestress, sufficient to give the beam a slight camber, was induced into the cables by unscrewing the jacks. The beams were then transported to the site, were placed in position and the straw-slab roofing fixed on top of them. It will be noticed that the 3-in. by 1-in. wooden plate permits the passage of conduit along the under surface of the roof without the necessity for chasing the beam. Finally the cables were given a further prestress by means of adjustments to the jacks, which were secured in their final projection by means of locknuts.

TRUSSED BEAM: SCHOOL IN BECKENHAM, KENT

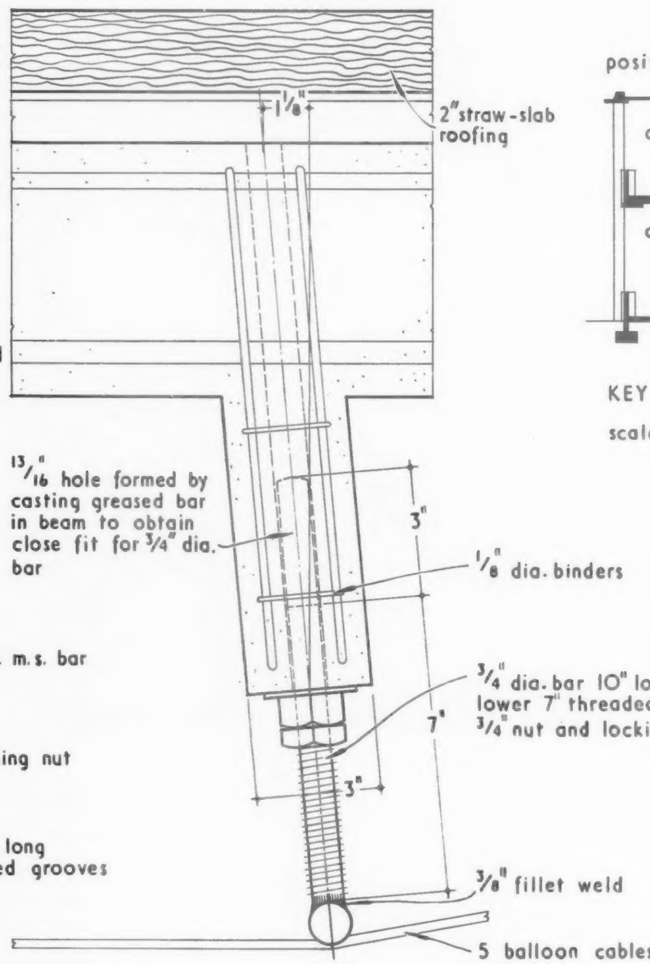
Elie Mayorcas, architect, n collaboration with S. H. Loweth, architect to the Kent County Council: F J. Samuely, consulting engineer



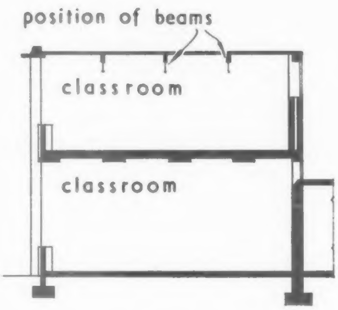
ELEVATION OF BEAM. scale 1/4" = 1'-0"



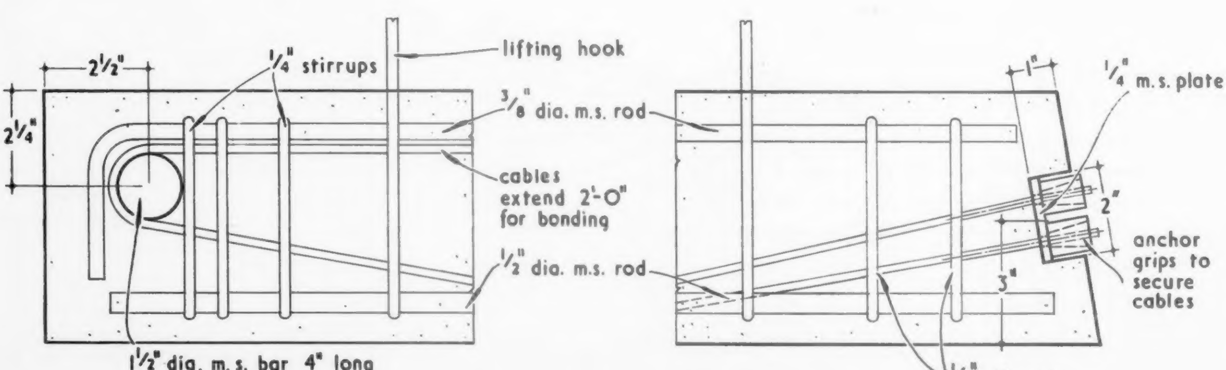
SECTION.



DETAIL OF STRUT.



KEY SECTION.
scale 1/16" = 1'-0"



DETAILS AT ENDS OF BEAM. scale 1/4 full size s

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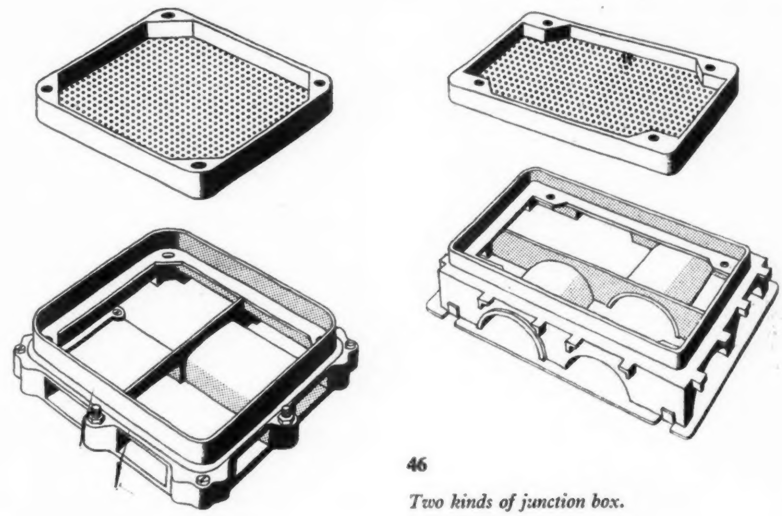
ferred, and for this reason it is proposed to discuss only this system in detail.

Firstly, if electric supply cables are to be distributed, e.g. for desk lights and power-operated machines, in a combined duct system with telephone cables, a duct system conforming to BS 774 or 815 should be chosen. These systems provide for a number of parallel ducts with combined junction boxes which prevent contact between cables of the different services being distributed. If only communication cables of a similar character are to be distributed, however, there are a number of duct systems which cater adequately for the less stringent conditions for use then obtaining.

Outlets are the points where the cables emerge from the ducts for connection to the telephone cord, and their siting is a point for early consideration. The best type of outlet so far devised is that which is fixed in the floor adjacent to the desk requiring the telephone,



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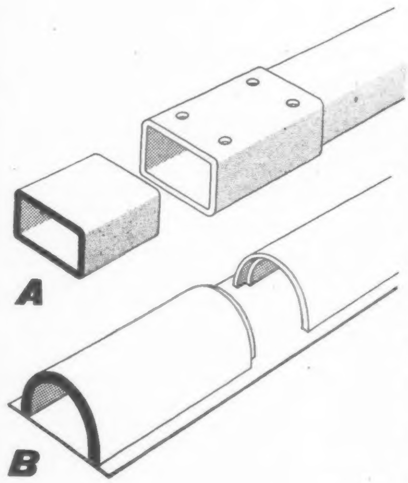
Two kinds of junction box.



45

(*a*) *a steel duct*, (*b*) *a fibre duct.*

thus removing the necessity for surface wiring and reducing the length of trailing cord to a minimum. This type of outlet is the only one which can satisfactorily serve a desk or a number of desks in the middle of a large room. A disadvantage of the floor outlet, however, is that when a desk is moved, perhaps only a few inches, the existing outlet should be closed and a new one provided if the outlet would otherwise be left in a dangerous or vulnerable position. If this is not done, the system rapidly deteriorates, and consequently, when considering the use of floor outlets, the ability or desire of the owner or tenant to maintain them should be taken into account for the individual building.

A reasonable compromise, which is often employed in the usual building containing small rooms, is to provide wall outlets at skirting level in the middle of each window bay. These outlets will serve the great majority of desks direct by means of a cord, and at the worst will involve only a small amount of wiring within the room. If these outlets are served by underfloor ducts, a desk remote from the wall can, if desired, be served *via* a floor outlet cut into the duct as required.

Layout of underfloor ducts: To be able to use the floor outlet to its full value, a grid of ducts must be provided so that a desk will stand over or adjacent to a duct no matter where it is placed. There are a number of methods of providing the grid, and three possible layouts for a combined distribution system are shown in Fig. 43. When telephone cables only are to be distributed, the duct arrangement shown in Layout III is usually most suitable, with ducts in the room terminating in a wall outlet as shown in Fig. 44. This layout, using a corridor duct, has the advantage over a duct which only runs round the perimeter of the building that it is not necessary to disturb the occupants of other offices when running a cable to any office requiring a telephone. Moreover, there is no danger of the floor junction boxes being concealed by heavy furniture as is possible when the junction boxes are inside the room when using a perimeter duct.

A point worthy of note is that bends in the ducts are not shown on any of the diagrams of duct layout. The reason for this is that if the whole of the cross-sectional area of the duct is to be used the ducts should be quite straight between access points, otherwise cables will pull into the inner radius of any bend and become interlocked. The only exception to this rule of no bends is where it may be necessary to use a bend to rise from a duct into a wall outlet.

The use of conduit in an underfloor duct system should be avoided. While a conduit is sufficient for many requirements, it is insufficient for the multi-pair cables which are necessary for house telephones, house exchange systems and the small switchboards which are often required in various parts of a building. Usually an underfloor duct system has sufficient space to take cables of sufficient size to meet these demands, but if conduit is employed for the last few feet of the system, into the outlet, such cables cannot be taken through the system.

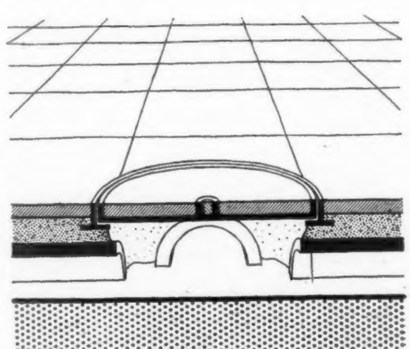
Underfloor Duct Systems

There are a number of duct systems, available from well-known manufacturers, which conform to B.S. Specification No. 774 for steel ducts or No. 815 for non-metallic ducts. These systems provide for single-way or multi-way distribution and should always be used when electric supply is one of the services to be included. Figs. 45 and 46 show typical ducts and junction boxes. Generally, any type of outlet can be employed, and the floor outlets may be pre-formed in the ducts at stated intervals or may be cut into the ducts as and when required.

Where only communication cables are concerned, however, there is the additional choice of a number of proprietary and non-proprietary duct systems which have appeared since the war.

Typical Construction of a Simple Underfloor Duct System (for Communication Cables only)

Procedure for underfloor systems is as follows: Firstly, the ducts should be laid on the structural floor along the scheduled runs, leaving 6 in. spaces at the positions of the junction boxes. If the screed is not to be put down immediately, a protective covering should be put over the ducts, and boxes approx. 6 in. square formed in concrete. When the top screed has been laid, the frame of the junction box can be set so that its top edge will be level with the top of the final floor finish. The frame is levelled in the screed to allow for the thickness of the finish, which material, incidentally, will also be used to fill in the top of the cover.



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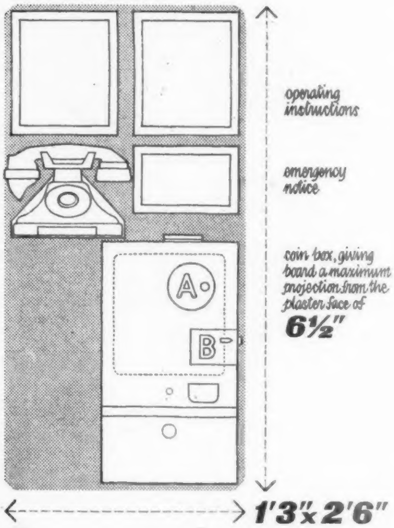
A junction box built in-situ.



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New GPO standard board for subscribers coin box installations (London version). The size of the provincial version is 1 *ft.* 3 *in.* × 2 *ft.* 1¾ *in.*

To complete the system, Fig. 44 shows a wall outlet which should be placed as near to the middle of the window bay as possible to give flexibility of direct access by means of a cord to different desk positions, and to give a central position to the duct in case a floor outlet is desired.

Accommodation for Telephone and Switchboards

The telephones in a large building will be served *via* a single large switchboard or a number of smaller boards probably associated with occupants in different parts of the building; but in any case it is a wise practice to plan a single switchroom which will accommodate the apparatus necessary to provide what is considered to be the ultimate telephone requirements of the building. The Telephone Manager will advise on the size of room which may be needed both initially and ultimately, although in the early planning stages of the building, there will probably not be any precise information of the occupants' requirements to enable the Telephone Manager to give detailed requirements. When such information is available any of the accommodation which is reserved for ultimate requirements, but not needed initially, may then be put to other use until required.

The reason for stressing this provision of a switchroom is that it is often difficult architecturally to provide a reasonable switchroom after the building has been erected. Floor strengths have to be considered because of the weight of apparatus, and there may also be the problem of getting the more bulky pieces of apparatus into position.

The switchroom should be adjacent to a riser to give easy access for cables. It should have ample natural light, but yet be away from direct sunlight, which renders signal lamps difficult to see. It should be away from noise, and in any case should receive acoustical treatment.

One last item of Post Office equipment which the architect may have to allow space for is the telephone cabinet—to give visitors the same telephone facilities that are provided by the familiar Post Office telephone kiosks. The apparatus is supplied and maintained by the Post Office, but the subscriber empties the cash container and pays the bill separately. The cabinet may be bought or rented from the Post Office, or may be built to match the interior of the individual building. If the latter course is chosen, the standard dimensions of 2 ft. 6 in. wide by 2 ft. 8 in. deep are recommended. Because of the various sizes of space available in subscribers' premises generally, the wallboards holding telephone, coin box and notice frames have always been provided on an individual basis, but steps are now being taken to standardise and improve the appearance of the wallboard and equipment. The new boards, when available, will be 15 in. × 30 in. high for London and 15 in. × 25¾ in. for the Provinces, of ebonised wood and stainless steel notice frames, with screw fixing at the four corners. A ¾-in. conduit should be provided in the cabinet for the incoming telephone cable, and the cabinet must, of course, be lighted.

It is not possible in the course of a few pages to list all the considerations which arise in telephone installations. More information can be got from the publications listed below, but the moral, as always, is that no published material can be taken as a substitute for early consultation with the specialised staff of the area Telephone Manager.

Bibliography

British Standard Code of Practice CP. 327:101 *—Telephones and Telegraphs Public Services* (and others in the CP. 327 series). Published by the British Standards Institution.

Post-war Building Studies No. 11*: Electrical Installations.* Published by Her Majesty's Stationery Office.

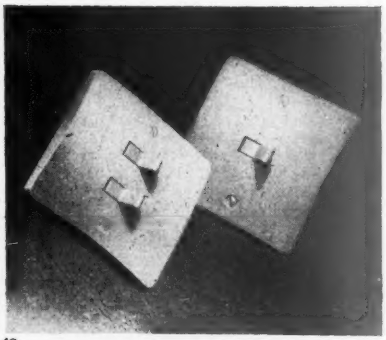
British Standard Code of Practice CP. 3, *Chapter VII: Engineering and Utility Services.* Published by the British Standards Institution.

In addition, the Post Office is now having printed a revised edition of the booklet *Facilities for Telephones in New Buildings*, which was first published in 1931. This will be available free to architects and others responsibly engaged in the design and erection of large buildings. Distribution will be announced in due course.

Acknowledgment: The JOURNAL is indebted to the Engineer-in-Chief of the Post Office Engineering Department for permission to publish and make use of material and illustrations.

SWITCHGEAR

One of the more immediate concerns of the architect—apart from the choice of fittings and appliances—is the selection of devices for controlling the outlet of electricity to the appliance. This section gives a brief survey of various types of switchgear for special purposes.



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One and two gang short break switches for A.C. current.

One of the major post-war developments is the micro break switch. This process began before the war, but (because A.C. supply is now almost universal) may now be regarded as standard practice. With D.C. supplies a quick make and break was desirable to prevent arcing and burning of the switching contacts, but with A.C. a small slow break is adequate, as the current flowing drops to zero every time the direction of the A.C. cycle changes. Micro gap switches are silent in operation and are also quite shallow so that they are suitable for use with present day partitioning and thin plaster coats. Several firms produce twin units which may contain either single or two-way switches, or both. The function of two-way switches needs no explanation, but perhaps not all architects realise that intermediate switches are produced which will allow single lamps, or groups, to be controlled from any number of points (see p. 611).

Switches for Special Purposes

Under this heading are grouped the many types of switch which are produced as standard articles by a number of manufacturers, but which are intended for use in particular types of building, in damp or explosive atmospheres, or for some special purpose not covered by the normal switch.

Mercury switches consist of a glass tube with the two contact wires fused into one end. The glass tube is mounted so that it can be tilted by the operation of the switch dolly, and contains a globule of mercury which makes contact when the tube is tilted in one direction and breaks it when the tube is tilted so that the mercury runs to the end remote from the contacts. The switches are quite silent in operation and are commonly used in hospital operating theatres and other rooms where explosive anaesthetic mixtures could be ignited by the small arc of an ordinary switch (Fig. 50).

Flameproof switches and sockets are also available for explosive atmospheres, but are more often used in factories, coal mines or petrol stores. Various Home Office and other regulations apply here and the appropriate regulations and BSS should be considered in relation to the risk involved (Fig. 51).

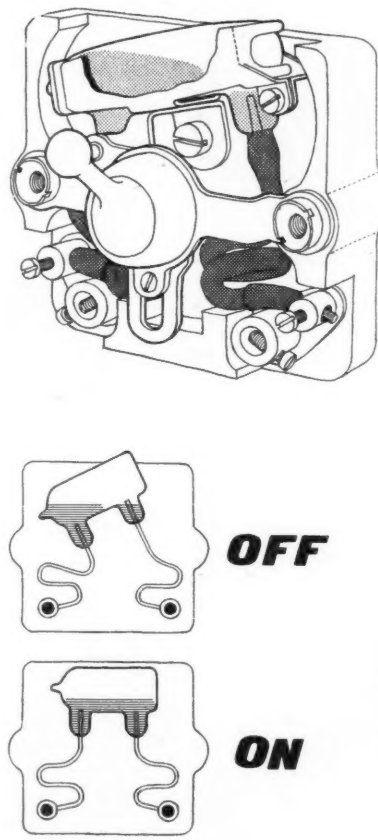
Waterproof switches and sockets are self explanatory. They are made in many different types, some of which could better be described as water resistant (Fig. 52). One firm makes a socket which can be hosed down.

Cupboard switches are spring loaded and work in the same way as the ordinary bell push. They may be arranged to switch on either when the door is opened (e.g. refrigerators or built in wardrobes) or when it is closed (w.c. cubicles) (Fig. 53).

Keyed switches may be made with a detachable dolly or for operation with a relatively simple rectangular or tubular key. Many types can also be operated with a little ingenuity and a penknife, and on some jobs it may be preferable to use a more expensive type controlled by a pin tumbler Yale type key (Fig. 54).

Time lag switches are also used to control staircase lighting in flat blocks (Fig. 55). The most common type has a bell push movement with a comparatively long travel, the return movement being controlled by an adjustable dashpot so that the lighting is switched off after an appropriate interval. The dashpots are not always reliable, and the time adjustment is too easily maltreated by tenants so that it is often simpler and more satisfactory to have a relay and a time escapement at a single point to control all the lights on one staircase with a simple push button control at each switch point.

Time switches may vary from the comparatively simple types (Fig. 57) which turn a cooker on or off at selected times to the more elaborate versions which may be used to control central heating temperature, turning it down in the evening and up in the morning, with additional



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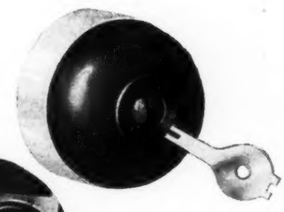

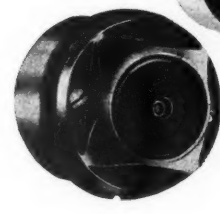

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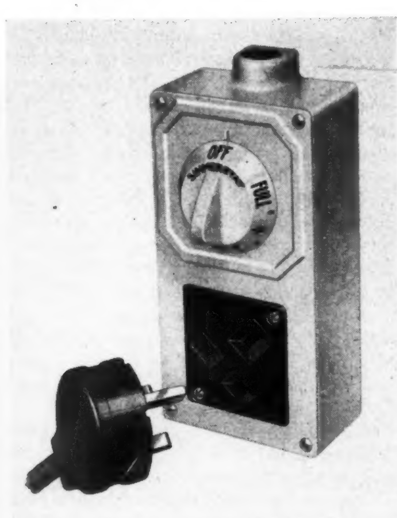

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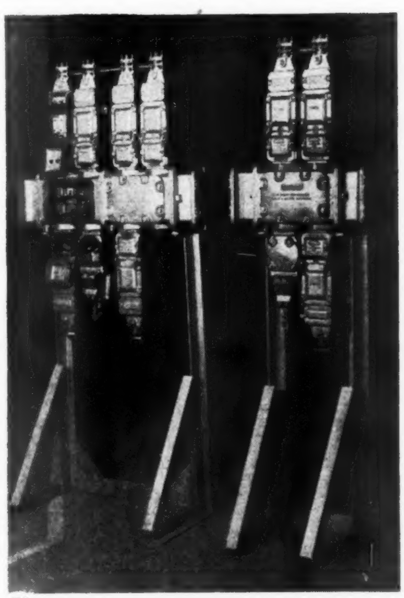

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50, mercury switch. 51, flame proof switches for a factory installation. 52, waterproof switch. 53, cupboard door switch. This is fixed so that the button is depressed (and the switch off) by the closed door. 54, key operated switch to prevent unauthorised use. 55, time lag switch which may be adjusted to give a delay period from 2 seconds to 1 hour. 56, the electrical equivalent of the gas tap, which acts in the same way as a cooker oven control. 57, a cooker time switch which can be set to switch the cooker on and off up to 12 hours in advance.

adjustments to leave the temperature low over the week-end in office blocks. Provided that a regular schedule can be drawn up, time controls can be produced to carry out the necessary switching operations without any attention.

Thermostats for wall mounting or built-in to electric heaters require no particular comment, but at least one manufacturer is producing a combined thermostat and plug with which the room temperature reached with any type of electric heater can be controlled. Somewhat similar in effect, though not true thermostats are devices originally introduced to control hot plates and ovens (Fig. 56). They are in effect the electrical equivalent of the ordinary gas tap. Sockets have recently been produced in which the ordinary on-and-off switch is replaced by such a device so that the heat of the fire can be controlled.

Relays are necessary for the control of heating circuits if D.C. supplies are used, as the micro-gap of the bi-metal strip thermostat is suitable only for A.C. supply. They are also used if comparatively heavy currents have to be controlled from some distance, as they then save long runs of heavy cable. Relays are sometimes also referred to as contactors, and the terms overlap to a certain extent in common usage.

Burglar alarm switches are simple low-voltage trigger or button types which may be applied to door and window frames or other vulnerable points. They are generally used with relays to operate bells or other warning signals.

Clock connectors are modified plugs and sockets which provide a semi-permanent connection, the socket being held in position by some form of knurled screw (Fig. 58). The plug generally contains a small cartridge fuse.

Workshop sockets are used in factories where non-standard voltages may be used for portable tools (Fig. 59). The pins of the plug are so arranged that they will not fit any normal two- or three-pin socket. Similarly, some portable apparatus, such as a motor-driven pump or other equipment, may need a three-phase supply, and three-pin sockets with a fourth pin for the earth connector are produced. All the sockets in an installation of this kind must be considered in relation to each other, so that there is no possibility of apparatus being used with the wrong voltage.

Panel mounting switches consist of the usual mechanism and dolly with brackets for two-hole fixing or a threaded shank for fixing with a nut or knurled ring. Used commonly in radio sets and electrical instruments, a large number of them can be mounted in a small area, or they may be neatly mounted in a metal door frame (Figs. 60, 61).

Circuit-breakers are little used in this country for low-voltage work, though they are common practice in America where they replace the usual fuse. *Earth-leakage* circuit-breakers will cut off the main supply as soon as an earth fault current reaches a predetermined level. They are a sensible precaution in country districts where dry weather or other reasons may make a low resistance earth connection difficult or unreliable (Fig. 62).

Light rays are sometimes used in conjunction with a light-sensitive cell to count vehicles or pedestrians or for the automatic opening of doors. Whatever operation is required the interruption of the light ray causes the cell to start the appropriate switch movements. Light outside the visible spectrum is also sometimes used in a similar way for burglar alarms or where a visible ray is thought undesirable.

Transformers are now produced with various tappings to suit all the American, Continental and British electric razor voltages, small units being made to incorporate the transformer and the necessary sockets (Fig. 63).

Bedhead fittings for hospitals now include several services, a socket for a lamp, a transformer for a low-voltage night-light and also a radio headphone socket (Fig. 64).

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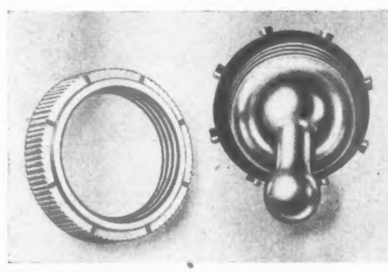

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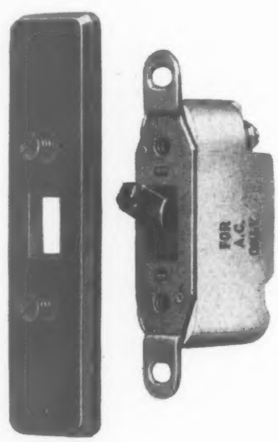

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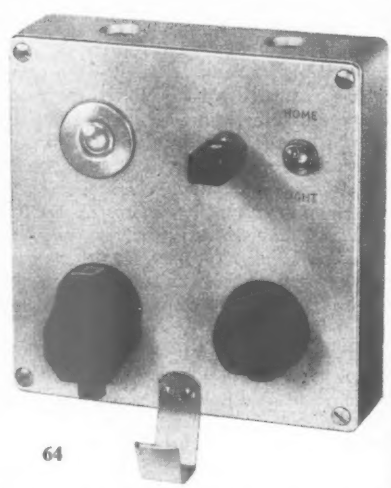

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58, a socket outlet for an electric clock. The plug is held in place by a knurled nut. 59, workshop socket and plug, for tough situations. 60, a plate switch with a ratchet device to prevent the knurled nut from working loose. 61, a switch suitable for steel door frame mounting. 62, a small circuit breaker. These perform the same function as a fuse in protecting circuits from excess energy. 63, tapped transformer fitting with outlets for various kinds of electric razor. 64, bedhead fitting for hospitals, providing a socket outlet for a light; transformer for low voltage night light and a socket for radio headphones.

REGULATIONS

Regulations are of two kinds. Those which stem from Acts of Parliament and govern the conditions of supply; and those which form guidance for installation methods, but are not statutory. An account is here given of the way in which these two sets of regulations affect practice.

Electricity Regulations in general use in Great Britain are issued by two authorities. The first are the regulations authorised by the Electricity Act of 1947, which have the force of law behind them. These are known as the Electricity Supply Regulations, and those in use at present were issued in 1937. These regulations cover the legal conditions which have to be observed "for securing the Safety of the Public, and for Insuring a Proper and Sufficient Supply of Electrical Energy" to quote the sub-title of the Regulations.

In these regulations conditions are laid down which Electricity Boards must observe, to ensure continuity of supply and the protection of all their lines from excess energy.

On the consumers side however, the chief necessity laid upon them by law is to prevent undue leakage of electricity to earth.

Regulation 26 for example gives every Electricity Board power to refuse to connect a consumer's installation if, when it was connected, a leakage of electricity would take place exceeding one ten-thousandth part of the maximum current to be supplied to the installation (i.e. when all lights etc., were turned on).

A leakage of this order might take place in a new installation if a nail in a floorboard had inadvertently been driven through a length of tough rubber cable piercing the insulation and touching the live conductor.

There is nothing however to prevent an Electricity Board from giving the consumer a supply temporarily if, for example, some branch switches were wrongly inserted in the neutral conductor instead of the live conductor or if socket outlets were reversed in polarity.

Regulation 27 makes it clear that Electricity Boards cannot be compelled to connect an installation, and that they also have powers to *disconnect* their supply from a consumer's installation, if they are not reasonably satisfied that all its cables, wires, apparatus, etc., are sufficiently adequate for the purposes for which electricity is to be used. They must be satisfied too that all these parts of the installation are constructed, installed, and protected so as to prevent danger.

This regulation also requires all single pole switches to be inserted in live conductors only, and some automatic means of cutting off the current in branch circuits (e.g fuses) to be provided in the event of excess current flowing. Single pole switches are largely used for the control of lighting fittings and socket outlets, while double pole switches are used for controlling main supplies so that when they are opened the whole of the installation is completely disconnected from the mains.

It is regulation 27 too in which the Institution of Electrical Engineers' Regulations are officially mentioned with the important provision that any consumer's installation complying with the I.E.E. regulations shall be deemed to fulfil the requirements of regulation 27.

Wiring Rules

"Satisfactory results including safety from fire and shock" are the concern of the "Regulations for the Electrical Equipment of Buildings."*

These are issued by the Institution of Electrical Engineers, and are the standard by which all electrical installations are judged and the basis of every specification of any repute. The twelfth edition is current at the time of writing, but the thirteenth is in course of preparation.

The I.E.E. Regulations are not mandatory—that is to say they cannot be enforced legally, although they form a recognised code to which everyone of repute engaged in electrical work is expected to adhere.

Broadly speaking the object of the I.E.E. Regulations is best explained by quoting the opening paragraph of the introduction which states:

"These Regulations, which state the main requirements and precautions for ensuring satisfactory results, including safety from fire and shock, relate to the distribution of electrical energy in and about all types of dwelling house, business premises, public buildings and factories . . . The Regulations are not intended either to take the place of a detailed specification or to instruct untrained persons . . .

In greater detail it can be said that the I.E.E. Regulations cover *inter alia* the following points:

The control and distribution of the supply in the building.

The arrangement of the circuits.

The installation of cables and methods of wiring.

The installation of lighting fittings and accessories.

The installation of current-using appliances.

Earthing—which is the means by which danger from electric shock is prevented.

The testing of installations.

Naturally, every care is taken to make the regulations comprehensive yet capable of reasonable interpretation, for example, the regulation which covers the connection of single-pole switches in the live conductor reads as follows :

(iii) (*a*) "In every installation connected to a source of supply having its neutral, middle wire, or common return conductor permanently and effectively connected with earth. . . . No fuse . . . switch . . . or circuit-breaker shall be inserted in the conductor connected with earth."

As a condition of a contract for an electrical installation the I.E.E. Wiring Regulations are of considerable value yet it does not follow that an Electricity Board will refuse to connect their supply to an installation which may not comply with the I.E.E. Regulations as long as leakage of electricity to earth will not exceed that laid down by the Electricity Regulations. That they do connect the installation in such cases does not mean that it is accepted as sound by the Electricity Board as such defects as listed above are recorded and can be used as evidence should a fire result, or death by electrocution or other accident occur.

The I.E.E. Regulations for the Electrical Equipment of Buildings are the only Regulations which are accepted as standard in this country—indeed, no others exist. They have been adopted by all the Electricity Boards in Great Britain.

British Standards

Electrical equipment, accessories, cables, and appliances are well served with British Standards, which have been steadily increasing in number over the past 53 years.

There are now some 23 sections dealing with electrical engineering in which are at least 60 individual British Standards of interest to the architect.

Among others they cover cables and conduit, heating, cooking, and water heating appliances, lamps, and fittings, switches, and socket outlets. In some cases when there are a number of British Standards covering a particular subject an abstract of all of them is published in handbook form.

British Standards have played a considerable part in the simplification of electrical installation work and any maintenance which may be necessary afterwards. Those applicable to socket outlets can be cited as an example. In an industry containing as it does so many individual and independent firms the manufacture of means of connecting portable electrical appliances to the mains has needed considerable supervision. Without some kind of standard the existence of, probably, dozens of sizes and types of socket outlet would have caused confusion well-nigh indescribable. Even with the British Standards in force today numbers of types and sizes of non-standard socket outlets are still being manufactured. Whilst these non-standard accessories may be excellent in every way the architect must surely consider whether the continued use of non-standard socket outlets is in his client's interest. In this connection it should be noted that the earlier British Standard No. 372 of 1930 for the two-pin type of socket outlets has become redundant since it does not afford earthing facilities.

Architects have long called for a single standard socket outlet which would supersede every type and size now sold. This socket-outlet is now in existence in the form of a universal all-purpose accessory (B.S.1363) and in due course its use will be as universal as its purpose, if architects and all who draw up specifications will only choose this standard fitment.

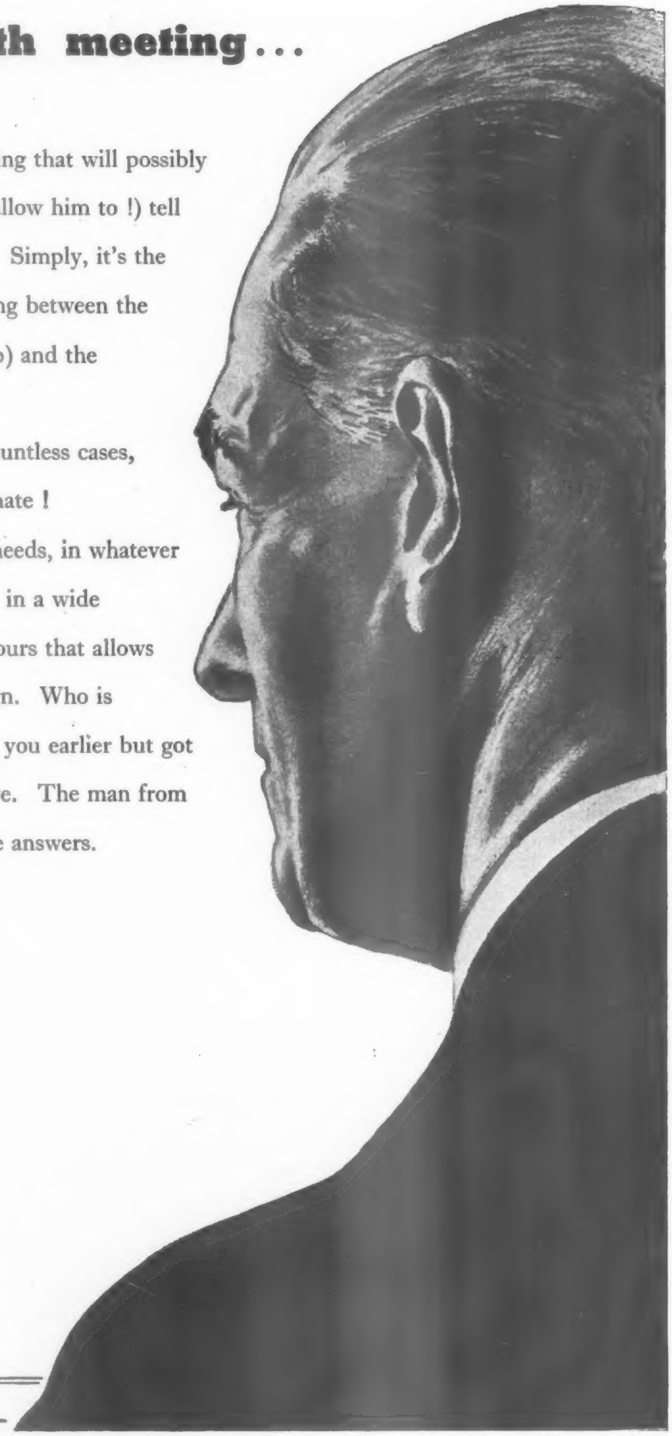
* Regulations for the Electrical Equipment of Buildings, price 5s., post free, and bound in paper, from the Institution of Electrical Engineers, Savoy Place, Victoria Embankment, London, W.C.2.

Here's a man worth meeting...

... a man with a viewpoint on rubber flooring that will possibly be new to you. He can (and will, if you'll allow him to !) tell you about " 3.75 ". What's that, you ask ? Simply, it's the thickness in millimetres of the rubber flooring between the ordinary $\frac{1}{8}''$ gauge (often too light for the job) and the more costly $\frac{3}{16}''$ gauge.

" 3.75 " is ideal for most jobs . . . has, in countless cases, provided the right answer—inside cost estimate !

He can, of course, supply *all* your flooring needs, in whatever grade of rubber you desire. Tiles are made in a wide variety of sizes and shapes in a range of colours that allows the greatest flexibility of planning and design. Who is this man ? Forgive us, we should have told you earlier but got rather carried away. He's our representative. The man from Runnymede Rubber. The man with *all* the answers.



RUNNYMEDE RUBBER CO. LTD., 6, OLD BAILEY, LONDON, E.C.3.

British Standards have also been prepared for electrical appliances of many kinds. One of the latter which is of considerable advantage covers the electric immersion heater which has a standard screwed head which can be inserted into a standard hot water tank or cylinder fitted with a standard flange the position of the latter being specified in the relevant B.S.

Codes of Practice

The British Standards Institution also publish a number of Codes of Practice which are recommended standards of good practice. Like the I.E.E. Regulations, however, they are not mandatory. Those of interest to the architect are as follows :

C.P. 321—1948, *Electric Installations.*
C.P. 321.101—1949, *Electrical Wiring Systems.*
C.P. 322.102—1948, *Electricity Supply Intake, arrangements for flats and other multi-occupier buildings.*
C.P. 322.103—1948, *Installation of Consumers' Electricity Supply Controls for Small Dwellings (for A.C. Systems).*
C.P. 324.101—1948, *Provision of Electric Lighting in Dwellings.*
C.P. 324.102—1948, *Provision of Electric Lighting in Schools.*
C.P. 324.201—1948, *Installation of Domestic Electric Space Heating Equipment.*
C.P. 324.202—1951, *Domestic Electric Water Heating Installations.*
C.P. 324.301—1948, *Selection and Installation of Domestic Electric Cookers.*
C.P. 324.403—1948, *Installation of Vapour Compression Type Domestic Electric Refrigerators.*
C.P. 326.101—1948, *Protection of Structures against Lightning.*

Of the above codes the most important to the architect are those dealing with electrical installations, electrical wiring systems and electricity supply intake arrangements. The others are intended for those who wish to study special applications and form a guide to the study of the problems involved.

Workmanship

Whilst compliance with rules and regulations and the use whenever possible of B.S. materials or accessories go a long way to ensure a satisfactory installation there remains the possibility of bad workmanship. No test after completion will reveal this defect which can only be detected by periodical inspection whilst the work is in progress.

Examples of bad workmanship are too numerous to list completely. Those which will affect subsequent tests and general reliability will include:

Careless setting of bends in conduit and lack of care in filing off internal burrs in conduit. Both of these will cut or chafe the insulation of cables when these are being drawn in.

Omitting to fix sufficient drawing-in boxes to facilitate easy drawing-in of cables into a conduit system. In general these should be not more than 25 ft. apart.

Cutting threads on conduit to an excessive length; the unprotected metal is subject to rust. Slack threads will cause poor electrical conductivity unless lock nuts are used.

Running conduit without regard to the drainage of moisture.

Conductors badly fitted in terminals or terminal screws not properly tightened.

GLOSSARY OF TERMS

Alternating Current: The direction of flow of the electric current is reversed many times a second. The national standard frequency in this country is 50 cycles per second. A cycle contains two reversals, viz., from one direction to the opposite, and then back to the original direction. Areas in this country which were originally supplied with other frequencies, have been, or are in the process of being converted to 50 cycles.

Alternator: See " Electric Generator."

Ampere (often comtracted to Amp.): The unit of electric current. Named after the famous French Physicist (1775-1836). As an indication of the order of magnitude of this unit, a 2-kW. electric radiator on a 240 volt circuit takes a current of 8·3 amperes. Minute currents, such as occur in certain radio circuits are measured in milli-amps. 1,000 of which equal one amp.

British Electricity Authority (B.E.A.): The Electricity Act of 1947 which brought the electric supply industry under national ownership established a Central Authority (the B.E.A.) to generate and transmit electricity to 41 Area Electricity Boards which in turn act as retailers and distributors of electricity to consumers.

British Thermal Unit (B.Th.U.): This is a unit of heat and is the quantity of heat required to raise the temperature of 1 lb. of pure water one degree Fahrenheit. One Unit of Electricity contains the same amount of energy as 3,412 (kW. hour) British Thermal Units.

Busbars—The heavy copper bars in a switchboard to which the main supply is taken and from which all feeder circuits and distribution switch and fusegear are fed.

Capacitor : An arrangement of conductors in the form of metal sheets or foil separated by a thin dielectric of paper or other insulating material; it provides what is known as capacity and is capable of storing a small electric charge. When a capacitor is connected to an A.C. Voltage it will take a current at " leading " power factor and capacitors are therefore used to " correct " a lagging power factor of motors, fluorescent lamps, etc. Capacitors are widely used in radio apparatus including radio interference suppressors.

Conductor: Is a substance which allows an electric current to pass relatively freely, i.e., has a high conductivity. Copper is a good conductor, the wire forming the heating element in an electric radiator is also a conductor, although not such a good conductor as copper.

Current : The movement or " flow " of electricity; usually measured in amperes.

Cut-out : A fuse such as the main fuse provided by the Electricity Board on a consumer's premises.

Dielectric: Insulation between two electrically charged bodies.

Direct Current—(D.C.) or Continuous Current : The flow of current is continuously in the same direction.

Discharge Lamp: In all previous types of lamp, the source of light was some body or material heated to a very high temperature. In the discharge lamp the current passes through a special mixture of gas and metallic vapour, forming a luminous electric discharge. The light may be greenish (mercury) or yellow (sodium) but in amount there is from 2½ to 5 times as much available as from filament lamps of equivalent consumption.

Distribution Mains: Are the low voltage street mains used for the general supply to consumers. These are usually fed from a high voltage feeder or ring-main through a transformer in a substation and are either buried underground or carried overhead on poles.

Double Pole (D.P.): When a switch is arranged to open and close both the wires or " poles " of a circuit it is described as a double pole switch.

Diversity Factor: Any particular electrical appliance is spoken of as having a high or great diversity, if among a group of appliances very few are in use simultaneously. If, say, 100 appliances, each loaded to 1 kW., produce a maximum demand of 20 kW., the diversity factor would be 1 in 5. It is the great diversity of domestic cooking and heating that enables Electricity Boards to quote low rates for general domestic use.

Earth, Earthing: " Connected with Earth " means connected with the ground, i.e. the general mass of the earth, in such a manner as will ensure at all times an immediate and safe discharge of energy.

Electric Generator : A machine which converts mechanical energy into electrical energy. One which generates direct current is usually called a " dynamo " while one which generates alternating current is usually called an " alternator."

Electrodes : The conductors which convey an electric current into or out of a liquid or a gas.

Electrolytes : Chemical compounds and solutions of chemical compounds, capable of being decomposed by the passage of an electric current.

Electro-Magnetic Induction: If an alternating current, or a direct current of varying strength is passing through a conductor, then any other approximately parallel conductor in the vicinity will have an electromotive force in-

duced in it. If the ends of the latter are jointed so as to form a closed circuit, then an electric current will be induced. In practice, the respective conductors usually take the form of coils of insulated wire. Electric generators, static transformers and induction motors depend upon electro-magnetic induction for their operation. The principle was discovered by Michael Faraday in the year 1831.

Electro-Motive Force (E.M.F.): A difference in electrical potential which tends to cause an electric current to flow from the point of higher potential to the lower.

Feeder: A main cable supplying a system of distributing mains.

Fluorescent Lamp: A tubular Discharge Lamp internally coated with a powder which fluoresces under the action of the discharge producing a white or coloured light.

Four Wire Distribution: The usual system of distribution employed on 3 phase A.C. systems; it consists of three " phase " wires and one neutral wire.

Fuse: A safety device consisting of a few inches of relatively fine wire, mounted in a suitable holder and connected as part of an electrical circuit. If the current exceeds a predetermined value in amperes, the fuse wire melts (i.e. the fuse " blows ") and thus obviates damage to the circuit protected by the fuse. The blown fuse wire should only be replaced by another of suitable capacity.

Grid: The high voltage transmission system constructed and formerly operated by the Central Electricity Board. It originally cost £30,000,000, including the associated grid stations. It is called " the grid " because the report of the committee, presided over by Lord Weir, on which the Act of 1926 was based, likened the proposed transmission system to a grid-iron.

High Voltage: Means a voltage normally exceeding 650 volts.

Horse Power (H.P.): The unit of rate of doing mechanical work. In the early days of the steam engine, when engines were replacing horses for pumping in mines, an engine which would comfortably do the work formerly performed by say, 5 horses, was called a 5 horse-power engine. An H.P. has been standardised at 33,000 ft. lb. per minute, which is equal to 746 watts. 1·34 H.P. is therefore equivalent to 1 kilowatt, when the efficiency of conversion is 100 per cent.

Installation: " Consumer's wiring installation" means the consumer's wiring, together with any apparatus upon the premises connected or intended to be connected thereto.

Insulation: Means non-conducting material enclosing, surrounding or supporting a conductor, e.g. rubber, plastic, china, glass, mica, air, etc.

Interlocking Switch Plug: A plug and socket so arranged that the plug cannot be inserted or withdrawn unless the switch is in the "off" position.

Kilowatt (kW.) equals 1,000 watts: The larger unit of electrical power. In the case of a direct current supply or a single phase A.C. supply at unity power factor, the number of kilowatts is obtained by multiplying the pressure in volts by the current in amperes and dividing by 1,000, e.g. an electric fire taking 5 amperes at 200 volts will consume power at the rate of $\frac{5 \times 200}{1{,}000} = 1$ kW. In the case of single phase A.C. other than at unity power factor, the product of volts and amperes must be multiplied by the power factor. In the case of 3-phase A.C. the product of volts and amperes must also be multiplied by the square root of 3 (i.e. 1·73). Thus a 3-phase motor taking a current of 5 amperes at 400 volts at a power factor of 0·75 is consuming power at the rate of

$$\frac{400 \times 5 \times 1{\cdot}73 \times 0{\cdot}75}{1{,}000} = 2{\cdot}6 \text{ kW.}$$

Kilowatt-hour (kWh.): Is the amount of electricity consumed, as measured by the kilowatts multiplied by time in hours. A kilowatt-hour is commonly called a unit of electricity.

Kilovolt-ampere (kVA.): Applies to A.C. only. Is the product of the pressure in volts and the current in amperes divided by 1,000. When multiplied by the power factor gives the power in kilowatts. Is sometimes called the " apparent " power and is used to describe the rating of a transformer or other A.C. equipment. To give an example, a 10-kVA., 200-volt single phase transformer would be fully loaded if used to supply a motor taking 50 amperes but if the power factor of the motor is only 0·6, the true power is only 6 kW. and the consumption as registered by the meter if the motor is run for one hour, will be 6 units.

Load Factor: Is expressed as a percentage and is the proportion of the number of units used or generated to the number which would have been used or generated if the maximum load had been maintained steadily and continuously. That is to say if a motor in a factory runs fully loaded for 44 hours a week and 50 weeks in a year, its load factor is $\frac{44 \times 50}{24 \times 365} = 25$ per cent. The present load factor of Britain's electricity upply is about 45 per cent. If it could be increased it would tend to reduce the cost of electricity by making greater use of the generating plant. Any electrical appliance in use during " off peak " hours tends to improve load factor.

Low voltage or Low Tension: Means not exceeding 250 volts under normal conditions.

Mains: Means any electric line (whether underground or overhead) through which electricity may be supplied for the purpose of general supply. A " service line " is not a main.

Maximum Demand: Is the greatest rate of consumption of electricity. In most cases, the maximum demand for the purpose of an electricity supply tariff is twice the largest number of units used or generated in any half-hour. There are, however, various other methods of determining the maximum demand. There is no precise definition, but it is usually measured in kW.'s or kVA.

Medium Voltage: Means a voltage exceeding 250 volts, but not exceeding 650 volts under normal conditions.

Megawatt: Equals 1,000,000 watts, i.e. 1,000 kW.

Meters: The ordinary meter used to measure a public supply of electricity is a kWh. meter and indicates on a series of dials the number of units (kilowatt-hours) used. There are also other meters such as ammeters and voltmeters, but these are usually termed "instruments." A kWh. meter in which the insertion of a coin enables a predetermined amount of electricity to be obtained is called a " prepayment " meter or " slot meter."

Milliamp: Equals a thousandth of an ampere.

Multi-heat Switches: Electricity can be controlled in various ways to provide different values of heat output from say, a boiling plate on an electric cooker. One method is to group the heating elements in parallel (together or singly) or in series or series-parallel combinations. Using two elements, up to four different heats can be obtained, or with three elements as many as nine heats. Other methods of multi-heat control are obtained by using " tapped " transformers (see " Transformer ") or by periodical movement of thermally operated contacts which provides infinitely variable heat control.

Negative: Applies to D.C. only. The negative terminal is usually either painted black or marked with the symbol (—).

Neon: A rare gas. When a high voltage electric current of several thousands of volts is passed through a glass tube containing neon gas under reduced pressure, a red glow is produced. Other rare gases produce different colours. Transformers are used to supply the high voltage necessary for the tubes.

Neutral Conductor (Neutral Wire): The middle conductor of a three-wire or four-wire system. The neutral is usually " earthed," and under conditions of balanced load carries no current. In a three-wire D.C. system, it is at an intermediate pressure between the positive and the negative conductors, and so is called " the neutral."

Ohm: The unit of electrical resistance. A resistance of one ohm will pass a current of one ampere when a potential difference of one volt (D.C.) is applied at its ends. This fundamental relationship between current and voltage is known as Ohm's law. It is also applicable to A.C. but only when supplied at unity power factor.

Oil-immersed: The contacts of large switches are immersed in a suitable oil, which helps to extinguish the arc formed on breaking heavy currents. The windings of large transformers are also immersed in oil to facilitate cooling.

Parallel: Conductors or circuits are said to be in parallel when they are so arranged as to cause an electric current to divide and subsequently to reunite. The conductors need not lie parallel in a geometrical sense. Electric lamps are wired in parallel in the ordinary way. See also " Multi-Heat Switches."

Positive: Applies to D.C. only. The positive terminal is usually painted red or marked with the symbol (+).

Potential: Electrical pressure. Usually measured in volts.

Power Factor: Applies only to A.C. systems generally and to individual motors, etc. Broadly speaking is a measure of the proportion of useful current employed to that expended in overcoming the effects of inductance and capacity. (See " Kilowatt.") Inductance is related to coils and applies particularly to motors and transformers. Capacity is related to capacitors and long cable lines both of which are capable of storing small amounts of energy.

Rectifier: A device without moving parts used for converting alternating current into direct current.

Refractor: An arrangement of glass such as a shade or bowl, specially fluted so as to deflect or refract rays of light passing through it.

Resistance: The resistance which a conductor or appliance offers to the passage of current. It is measured in ohms and is equal to the voltage divided by the current in amps. (See also " Ohm.")

Ring Main: A main arranged in the form of a ring or loop as distinct from a single open-ended length of conductor.

Rupturing Capacity: A rating of a switch, circuit-breaker or fuse measured by the amount of power (in kVA.) which it is designed to interrupt and which therefore governs its suitability for any particular duty, e.g., a 30-ampere fuse in a factory near a power station would need a higher rupturing capacity than a 30-ampere fuse in a remote country cottage. The estimation of the maximum fault current that can flow in a circuit is a complex electrical engineering calculation but in practice all modern switch and fuse gear has sufficient rupturing capacity for ordinary low and medium voltage circuits.

Series: Conductors or circuits are said to be in series when an electric current passes first through one and then through the other.

Service Charge: The charge made by an Electricity Board for providing a service line.

Service Line: Means any electric line (whether underground or overhead) through which electricity may be supplied to a consumer from any main. When such a service line is extended to supply another consumer, the extension is called a " sub-service."

Slip-ring Motor: A type of induction motor for use with A.C. in which the current in the revolving winding is controlled during starting through the revolving slip-rings and fixed brushes by means of an external resistance. Motors of this type are used for industrial purposes especially for powers greater than about 20 H.P. or when some speed variation is required. The starting torque is good and this motor is therefore useful for starting against a load without taking too much current.

Squirrel-Cage Motor: The simplest type of induction motor for use with A.C., in which the revolving windings are in the form of a squirrel cage and have no external electrical connections. As the cage is, in effect, a short-circuited winding, the starting current is high unless reduced (to comply with the Electricity Board's requirements) by a " star-delta " or " auto-transformer " starter which reduces the applied voltage during the starting period. These motors are often used in small refrigerators, fans, pumps or cases where the motor does not have to start against a load.

Standing Charges: Those charges which remain unaltered whether electricity is being used or not.

Substation: Means any premises or enclosure containing apparatus for transforming or converting electricity (with or without switchgear) and large enough to admit the entrance of a person when the apparatus is in position.

Switch-Fuse: A switch and fuse combined in one case.

Switch Station: Similar to a substation and containing switchgear, but no transforming or converting plant.

Thermostat: A device for maintaining a constant temperature by automatically closing or opening a circuit as may be necessary.

Three-Phase A.C.: An A.C. system employing either 3 or 4 conductors, in which the changes in direction of the current in the three " phase " conductors do not occur at the same time, but in a regular sequence. Such a system has certain economic and technical advantages, both as regards transmission, distribution, transformation, and for power purposes. (See also " Alternating Current.")

Three-Pin Plug: Two of the pins are for the supply of current to a portable appliance. The third pin is to enable the appliance to be " earthed " through a third conductor. Three-core flex must, of course, be used. It is very important to use three-pin plugs in kitchens, sculleries, and wherever there is a tile or concrete floor or where there are water or gas pipes or taps.

Tough Rubber Sheathed Cable (T.R.S.): A cable sheathed with a tough rubber compound (or artificial rubber compound) so as to be suitable for use, in suitable circumstances, without further protection, e.g., conduit.

Transformer: A piece of electrical apparatus without moving parts, which enables the pressure of a supply of A.C. to be raised or lowered. It consists essentially of coils of insulated copper wire, wound on a core of laminated soft iron, and works on the principle of electro-magnetic induction.

Tubular Heaters: Low temperature (operating at about 180 deg. F.) heaters consisting of elements encased in steel tubing, having a diameter of about 2 in. The usual loading is about 60 watts per foot run.

Turbine: A machine in which jets of steam or water impinge upon blades attached to one or more discs or wheels mounted on a shaft supported in bearings. The shaft thus rotates and can be made to drive an electric generator or other machinery. The development of the steam turbine was largely due to the genius of the late Sir Charles Parsons.

Turbo-Alternator: An arrangement consisting of a turbine driving an alternator, either direct-coupled or through reduction gearing.

Unit of Electricity (or Kilowatt-hour or " kWh."): It is the unit of electrical energy and is the amount of energy corresponding to a power of one kilowatt (1,000 watts) sustained for one hour, or equally, for example, two kilowatts for half an hour. Thus a 60-watt lamp will, in approximately 17 hours, consume 1,000 watt-hours or one unit.

V.I.R. Cable: The conductors are insulated with vulcanised india-rubber.

Volt: The unit of electrical pressure, named after the famous Italian scientist, Volta. The National Standard for domestic and lighting purposes is 240 volts, although it varies from one part of the country to another.

Voltmeter: An instrument for measuring electrical pressure in volts.

Watt: A smaller unit of electric power. Named after the famous Scottish engineer, James Watt. With D.C., volts × amps. = watts, 1,000 watts equals one kilowatt.

Wiring: " Consumer's wiring " means the electric lines situated upon the consumer's side of the supply terminals.

Wiring Rules: An extensive code of regulations drawn up by the Institution of Electrical Engineers, setting out details of what is recommended for the electrical equipment of buildings.

Readers requiring up-to-date information on building products and services may complete and post this form to the Architects' Journal 9, 11 and 13, Queen Anne's Gate, S.W.1

ENQUIRY FORM

I am interested in the following advertisements appearing in this issue of "The Architects' Journal." (BLOCK LETTERS, and list in alphabetical order of manufacturers names please.)

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Acknowledgments

For material from which the illustrations in this issue were prepared, the JOURNAL is indebted to the persons, organisations and manufacturers listed below.

1, 2: E. Jacobi. 3: British Insulated Callender's Cables Ltd., Norfolk House, Norfolk St., W.C.2. 4: The General Electric Co. Ltd., Magnet House, Kingsway, W.C.2. 5-8: E. Jacobi. 9: The English Electric Co. Ltd., Queens House, Kingsway, W.C.2. 10: British Electrical Development Association, 2 Savoy Hill, W.C.2. 11: British Insulated Callender's Cables Ltd. 12, 13: E. Jacobi. 14: Midland Electrical Manufacturing Co. Ltd., Tyseley, Birmingham, 11. 15: E. Jacobi. 16: Walsall Conduits Ltd., Excelsior Works, West Bromwich. 17: John Lacey, Durham. 60, 61: J. H. Tucker & Co. Ltd. 62: Dorman & Smith Ltd., 10 Emerald F. J. Samuely. 18-22: E. Jacobi. 23-25: General Electric Co. Ltd. 26: British Electrical Development Association. 27: Lumenated Ceilings Ltd., 4, Lloyd's Avenue, E.C.3. 28: Building Research Station. 29: British Thomson-Houston Co. Ltd., Crown House, Aldwych, W.C.2. 30-33: British Electrical Development Association. 34, 35: General Electric Co. Ltd. 36: British Electrical Development Association. 37-48: General Post Office. 49: M.K. Electric Ltd., Wakefield Street, N.18. 50: Wandsworth Electrical Manufacturing Co. Ltd., 90 Vittoria St., Birmingham 1. 51: Cantie Switches Ltd., Port Causeway, New Ferry, Birkenhead. 52: J. H. Tucker & Co. Ltd., Kings Road, Tyseley, Birmingham 11. 53: Arcolectric (Switches) Ltd., Central Avenue, West Molesey, Surrey. 54: J. H. Tucker & Co. Ltd. 55: Power Equipment Co. Ltd., Kingsbury Works, The Hyde, N.W.9. 56: J. H. Tucker & Co. Ltd. 57: Metalform Ltd., 258 Grays Inn Road, W.C.1. 58: M. K. Electric Ltd., 59: A. Reyrolle & Co. Ltd., Hebburn, Co. Street, W.C.1. 63: Chilton Electric Products Ltd., 19 Old Queens Street, S.W.1. 64: Wandsworth Electrical Manufacturing Co. Ltd.

Announcements

Mr. L. Mason Apps, A.R.I.B.A., A.M.T.P.I., has changed his address from 11, Granada House, Maidstone, to 22a, Gabriel's Hill, Maidstone (Telephone: Maidstone 51589), where he will be pleased to continue receiving trade catalogues.

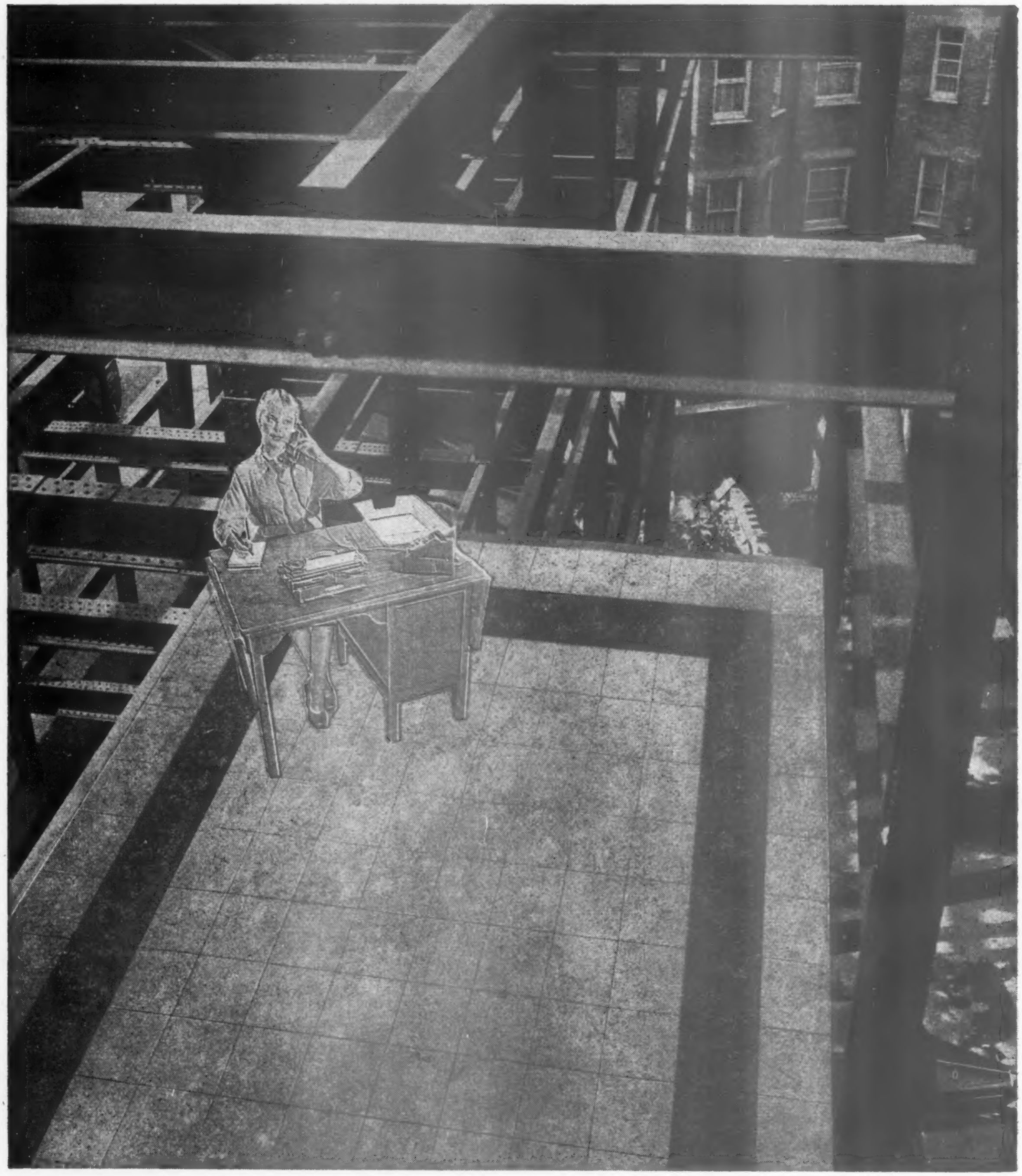
Mr. Alan W. D. Marshall has resigned his position as Chief Structural Engineer in the County Architects' Department of the Surrey County Council, and has commenced in private practice as a Consulting Structural Engineer. The practice is under the title of Alan Marshall & Partners, 115, Gloucester Place, W.1. Trade catalogues will be welcomed.

William Pinchin & Co. Ltd., Frome, Somerset, announce that R. G. Else, 6, Roland Houses, Roland Gardens, London, S.W.7 (Fremantle 3282), has been appointed their London contracts manager.

The Glazed Cement Manufacturers Association has recently been formed of manufacturers of glazed cement finishes.

Mr. James G. Andrew has been appointed Area Manager for the Southern Counties for International Paints Ltd., Mr. Andrew will be pleased to give every assistance to architects on specifications, colour schemes, etc. The address of his office is: International Paints Ltd., Inland Division, 24-30 Canute Road, Southampton. In the same Company, Mr. E. B. Marquand has been appointed Manager of the Decorative Division.

Mr. A. W. Evans has been appointed General Sales Manager to Air Control Installations Ltd.; the Birmingham office will be managed by Mr. W. Lennon.



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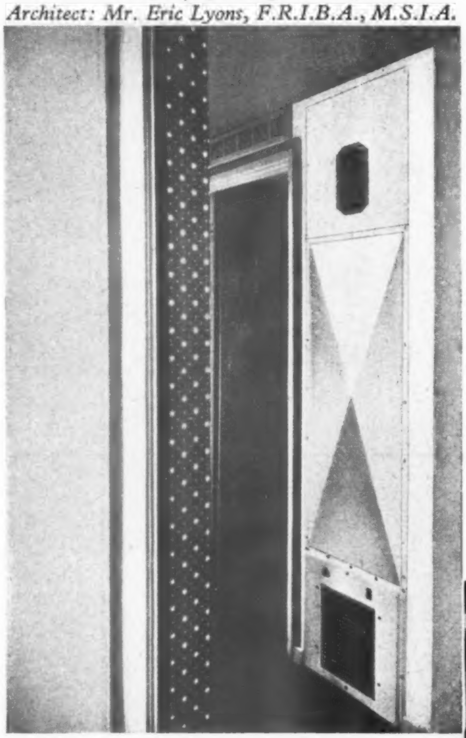

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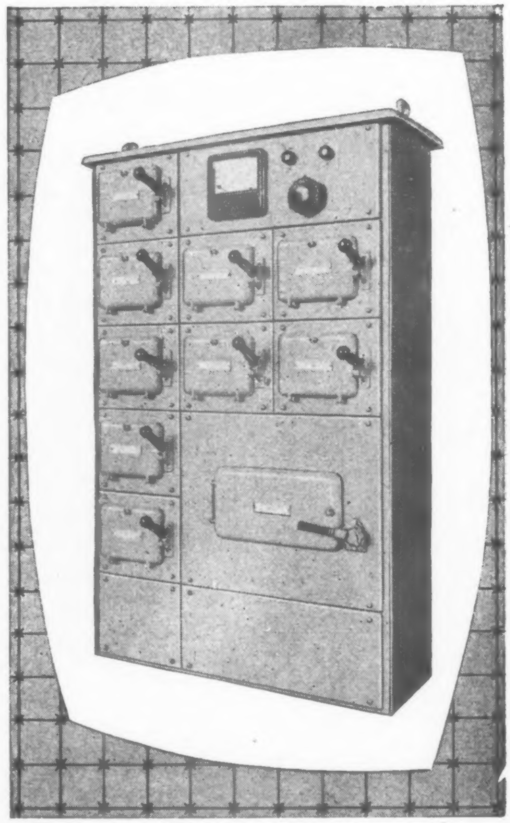

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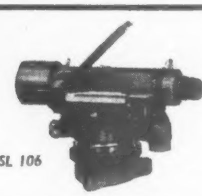

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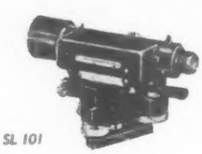

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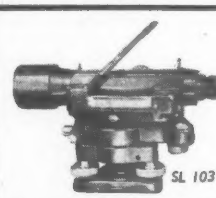

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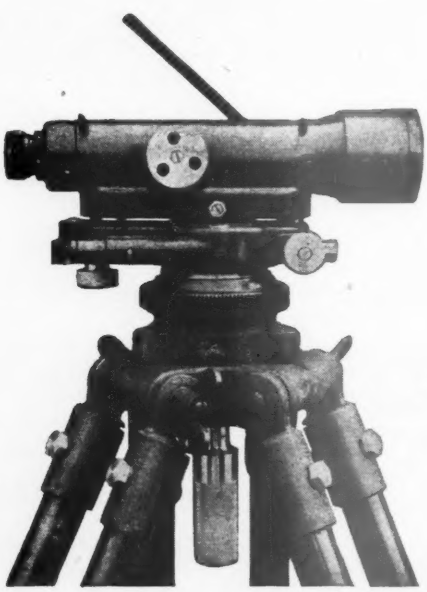

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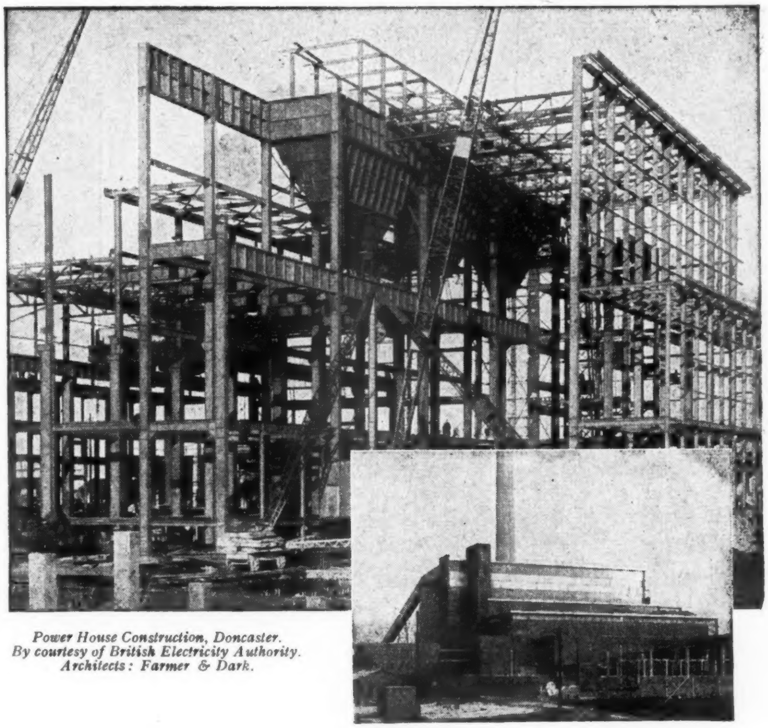

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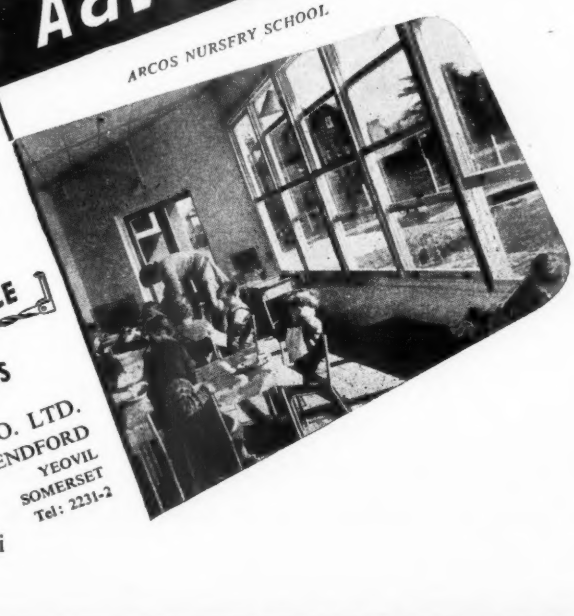

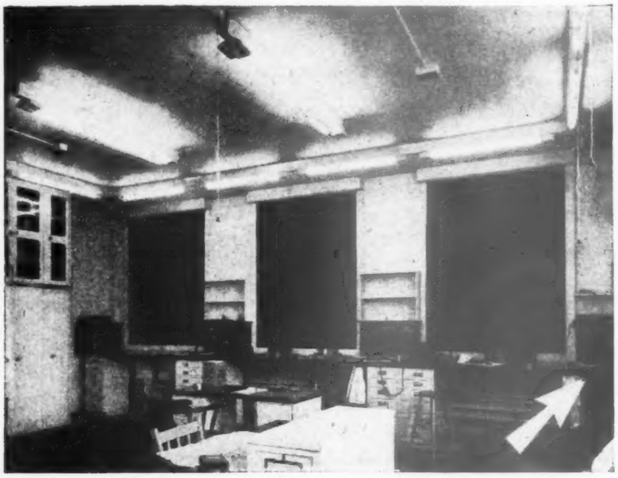

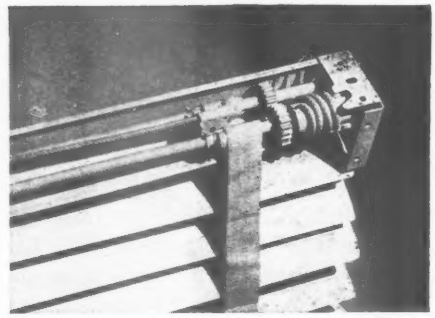

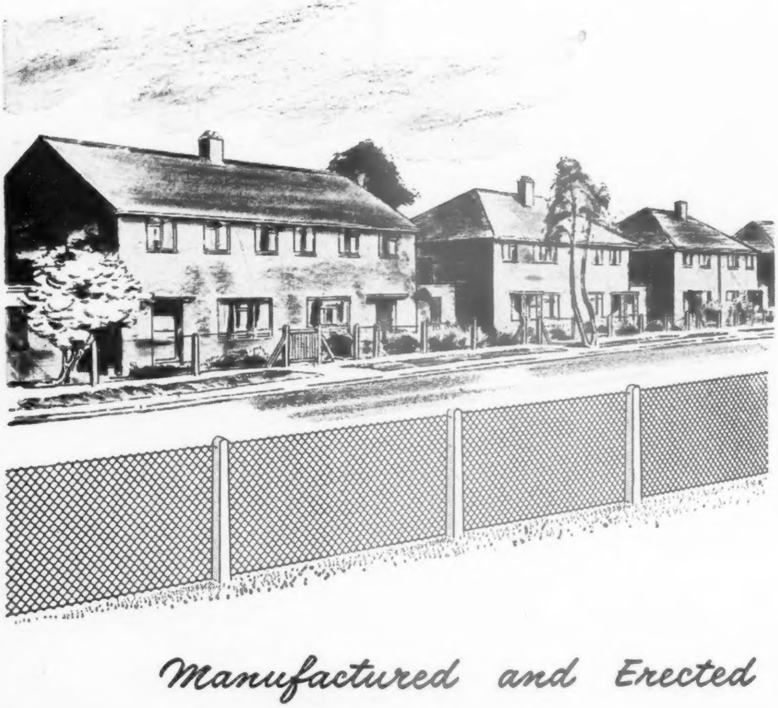

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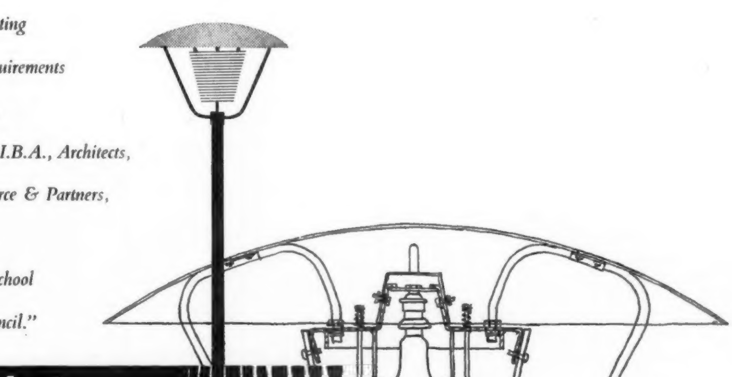

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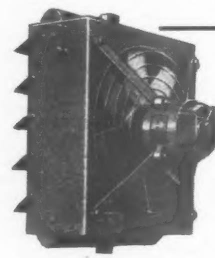

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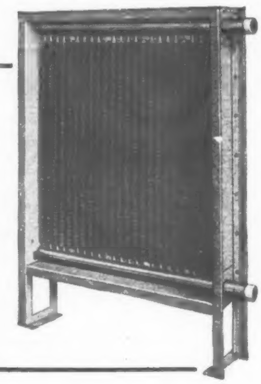

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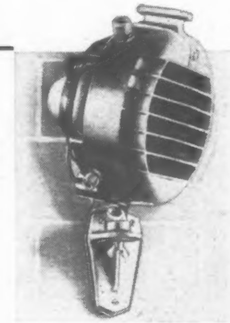

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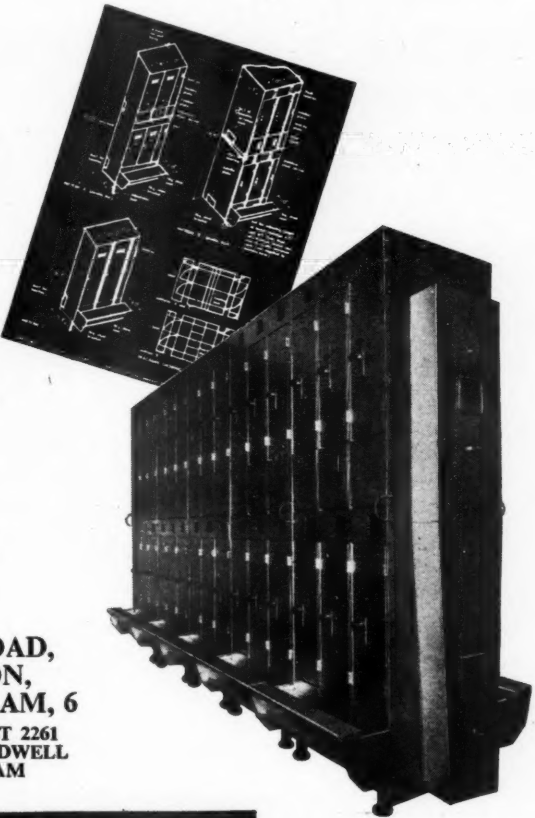

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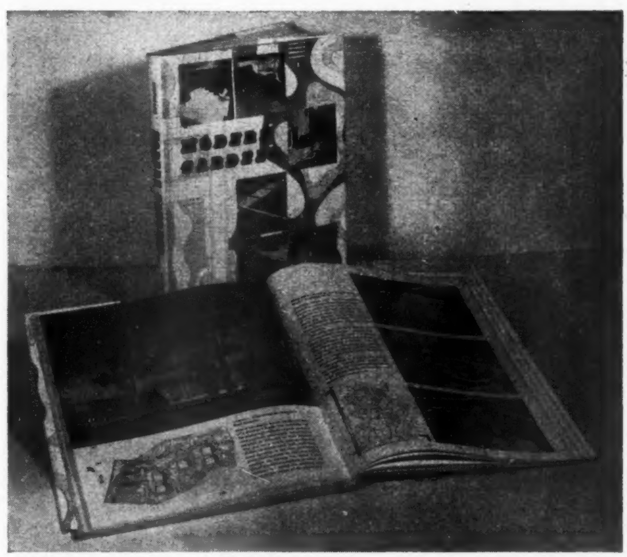

THIS BOOK IS ABOUT the design, planning and planting of the Modern Garden. It will interest all those who design and plan gardens, professionals and amateurs alike, and indeed all who have any love for gardens and gardening. Its author is a practising landscape architect, as well as an architect of buildings and a town planner.

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The author has drawn his examples from all over the world; from Belgium, Brazil, Denmark, England, France, Italy, Sweden, Switzerland and the U.S.A.; they vary from the little twenty-feet-square garden at the back of a London East-end terrace house to the several square miles of Stockholm's famous public parks, and include examples of roof gardens, indoor gardens, long narrow town gardens, large country gardens set in woodland, and gardens in the desert and by the seashore. He provides numerous plans of the gardens and whenever possible gives details of the material used in the construction of paths, walls, terraces, pergolas, etc., and the names of the plants which are grown.

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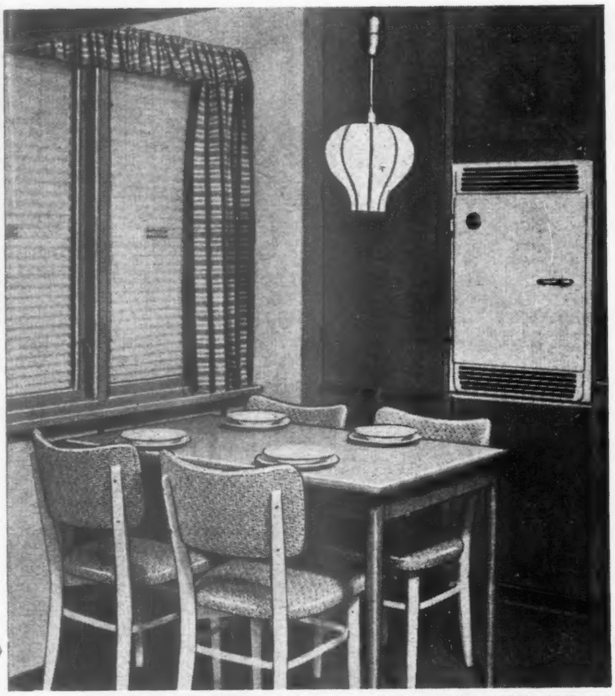

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The salary for the post will be on Range A of the Scheme for Chief Officials' Salaries on the scale £1,000—£1,200 by four annual increments of £50 and the successful applicant shall be given a placing on the scale in accordance with his age, qualifications and experience.

The appointment is superannuable under the Local Government Superannuation (Scotland) Acts 1937 and 1952 and the successful applicant will be required to pass a medical examination.

Copies of the Conditions of Appointment of the Burgh Architect may be obtained from the undersigned, with whom applications, giving full particulars of age, professional qualifications and experience and accompanied by copies of three recent testimonials, should be lodged not later than 24th November, 1954.

J. HUTCHEON, *Town Clerk.*

Municipal Chambers, Dumfries.
2nd November, 1954. 4592

MINISTRY OF WORKS.

ARCHITECTURAL ASSISTANTS are required for drawing office work in London and various Scottish and Regional Offices.

Candidates must have had at least three years architectural training, some experience in an Architect's office, and be of intermediate R.I.B.A. standard.

London salaries £420 (at age 21) to £670 per annum. Starting pay according to age and experience. Rates in the provinces slightly less. Prospects of promotion and establishment.

State age, nationality and full details of training and experience to W.G.10/C.A.6(F), Ministry of Works, Abell House, John Islip Street, London, S.W.1. 3026

BIRMINGHAM REGIONAL HOSPITAL BOARD require ASSISTANT QUANTITY SURVEYOR (£600 × £25 (7) × £30 (3)—£865 p.a.) for Architect's Department. Applicants should have Final R.I.C.S. and be fully experienced in taking off and preparing bills of quantities and settling final accounts. Superannuable appointment. Write, naming three referees to Secretary, 10, Augustus Road, Birmingham 15, by 29th November, 1954. 4648

CARDIGANSHIRE COUNTY COUNCIL.
AMENDED ADVERTISEMENT.
APPOINTMENT OF
ASSISTANT ARCHITECTS (TWO).

Applications are invited for the above appointments in accordance with Grade IV namely £675—£825 per annum, from 1st January, 1955, in the County Architect's Department, Aberaeron. Commencing salary will be in accordance with the qualifications and experience of successful applicants.

Applicants should be members of the R.I.B.A. and must disclose whether to their knowledge they are related to any Member or Senior Officer of the Authority.

Forms of application may be obtained from the County Architect, County Hall, Aberaeron. Applications must be returned to the undersigned by not later than 12.0 noon on 29th November, 1954.

J. E. R. CARSON,
Clerk of the County Council.

Swyddfa'r Sir, Aberystwyth. 4585

CITY OF LIVERPOOL.
CITY ENGINEER & SURVEYOR'S DEPARTMENT.

Applications are invited for the appointment of PLANNING ASSISTANT, Town Planning Branch. Salary, £620—£670 per annum (A.P.T. Grade V). Applicants must be Corporate Members of the Town Planning Institute, or hold an equivalent qualification. Applicants should have received a training in architecture and should be good colourists and capable of producing perspectives and sketches.

Application forms, obtainable from the City Engineer and Surveyor, Municipal Buildings, Liverpool, 2, should be returned to him by the 26th November, 1954.

The appointment is superannuable and subject to the Standing Orders of the City Council. Canvassing disqualifies.

THOMAS ALKER, *Town Clerk.*

Municipal Buildings, Liverpool, 2.
(JA.3724.) 4694

METROPOLITAN BOROUGH OF WANDSWORTH.
ARCHITECTS.

Applications are invited for the established appointments of:—

(a) SENIOR ASSISTANT ARCHITECT—A.P.T. VII/VIII.

(b) ASSISTANT ARCHITECT—A.P.T. VA/VI £680—£790 per annum.

These salary scales may be increased to £780—£930 in case of (a) and £705—£855 in case of (b).

Applicants for both posts should be Associates of the R.I.B.A. and have had experience in the design and planning of housing estates, particularly multi-storey blocks of flats and/or other framed buildings, and in supervision of their erection. Applicants for (a) must also have had experience in the control of staff.

Application forms, obtainable from the Borough Engineer, must reach me by 23rd November, 1954.

R. H. JERMAN,
Town Clerk.

Municipal Buildings,
Wandsworth, S.W.18. 4627

BOROUGH OF SOLIHULL.

ASSISTANT ARCHITECT, Grade A.P.T. VA, £650—£710 (from January 1955, new Grade A.P.T. III, £675 × £25—£725).

Applications are invited for the above appointment in the Borough Engineer & Surveyor's Department, 90, Station Road, Solihull.

The appointment will be subject to the provisions of the Local Government Superannuation Acts, to the terms of the National Scheme of Conditions of Service and to one month's notice on either side. Housing accommodation will be made available as soon as possible.

Applications giving full details as to age, present position and salary, qualifications and experience, together with the names and addresses of two referees, should be delivered to the Borough Engineer & Surveyor at the above address not later than Tuesday, November 30th.

W. MAURICE MELL, *Town Clerk.* 4690

LONDON COUNTY COUNCIL.
ARCHITECT'S DEPARTMENT.

Vacancies for ARCHITECTS, Grade III (up to £892 10s.), and ARCHITECTURAL ASSISTANTS (up to £739 10s.), in Schools and Housing Divisions.

Particulars and application forms from Architect (AR/EK/A/2), County Hall, S.E.1. (1056) 2206

COUNTY COUNCIL OF RENFREW.

Applications are invited for the appointment of SENIOR ARCHITECTURAL ASSISTANT in the County Engineer's Department (A.P.T. V/VI—£630—£770). Applicants must be Registered Architects and Members of R.I.B.A. and/or R.I.A.S. Previous Local Authority experience would be an advantage. The appointments are superannuable. Applications stating age, qualifications and experience, together with recent testimonials, should be sent immediately to the County Clerk, County Buildings, Paisley. 4677

BOROUGH OF NELSON.
CHIEF ARCHITECTURAL ASSISTANT.

Applications are invited for the appointment of CHIEF ARCHITECTURAL ASSISTANT in the office of the Borough Engineer and Surveyor, at a salary in accordance with A.P.T. Division Grade VI of the National Scales of Salaries (£695—£760 per annum).

Applicants must be students of the R.I.B.A. and preferably Associates of the R.I.B.A. They should have experience in housing design, supervision, surveys, specifications and general work.

Applications, giving details of experience and qualifications, and endorsed "Chief Architectural Assistant", together with the names and addresses of three referees, must be received by the undersigned not later than Saturday, 20th November, 1954.

F. W. ROBERTS,
Town Clerk.

Town Hall, Nelson.
2nd November, 1954. 4623

LONDON COUNTY COUNCIL.

Hammersmith School of Building and Arts and Crafts, (1) TEACHER, assistant Grade B, of Painting and Decorating in C. & G. courses and to assist in the Interior Design course for National Diploma in Design; should hold at least a first class C. & G. Final Cert. and have industrial experience. (2) TWO TEACHERS, assistant grade B, and assistant Grade A, for Building Science and Maths. or for these subjects separately, in Diploma and Certificate courses, C. & G. trade courses and in classes for Structural Engineers, Architects and Surveyors. Teaching experience is desirable for all posts, but not essential. Burnham F.E. salary scales: (1) & (2B) from £561 × £25—£1,012 (men), £511 × £20—£820 (women), and 2(A) from £486 × £18—£917 (men), £441 × £15—£745 (women); commencing and maximum salary according to age, qualifications and experience. Application forms from the School, Lime Grove, Shepherds Bush, W.12, for return by 2nd December. (1449.) 4660

BOROUGH OF ILKESTON.

(a) ENGINEERING ASSISTANT, A.P.T. III to V, according to qualifications and experience. Previous municipal engineering experience essential.

(b) ARCHITECTURAL ASSISTANT, General Division to A.P.T. III, according to qualifications and experience. Previous experience in design and construction of Local Authority housing essential.

N.J.C. conditions. Housing accommodation available.

Application forms obtainable from A. O. Marshall, M.I.Mun.E., M.I.Struct.E., F.I.A.A., Borough Surveyor & Water Engineer, Town Hall, Ilkeston, Derbyshire, to whom they are to be returned by 29th November, 1954.

Canvassing disqualifies.

J. YATES, *Town Clerk.* 4694

CITY OF SALFORD.

Applications are invited for the undermentioned appointments on the permanent establishment of the City Engineer & Surveyor's Department:—

(a) ARCHITECTURAL ASSISTANT, A.P.T. Grade VIII (£785 to £860).

(b) QUANTITY SURVEYORS' ASSISTANT, A.P.T. Grade III (£550 to £595).

Applicants for Appointment (a) must be Associate Members of the Royal Institute of British Architects and have had considerable experience in the design and construction of schemes for houses, flats, schools and public buildings, together with adequate administrative experience.

For Appointment (b) preference will be given to candidates who have passed, or are preparing for, the Intermediate Examination of the R.I.C.S.

The appointments are pensionable and subject to the passing of a medical examination.

Applications, stating age, qualifications and experience, accompanied by copies of two recent testimonials, are to be addressed to the City Engineer & Surveyor, Town Hall, Salford, 3, enclosed in envelopes appropriately endorsed, and forwarded so as to be received not later than the first post on Monday, 6th December, 1954.

Applicants must disclose, in writing, any known relationship to Members or Officers of the Council.

R. RIBBLESDALE THORNTON,
Town Clerk. 4699

BISHOP AUCKLAND URBAN DISTRICT COUNCIL.
ARCHITECTURAL ASSISTANT.

Applications are invited for the appointment of an ARCHITECTURAL ASSISTANT to work under the direction of the Council's Architect, Surveyor and Engineer. The salary for the appointment will be in accordance with Grade V of the A.P.T. Division of the National Scales commencing at £620 per annum. Applicants must be Corporate Members of the Royal Institute of British Architects. The appointment will be subject to the provisions of the Local Government Superannuation Acts, 1937-1953 and also to one month's notice on either side. If required housing accommodation will be provided within a reasonable time after the appointment is made, but this must be vacated if and when the appointment is terminated.

Applications stating age, qualifications experience and present appointment, accompanied by the names and addresses of two persons to whom reference can be made must reach the undersigned not later than Saturday, November 27th, 1954.

R. W. BLYTHE,
Clerk of the Council.

Town Hall, Bishop Auckland.
5th November, 1954. 4675

SOUTH-EASTERN REGIONAL HOSPITAL BOARD, SCOTLAND.
REGIONAL ARCHITECT'S DEPARTMENT.

A vacancy occurs for an **ARCHITECTURAL ASSISTANT** on a salary scale £440 × £25 (1) × £20 (8)—£625 per annum, Headquarters in Edinburgh. The starting salary will be dependent on the experience of the successful applicant.

Applicants should be Registered Architects. Experience in the design of Hospital building is desirable but not essential.

Applications giving details of age, qualifications and experience along with the names of two referees should be sent to the Regional Architect, 8, Drumsheugh Gardens, Edinburgh, 3, on or before Monday, 29th November, 1954. 4698

GOVERNMENT OF KENYA.
ARCHITECT FOR PUBLIC WORKS DEPARTMENT, KENYA.

Required to prepare sketch designs and working drawings for Government buildings including Schools, Police Stations, Government Offices, Housing, Hospitals, Prisons, Agricultural Buildings, etc. To be in charge of a section dealing with one or more of such group of buildings.

Appointment will be on contract for four years in the salary range £655—£1,320 per annum, point of entry determined by war service and approved experience. Gratuity at the rate of 13½ per cent of total substantive salary drawn payable on termination of contract. Cost of living allowance 35 per cent of salary subject to maximum of £350 per annum.

Free passages on appointment and on leave for officer, his wife and children up to a maximum cost of three adult passages. Leave at rate of 4½ days for each month of resident service. Successful candidate to proceed to Kenya by air.

Candidates, not to exceed 40 years of age, must be A.R.I.B.A., with at least six years' post qualification experience in an Architect's office. Administrative and practical supervisory experience will be an advantage.

Apply in writing to the Director of Recruitment, Colonial Office, Sanctuary Buildings, Great Smith Street, London, S.W.1, giving briefly age, qualifications and experience. Mention the reference No. BCD 112/7/011. 4671

GOVERNMENT OF ADEN.
ARCHITECT, PUBLIC WORKS DEPARTMENT.

Duties include the design and construction of public buildings, including housing, under the direction of the Chief Architect, Public Works Department.

Appointment is on contract for one tour of 18-24 months in the first instance with possibility of extension in the salary scale £1,032—£1,788 per annum; plus a gratuity of £100—£150 per annum on satisfactory completion of contract. Starting salary in the scale will depend upon professional experience after attaining A.R.I.B.A.

First class return passages for officer, wife and four children below the age of 18, provided. Seven days leave for each completed month of service. Furnished quarters provided at a low rental.

Candidates must be A.R.I.B.A.

Apply in writing to the Director of Recruitment (Colonial Office), stating briefly age, qualifications and experience, and quoting reference number BCD 112/2/03. 4672

HERTFORDSHIRE COUNTY PLANNING DEPARTMENT.
SENIOR PLANNING ARCHITECT
(£785—£860, VIII—subject to review).

Considerable Architectural experience and preferably some planning training; experience in design for Urban and Rural areas and in the pictorial presentation of ideas. Post calls for ability in negotiating with Architects and Builders.

Must be Corporate member of R.I.B.A. and preferably T.P.I..

Permanent appointment with car allowance.

Forms of application from County Planning Officer, County Hall, Hertford. Closing date 26th November, 1954. 4673

HERTFORDSHIRE COUNTY COUNCIL.
COUNTY ARCHITECT'S DEPARTMENT.

Applications are invited for the following appointments:—

(a) **SENIOR ASSISTANT QUANTITY SURVEYORS**, Grade VII, £735—£810 (subject to review).

(b) **ASSISTANT QUANTITY SURVEYORS**, Grade VI, £695—£760 (subject to review).

(c) **ASSISTANT QUANTITY SURVEYORS**, Grade V, £620—£670 (subject to review).

Previous Local Government experience not essential.

Applications stating clearly which post is applied for, together with the names of two referees, to the County Architect, County Hall, Hertford, Herts., not later than 30th November, 1954. 4674

MINISTRY OF WORKS.
LEADING ARCHITECTURAL ASSISTANTS

required for drawing offices in the Chief Architect's Division in London, Edinburgh and various provincial offices.

Candidates must have had at least three years architectural training, good experience in an architect's office, and be of Intermediate R.I.B.A. standard. London salary £710—£834 per annum. Rates elsewhere slightly less. Starting pay according to experience. Prospects of promotion and establishment.

State age, full details of training and experience, and office desired, to E. Bedford, Esq., C.V.O., A.R.I.B.A., Chief Architect, Ministry of Works, W.G.10/C.A.10(F), Abell House, John Islip Street, London, S.W.1. 4732

CITY AND COUNTY OF NEWCASTLE-UPON-TYNE.
CITY ARCHITECT'S DEPARTMENT.
PROPOSED NEW TOWN HALL.
APPOINTMENT OF ARCHITECTURAL STAFF.

Applications are invited from Associate Members of the R.I.B.A. for the undermentioned special appointments in the City Architect's Department. These appointments are additional to the present Establishment of the Department, and the successful candidates will be engaged solely upon duties in connection with the New Town Hall Scheme, the estimated total cost of which is in the region of £2 million. The present position is that the Minister of Housing and Local Government has approved in principle the building of Stage I of the Scheme, which is estimated to cost some £600,000. It is hoped to commence building work early in 1956.

(A) PRINCIPAL ASSISTANT ARCHITECT, A.P.T. Division, Grade X (£920—£1,050), as from 1st January, 1955, amended A.P.T. VIII (£980—£1,100).

(B) SENIOR ASSISTANT ARCHITECT, A.P.T. Division, Grade VIII (£785—£860), as from 1st January, 1955, amended A.P.T. V (£840—£900).

(C) ASSISTANT ARCHITECT, A.P.T. Division, Grade VI (£695—£760), as from 1st January, 1955, amended A.P.T. IV (£705—£825).

Candidates for each of the above appointments must have received a sound architectural training, preferably at a recognised School of Architecture, and experience in Architectural work of exceptional quality will be an advantage.

Applicants for appointment (A) should have wide experience, and should be capable of taking responsibility for the day-to-day administration of a large building contract of this nature.

The appointments are intended to be for the duration of the Scheme, subject to satisfactory service, and will be subject to the National Conditions of Service as adopted by the City Council; to the provisions of the Local Government Superannuation Act, 1953, and to one month's notice on either side. The successful candidates will be required to pass a medical examination.

Applications stating age, particulars of training, qualifications, experience, present and past appointments and salaries attaching thereto, together with copies of two recent testimonials, or the names and addresses of two persons to whom reference may be made, should be addressed to George Kenyon, A.R.I.B.A., A.M.T.P.I., City Architect, 18, Cloth Market, Newcastle-upon-Tyne 1, not later than Thursday, 2nd December, 1954.

JOHN ATKINSON, *Town Clerk.*
Town Hall, Newcastle-upon-Tyne, 1. 4713

CITY OF WAKEFIELD.
CITY ENGINEER'S DEPARTMENT.
ARCHITECTURAL ASSISTANT.

Applications are invited for the above permanent appointment on Grade A.P.T. V (£620—£670) commencing at £620 p.a.

Applicants should be A.R.I.B.A. and have good experience of Housing, Schools, and General Municipal work.

Applications giving age, and full particulars of experience, with the names of two referees to be sent to the undersigned by the 30th November, 1954.

W. S. DES FORGES, *Town Clerk.*
Town Hall, Wakefield. 4688

BOROUGH OF RAWTENSTALL.
ARCHITECTURAL ASSISTANT.

Applications are invited for the above position at a salary in accordance with A.P.T., Grade III (£550—£595 per annum).

Applicants should have passed the Intermediate Examination of the Royal Institute of British Architects. The appointment is permanent and subject to the Local Government Superannuation Acts 1937-1953, the passing of a medical examination and to termination by one month's notice on either side.

Housing accommodation will be made available if required.

Applications stating age, qualifications, present and previous appointments, and giving full details of experience, together with the names and addresses of two referees should be delivered to the undersigned not later than Tuesday the 23rd November, 1954.

J. W. BLOMELEY, *Town Clerk.*
Town Hall, Rawtenstall,
Rossendale, Lancs. 4689

STAFFORDSHIRE COUNTY COUNCIL.
COUNTY PLANNING AND DEVELOPMENT DEPARTMENT.

Applications are invited for the appointment of a PLANNING ASSISTANT on A.P.T. Grades I-IV (£490 to £625 per annum) in the Northern Area Planning Office at Newcastle-under-Lyme.

Applicants for the appointment should have had training in an Architect's, Engineer's, Surveyor's or Planning Office and preference will be given to those who have passed the Intermediate Examination of the Town Planning Institute or its equivalent.

Applicants should give details of age, education and training qualifications, present and previous appointments and experience, and the names of two persons to whom reference can be made. Applications, in which relationship to any member or senior officer of the County Council must be disclosed, should be sent to D. W. Riley, County Planning and Development Officer, 41a, Eastgate Street, Stafford, not later than the 24th November, 1954.

T. H. EVANS,
Clerk of the County Council. 4669

COUNTY BOROUGH OF BOLTON.

Applications are invited for the permanent appointment of an **ARCHITECTURAL ASSISTANT** in the Borough Engineer and Surveyor's Department at a salary in accordance with Grade A.P.T. II of the National Scales (£520—£565). Commencing salary will be fixed according to the candidate's experience and qualifications.

Applicants should have attended a full-time course of Architecture, and have passed the Intermediate Examination of the R.I.B.A. or its equivalent.

The appointment is subject to the provisions of the Local Government Superannuation Acts.

Applications, on forms to be obtained from the undersigned, together with copies of not more than two testimonials, should be forwarded to me not later than 29th November, 1954.

PHILIP S. RENNISON, *Town Clerk.*
Town Hall, Bolton. 4717

NORTHERN IRELAND HOSPITALS AUTHORITY.
ASSISTANT ARCHITECTS.

Applications invited for appointments in Architect's Department, which will be made in one of the following grades, according to qualifications and experience:—Grade I, Salary £800 × £25—£875; Grade II, £725 × £25—£800; Grade III, £625 × £25—£725.

Applicants must be Associates of Royal Institute of British Architects; special consideration will be given to applicants possessing a University Degree in Architecture. Some experience of hospital design and work would be an advantage.

Person appointed will be on Authority's Headquarters staff but may be required to undertake work throughout Northern Ireland.

Application forms and further particulars may be obtained from the Secretary, Northern Ireland Hospitals Authority, Victory Buildings, 44/46, Queen Street, Belfast, to whom completed forms should be sent not later than 10th December, 1954. 4711

COUNTY BOROUGH OF BURNLEY.

Applications are invited for the appointment of a QUANTITY SURVEYING ASSISTANT in the Borough Engineer's Department, at a salary in accordance with A.P.T. Grade III of the National Scales (£550—£595).

Applicants should have a sound knowledge of building construction and experience in the preparation of Bills of Quantities and measurement of works is essential. Preference will be given to candidates holding appropriate qualifications.

Forms of application and conditions of appointment may be obtained from the Borough Engineer, 22/24, Nicholas Street, Burnley, to whom applications should be returned not later than first post on Saturday, the 3rd December, 1954.

C. V. THORNLEY, *Town Clerk.* 4712

SHARDLOW RURAL DISTRICT COUNCIL.
SURVEYOR'S DEPARTMENT.
SENIOR ARCHITECTURAL ASSISTANT.

Applications are invited for the appointment of a SENIOR ARCHITECTURAL ASSISTANT, A.P.T. Grade IX (£840—£960). The successful applicant must be an Associate of the Royal Institute of British Architects. He will be required to carry out, under the direction of the Council's Surveyor, the preparation of drawings, bills of quantities, contract administration, and the supervision of work in the construction of new houses and other buildings required by the Council, and must have adequate experience for these purposes.

The appointment will be subject to the Local Government Superannuation Acts and will be terminable by one month's notice on either side. The Council will pay the appropriate travelling allowance on the National Scale.

Applications stating age, full details of experience and qualifications, together with copies of two recent testimonials, should be sent to the undersigned not later than 30th November, 1954.

F. CLAYTON,
Clerk of the Council.
4, Full Street, Derby.
November, 1954. 4714

COUNTY BOROUGH OF WEST BROMWICH.

Applications are invited for an ASSISTANT ARCHITECT on amended Grade III (£600—£725). N.J.C. Conditions of Service.

Applications, with names of two referees, to be sent to Borough Surveyor, Town Hall, West Bromwich, by 25th November, 1954. 4661

CITY OF OXFORD.
CITY ARCHITECT AND PLANNING OFFICER'S DEPARTMENT.

Vacancy for PLANNING ASSISTANT within the range £675—£825 (New Grade IV from 1st January, 1955), according to experience. Grading may also be the subject of further review in light of National Council decision. Permanent pensionable post; medical examination. Candidates must be qualified members of the Town Planning Institute and have had experience in the planning work of a Local Authority. Additional qualifications will be an advantage. Successful applicant will be required to undertake varied duties in Planning Section of Department.

Housing Accommodation, if required, will be provided by the Council.

Forms of application and conditions of appointment may be obtained from the City Architect and Planning Officer, Town Hall, Oxford, to whom completed forms must be returned by 11th December, 1954.

HARRY PLOWMAN,
Town Clerk.
Town Hall, Oxford. 4736

CITY OF LEEDS.
CITY ARCHITECT'S DEPARTMENT.

Applications are invited for the following appointments:—

(a) ASSISTANT ARCHITECTS, A.P.T. VI, £695—£760.
(b) ASSISTANT ARCHITECTS, A.P.T. V, £620—£670.
(c) ARCHITECTURAL ASSISTANTS, A.P.T. IV, £580—£625.
(d) ARCHITECTURAL ASSISTANTS, A.P.T. II, £520—£565.
(e) ARCHITECTURAL ASSISTANTS, A.P.T. I, £490—£535.
(f) ASSISTANT QUANTITY SURVEYOR, A.P.T. VIII, £785—£860.
(g) ASSISTANT QUANTITY SURVEYORS, A.P.T. V, £620—£670.
(h) ASSISTANT QUANTITY SURVEYORS A.P.T. III, £550—£595.

The payment of salary increments will be subject to satisfactory service, and will be granted normally with effect from the 1st April following the completion of six months service.

The appointments are subject to the Local Government Superannuation Acts 1937—1953, and the successful applicants will be required to pass a medical examination.

Application forms may be obtained from the City Architect, Priestley House, Quarry Hill, Leeds, 9, to whom they should be returned together with copies of three recent testimonials, by 12 noon, Saturday, 27th November, 1954.

Canvassing in any form, either directly or indirectly, will be a disqualification.

R. A. H. LIVETT, O.B.E., A.R.I.B.A.,
City Architect.

Priestley House, Quarry Hill,
Leeds, 9.
6th November, 1954. 4733

LONDON ELECTRICITY BOARD.
JUNIOR QUANTITY SURVEYOR.

Applications are invited for the above position in the Chief Engineer's Department in Central London.

Applicants should have had experience in working-up in all trades, and the successful candidate will work under the direction of a Chartered Quantity Surveyor.

The post is graded under Schedule "C" of the National Joint Board agreement as Grade 9—£415 per annum rising to £600 12s. 0d. per annum, inclusive of London Allowance.

Application forms obtainable from Personnel Officer, 46, New Broad Street, E.C.2, to be returned completed by 30th November, 1954. Please enclose addressed envelope and quote ref.: V/1845/A on envelope and all correspondence. 4680

NORTH WEST METROPOLITAN REGIONAL HOSPITAL BOARD.

ASSISTANT ARCHITECT required. Applicants should be associate members of the R.I.B.A., and be experienced in design and construction preferably in new hospitals and associated buildings. Salary £600 × £25 (7) × £30 (3)—£865 plus London Weighting £20—£40. Commencing salary above minimum may be paid subject to certain conditions.

ARCHITECTURAL DRAUGHTSMAN required. Applicants must have had suitable training including three years' technical experience in architectural drawing. Salary £360 (age 21 and over) × £20 (4) × £25 (1) × £20 (4)—£545 plus London Weighting £20—£30. Commencing salary at minimum of scale.

Apply giving age, qualifications and experience with names of two referees to Secretary, North West Metropolitan Regional Hospital Board, 11a, Portland Place, W.1, by 30th November. 4670

GOVERNMENT OF THE FEDERATION OF MALAYA.
ASSISTANT TOWN PLANNER—TOWN PLANNING DEPARTMENT.

To undertake work under the direction of Federal Town Planner in connection with planning schemes throughout the Federation.

Appointment permanent and pensionable in salary range £1,005—£2,044. An additional expatriation allowance varying from £91—£259 is payable to married candidates. A substantial variable cost of living allowance is also payable.

Free passages provided on appointment and on leave for the officer, his wife and up to three children under 10 years. Furnished quarters, if available, are provided at reasonable rents. Leave is granted at the rate of four days for each month of resident service.

Candidates, who should be between the ages of 28 and 35, must be A.M.T.P.I. and preferably possess an additional architectural, civil engineering or surveying qualification; and have a good knowledge of recent town planning legislation.

Apply in writing to the Director of Recruitment, Colonial Office, Great Smith Street, London, S.W.1, giving briefly age, qualifications and experience and quoting reference No. BCD 62/23/01. 4687

MIDDLESEX COUNTY COUNCIL.
COUNTY ARCHITECT'S DEPARTMENT.

AREA ARCHITECT required. Commencing salary of £1,250 × £50—£1,450. Must be registered Architect. Established and pensionable, subject to medical assessment and prescribed conditions. Application forms (stamped addressed foolscap envelope) from County Architect, 1, Queen Anne's Gate Buildings, Dartmouth Street, Westminster, S.W.1, returnable by 29th November (quote P.433 AJ). Canvassing disqualifies.

CLIFFORD RADCLIFFE,
Clerk of the County Council.

Guildhall, Westminster, S.W.1. 4692

HARLOW DEVELOPMENT CORPORATION.

Application is invited for the post of JUNIOR ASSISTANT ARCHITECT, Grade V(b) (£550 × £25 to £650 per annum). Minimum qualification Inter. R.I.B.A. or equivalent. Housing accommodation available. Detailed application with names of two referees to reach the General Manager, Terlings, Gilston, Harlow, Essex, by 29th November, 1954. 4710

COUNTY BOROUGH OF WOLVERHAMPTON.
TOWN PLANNING STAFF.

Applications are invited for the following appointments in the department of the Borough Engineer and Planning Officer:—

1. SENIOR PLANNING ASSISTANT, Grade A.P.T. IV or V (according to qualifications and experience). Candidates should hold appropriate qualifications and must have had good general experience in a planning office.

2. PLANNING ASSISTANT, Grade A.P.T. I to III (according to experience). Candidates should be good draughtsmen, preferably with experience in a planning office.

Appropriate revised A.P.T. grades applicable from 1st January next, N.J.C. conditions, superannuable posts, medical examination.

Applications with two names for reference, and appropriately endorsed, to Borough Engineer, Town Hall, Wolverhampton, by 29th November. Candidates must state for which appointment and grade they are applying.

A. G. DAWTRY, *Town Clerk.*

Town Hall, Wolverhampton. 4691

MINISTRY OF WORKS.

ARCHITECTURAL ASSISTANTS required for drawing offices in London, Edinburgh and various provincial offices, including Aldermaston, Berks; Harwell, Berks; Nancekuke, Cornwall; Ranskill, Notts; and Bishopton, Renfrew.

Candidates must have had at least three years architectural training, some experience in an architect's office, and be of Intermediate R.I.B.A. standard.

London salary £442—£695 per annum. Rates elsewhere slightly less. Starting pay according to age and experience. Prospects of promotion and establishment.

State age, full details of training and experience and office desired, to E. Bedford, Esq., C.V.O., A.R.I.B.A., Chief Architect, Ministry of Works, W.G.10/C.A.10(F), Abell House, John Islip Street, London, S.W.1. 4731

COUNTY BOROUGH OF GREAT YARMOUTH EDUCATION COMMITTEE.
SCHOOLS ARCHITECT'S DEPARTMENT.

Applications are invited from Associate Members of the Royal Institute of British Architects for the appointment of SENIOR ASSISTANT ARCHITECT on the permanent staff, salary Grade VII (£735—£810).

Candidates should have a knowledge of modern school design and construction.

The Council is unable to assist with housing accommodation. An allowance of 25s. per week will be paid for a period not exceeding six months, in the event of a married man being appointed who is unable to find accommodation.

Further particulars and forms are to be obtained from The Schools Architect, 22, Euston Road, Great Yarmouth, to whom they should be returned by the 3rd December, 1954.

D. G. FARROW,
Chief Education Officer.
4730

PADDINGTON BOROUGH COUNCIL

require DRAUGHTSMAN in architectural drawing office. Salary according to age (for men £310 at 21; rising to £500 at 30; slightly lower for women). Improved grading from 1st January, 1955. Appointment suitable for probationer members of R.I.B.A. Send particulars of age, education, training, experience, national service, names and addresses of two referees to the undersigned by 27th November, 1954, quoting A.186.

W. H. BENTLEY,
Town Clerk.

Town Hall,
Paddington Green, W.2.
9th November, 1954. 4729

COUNTY BOROUGH OF IPSWICH.

Applications are invited for the appointment of ARCHITECTURAL ASSISTANT in the Borough Surveyor's Department.

The appointment is superannuable and subject to the passing of a medical examination. Salary in accordance with Grade A.P.T. VI of the National Salary Scales (£695—£760 per annum).

Candidates must have passed the final examination of the R.I.B.A. (or hold a similar qualification), should have had experience in general architectural work with a Local Authority and possess a sound knowledge of design and construction.

Applications, with names of three referees must be received by the Borough Surveyor, 19, Tower Street, Ipswich, not later than 3rd December, 1954. Canvassing disqualifies.

J. C. NELSON,
Town Clerk.

Town Hall, Ipswich.
18th November, 1954. 4735

Architectural Appointments Vacant

4 lines or under, 7s. 6d.: each additional line, 2s.

The engagement of persons answering these advertisements must be made through a Local Office of the Ministry of Labour or a Scheduled Employment Agency if the applicant is a man aged 18-64 inclusive or a woman aged 18-59 inclusive unless he or she or the employment is excepted from the provisions of the Notification of Vacancies Order, 1952.

REQUIRED for Architects' office, Central London area, young qualified ASSISTANTS interested in design and construction. Write, stating experience and salary required. Box 4325.

BUILDING SURVEYING ASSISTANT (about R.I.C.S. Final Standard) with at least two years' practical experience required by City firm of Chartered Surveyors & Architects. 3925

ARCHITECTURAL ASSISTANT required. Wide variety of work. Write giving full details, age, experience, training, etc., to the Personnel Officer, Ericsson Telephones Limited, Beeston, Nottingham. 4510

ARCHITECTURAL DRAUGHTSMAN required for making brochure drawings of new forms of building materials. Previous experience of this type of work would be an advantage but is not essential. Please write to Box 4562.

ASSISTANT ARCHITECTS required. Inter. R.I.B.A. or equivalent qualifications; salaries ranging to £745 per annum. Practical experience of work on commercial and industrial buildings essential. Applications stating age, experience, qualifications and salary required to:—W. J. Reed, F.R.I.B.A., Chief Architect, Co-operative Wholesale Society Ltd., 99, Leman Street, London, E.1. 4559

JUNIOR ARCHITECTURAL DRAUGHTSMAN required by London firm of Architects and Surveyors. Good prospects. Study time allowed for man taking professional examinations. Apply stating age and experience. Box 4558.

SENIOR ARCHITECTURAL ASSISTANT urgently required by London firm of Architects and Surveyors for new buildings and conversions. Salary £600—800. Apply stating age, qualifications and experience. Box 4557.

WEST End firm of Architects require experienced ASSISTANT ARCHITECT, primarily for site supervision. Good working drawings and appreciation of contemporary architecture essential. Salary £800/£900. Five-day week. Box 4530.

JUNIOR ASSISTANT (Intermediate standard) required for Central London practice. Some previous experience preferred. Apply stating age, experience and salary required to Box 4631.

ASSISTANTS required for firm of contemporary Architects, the following qualifications being essential:—

(a) Should have reached Intermediate standard.
(b) Excellent drafting ability.
(c) Several years' office experience.
(d) Sound knowledge of construction.
(e) Keen interest in modern architecture.

Boissevain & Osmond, W.1. LAN. 7406. 4646

ARCHITECTURAL ASSISTANT or building draughtsman, age up to 35, required for work on industrial buildings. Preference given to candidates with Inter. R.I.B.A. but this not essential although O.N.C. in building is the minimum acceptable qualification. Applicants should have experience in foundation work, drainage and factory buildings. Permanent position and attractive salary. Assistance with housing given if necessary. Write in confidence to Personnel Manager, Michelin Tyre Co., Ltd., Stoke-on-Trent, Staffs., giving all relevant information. 4643

ADAM GELISTER, A.R.I.B.A., 42, South Molton Street, W.1, MAYfair 3506, requires JUNIOR ASSISTANT immediately. Telephone or write for interview. Salary according to experience. 4636

ASSISTANT urgently required for busy and varied practice Hampstead Heath area. Intermediate Standard, contemporary outlook preferred. Please apply by telephone: Hampstead 1698. 4614

ARCHITECTURAL ASSISTANT required with contemporary outlook in private Sheffield office. Salary according to qualifications and experience. Frank Melling, A.R.I.B.A., 13, St. James' Row, Sheffield, 1. 4630

ARCHITECTURAL ASSISTANTS required for Glasgow Office working five day week. Salaries from £450 to £700, according to age and experience. Write giving full particulars. Box 4629.

ARCHITECTURAL ASSISTANTS with experience, required for general practice. Reply, stating age, experience and salary required, to Thomas Worthington & Sons, 178, Oxford Road, Manchester, 13. 4576

ARCHITECTURAL ASSISTANT required for busy Maidstone office for working and details drawings. Write stating age, experience, salary required. Box 4577.

ASSISTANTS required; Provincial Office. Flat available in one instance, not suitable for children. Reply stating age, experience and salary required. Box 4580.

ARCHITECTURAL DRAUGHTSMAN with at least three years drawing office experience, required by City firm engaged on design and supervision of large reconstruction projects. Apply Box 4583.

S. PENN SMITH, F.R.I.B.A., Hastings Street, Leicester, offers ASSISTANTS appointments; progressive office, facilities complete training and/or professional practice. Write giving particulars. 4610

ARCHITECTURAL ASSISTANT required for Private Practice in Worcester, capable of carrying out work from sketch drawing to Final Account. Five-day week. Full particulars, including salary required to Box 4688.

EXPERIENCED ARCHITECTURAL DRAUGHTSMAN required by University of Cambridge Department of Estate Management. Good knowledge of working drawings and details essential. Salary according to age and experience. Applications giving details of age, present salary and experience, with copies of recent testimonials to Secretary, 74, Trumpington Street, Cambridge. 4597

EXPERIENCED ASSISTANT ARCHITECT required. Only first-class man will be considered. Applicants should write in the first instance giving full details of their age, training, experience, present salary and salary required. Write to Messrs. David Carr & Stuart Matthew, Architects, 14, Lynedoch Place, Edinburgh. 4595

ARCHITECTURAL ASSISTANTS required of intermediate and final standard, preferably with office experience. Write stating age, experience and salary required. Box 4600.

ARCHITECTURAL DRAUGHTSMAN. Applications are invited by a Leeds Company with a substantial business in prefabricated housing and schools for home and overseas markets. Accurate and neat draughtsmanship will be required of applicants, who should be preferably of Intermediate standard. The work is interesting, varied, and demands imagination, initiative and a contemporary approach to building problems. A man with these qualities, who is prepared to devote some effort to learning the technique of prefabrication, will find ample and progressive scope for their deployment. A pension scheme is in operation. Reply, stating age, experience and present salary to: Messrs. Cawood Wharton & Co., Ltd., 1a, Cavendish Road, Leeds, 1. 4690

THE Milk Marketing Board requires a JUNIOR DRAUGHTSMAN and TRACER in their Architect's Department. Salary according to experience. Applications in writing to The Staff Officer, Milk Marketing Board, Thames Ditton, Surrey. 4700

ARCHITECTURAL ASSISTANT, Intermediate standard R.I.B.A., with some previous experience in an Architect's office, required in the Lake District. Salary according to experience. Write, stating age, experience, to Jennings & Gill, L./A.R.I.B.A., Market Place, Ambleside. 4701

BROWN, MOULIN & ANTRUM, 14, Queen Anne's Gate, S.W.1, invite applications from experienced ASSISTANTS interested in working on large hospital project and able to take charge. Salary by arrangement. 4702

ARCHITECTURAL ASSISTANT, Final Standard, for varied work in small busy office in Westminster. Considerable office experience essential, good draughtsman and capable managing medium contracts. Details and salary to Box 4703.

ARCHITECT'S ASSISTANTS required by a large Chain Store organisation. Commencing salary £600—£750 per annum, according to experience. Subsidised Staff Canteen. Staff Pension and Life Assurance Scheme. Write, giving details of past experience, age, etc., to Box AJ873, LPE, 55, St. Martin's Lane, W.C.2. 4728

ARCHITECTURAL ASSISTANT (Intermediate standard), required in West End office. Box 4726.

ARCHITECTURAL ASSISTANT with previous office experience required immediately. Write stating age, experience and salary required to Scherrer and Hicks, 27, Harcourt House, 19, Cavendish Square, London, W.1. 4725

JUNIOR ARCHITECTURAL ASSISTANT, Intermediate Standard, for General Practice in Lincolnshire. Starting salary £300—£400, according to experience. Apply in writing giving full details and date available. Box 4723.

JUNIOR ASSISTANT, competent to make measured surveys and prepare working drawings, required by Wallis and Smith, Chartered Architects, Basingstoke. Salary £7 to £9 per week. 4722

ARCHITECTURAL ASSISTANT, R.I.B.A., Intermediate standard, wanted immediately. G. A. Jellicoe, F.R.I.B.A., 12, Gower Street, W.C.1. 4721

ARCHITECTURAL ASSISTANT required, with experience in design of industrial buildings, and capable of preparing surveys, working drawings and details. Applications, stating age, education, experience and salary required, should be addressed to E.M.A., Cadbury Brothers, Ltd., Bournville, Birmingham. 4737

ARCHITECTURAL ASSISTANTS required. Intermediate standard. Contemporary work, schools, factories, houses, etc. Profit sharing scheme. Write or telephone: Hugh Macintosh & Partners, 33, High Street, Croydon. CROydon 1890. 4719

HARRODS Ltd. invite applications for the following posts in their Architect's Office:—One SENIOR ARCHITECTURAL ASSISTANT, starting salary £700—£850. One JUNIOR ASSISTANT, salary £450. The work consists chiefly of re-planning and maintenance of existing Store Buildings, factories and workshops. Applicants will be required to prepare layouts and working drawings from sketch plans, and to carry out surveys. Applications in writing, giving full particulars, should be addressed to J. L. Harvey, F.R.I.B.A., Messrs. Harrods Ltd., 44, Hans Crescent, S.W.1. 4718

ASSISTANT (intermediate standard) required for Architects' Office in Basingstoke. Write full details of experience and salary required. Box 4529.

REQUIRED by industrial design organisation, SENIOR ARCHITECTURAL DRAUGHTSMAN. Write stating experience. Box 4724.

EXPERIENCED qualified ARCHITECT, with practical experience of Estate Development for Land Agents' office on borders of Beds. and Bucks. Salary and good bonus. Every opportunity for keen young man. Apply stating age, experience, qualifications, to Box 4704.

CECIL Howitt & Partners, Architects, St. Andrew's House, Mansfield Road, Nottingham, require JUNIOR ARCHITECTURAL ASSISTANTS, preferably Inter. R.I.B.A. standard. Please apply in writing, giving full details and stating salary required. 4705

ARCHITECTURAL ASSISTANT required by the John Lewis Partnership for lay-out and store-fitting details on large re-building programme in W.1 area. Previous experience of shop-fitting helpful but not essential. Minimum salary £400 per annum. Write giving all details to Director of Personnel, 32, Cavendish Square, London, W.1. 4716

THE Milk Marketing Board require an ASSISTANT in their Architect's Department capable of preparing working drawings and details and able to make field surveys and surveys of existing buildings. The salary will be £525 per annum and preference will be given to applicants who have already passed their Intermediate R.I.B.A. examination. Apply, stating age and previous experience, to the Establishment Officer, Milk Marketing Board, Thames Ditton, Surrey. 4708

THE Timber Development Association Ltd., invite applications for the following posts:—

(a) STRUCTURAL ENGINEER, commencing salary £1,200 per annum.

(b) ASSISTANT STRUCTURAL ENGINEER, commencing salary £750 per annum.

Applicants for post (a) should be Corporate Members of the Institute of Civil Engineers and/or the Institute of Structural Engineers with at least 15 years' practical and design experience. The post is one of considerable responsibility and the work will consist of advisory work on timber construction and the general advancement of structural design technique. Previous experience in timber is desirable but not essential. The successful candidate will be called upon to give lectures.

Applicants for post (b) should be Corporate Members of the Institute of Civil Engineers and/or the Institute of Structural Engineers with at least five years' practical experience. The work will consist of research and design of structural components and buildings and candidates should be capable draughtsmen.

Applications should be in tabulated form, addressed to the Director, Timber Development Association Ltd., 21, College Hill, London E.C.4, endorsed (a) or (b) above. 4709

ARCHITECTURAL ASSISTANTS required Intermediate and Final Standard. Opportunity to gain experience. House available for senior. Pension scheme. State age and salary required. Apply Chief Architect, Friary Brewery, Guildford, Surrey. 4666

SENIOR ARCHITECTURAL ASSISTANT required. Westminster office. Experience of commercial and industrial buildings in London essential. Salary approx. £1,000, according to ability. Write in first instance giving details of experience. Box 4668.

ARCHITECTURAL DRAUGHTSMAN required in the London Co-operative Society's Works Department, Whitta Road, Manor Park, E.12. General Architectural Drawing experience necessary and preference will be given to applicants with experience of Structural Detailing. Commencing salary £475 16s. p.a., inc. Write, stating age, details of career and technical qualifications to Staff Office (AJ), L.C.S. Ltd., 54, Maryland Street, Stratford, E.15. 4676

EXPERIENCED ARCHITECTURAL DRAUGHTSMAN required for permanent post in Architects' Department of firm developing the Modular system of construction. Salary £500—£700 per annum. 5-day week. Apply to Mod-X Structures, 20, Lowndes Street, London, S.W.1. 4678

ARCHITECTURAL ASSISTANTS urgently required for busy, varied and progressive country practice. Write, giving details age, experience, salary required. Geoffrey Bazeley & Barbary, 15/16 Alverton, Penzance, Cornwall. 4664

NAIROBI, for expanding practice: SENIOR ASSISTANT, preferably qualified. Must be able to work quickly and accurately on own. Salary up to £100 monthly. Write quoting Box OSS 74/1, Overseas Technical Service, 5, Welldon Crescent, Harrow. 4681

ASSISTANT ARCHITECT required for Bishop's Stortford office; Finals Standard. Apply by letter stating age, experience and salary required to Gerald Lacoste, F.R.I.B.A., 30, South Street, Bishop's Stortford. 4684

ARCHITECTURAL ASSISTANT of Intermediate R.I.B.A. standard with good general experience required. Apply stating education and experience to Brierley Syme & Leckenby, 13, Lendal, York. 4653

IMMEDIATE vacancy with prospects of early advancement for ARCHITECT'S ASSISTANT in growing practice in Marylebone. Salary according to experience up to £1,000. Reply Box 4659.

ASSISTANT, about R.I.B.A. Intermediate standard with office experience. Write giving details and salary required. Box 4665.

WANTED. — ARCHITECTURAL ASSISTANTS, qualified and inter. standard. Contemporary work in Factories, Hospitals, Churches, Schools, etc. Experience in Middle East helpful. For posts in Huddersfield or Shrewsbury Offices. Apply, Abbey & Hanson, 11, Cloth Hall Street, Huddersfield. Tel. No. Hudds. 225. 4683

ARCHITECTURAL ASSISTANT of intermediate standard required principally for licensed house work. Pension and Profit Sharing schemes in operation. Five-day week. Write with full particulars of training, experience and salary required to H. R. Robinson, L.R.I.B.A., The Stroud Brewery Co. Ltd., Stroud, Glos. 4682

ARCHITECTURAL ASSISTANTS (Intermediate R.I.B.A. standard or thereabouts), required in N.W. London office engaged on domestic and industrial schemes. Excellent prospects and scope. Permanent pensioned employment for suitable applicants. Apply in writing, stating age, qualifications, experience and salary required to Sidney Greenwood, A.R.I.B.A., 33, Bunn's Lane, London, N.W.7. 4685

ARCHITECTURAL ASSISTANT required in small busy office in Hertfordshire. Interesting work. Applicant must be qualified and have had good office experience. Reply stating age, experience, qualifications and salary required to Box 4686.

WEST END firm requires First-Class ESTIMATOR for Joinery Factory. Must be used to estimating for joinery and every description of furniture, ships' panelling, and architectural woodwork. Write stating age, experience and salary required to Box 4693.

CARDIFF Architects require experienced ASSISTANT; salary £12 10s. per week. Box 4695.

ARCHITECTURAL ASSISTANTS urgently required for schools development projects based upon prefabricated construction. Birmingham office. Good prospects for right men. Reply, giving particulars of age, qualifications, present Salary, to Box 4654.

ASSISTANT, Intermediate Standard, required for architects office, London. Five-day week. Full details to Box 4655.

COUNTRY OFFICE (West Surrey) require ARCHITECTURAL ASSISTANT for general practice. Inter. to Final standard. Salary required and details of experience to Box 4656.

KIRKCALDY, Fife. Architects engaged on contemporary schools and hospitals urgently require experienced SENIOR ASSISTANT. Apply stating details of career, salary required, etc., to Walter Alison & Hutchison, F.R.I.B.A., F.R.I.A.S., 27, Kirk Wynd. 4657

TRAINEE ASSISTANT QUANTITY SURVEYOR or BUILDER'S ASSISTANT required for preparing estimates & bills of quantities in connection with industrial building construction. Pension scheme & five-day week. Apply in writing to Humphreys & Glasgow Limited, Humglas House, Carlisle Place, London, S.W.1, stating age, experience and salary required. 4662

Architectural Appointments Wanted

A. R.I.B.A. (39), Public School education, requires responsible position with prospects of partnership later. Hants, Wilts, or Somerset preferred, although other parts considered. 4667

A. R.I.B.A., A.M.T.P.I. (40s), 26 years' good general London experience seeks responsible progressive appointment in or near London with well-established business or industrial concern or as partner in private practice. Minimum starting salary, £1,000 p.a. Box 898.

EXPERIENCED SHORTHAND TYPIST having previous experience in Architect's Office, wants temporary work in architect's office. Box 4696.

QUALIFIED ARCHITECT (39), wide experience requires responsible appointment. London Area. Box 4658.

A. R.I.B.A., 37; Schools, industrial, domestic, exhibitions, surveys, etc., and wide general experience, seeks permanent position with good prospects, or Part-time Temporary, London to 40 miles west. Car. Box 4697.

POSITION in West Country required by ASSISTANT: married aged 26, needs pro. prac. to qualify. Five years schooling and three years varied London experience. Interested alterations and additions, besides new work. Box 4720.

SENIOR ASSISTANT, A.R.I.B.A., seeks temporary or part-time appointment with Architect for a period up to six months. Box 4706.

Other Appointments Vacant

4 lines or under, 7s. 6d.: each additional line, 2s.

The engagement of persons answering these advertisements must be made through a Local Office of the Ministry of Labour or a Scheduled Employment Agency if the applicant is a man aged 18-64 inclusive or a woman aged 18-59 inclusive unless he or she or the employment is excepted from the provisions of the Notification of Vacancies Order, 1952.

SECRETARY/SHORTHAND TYPIST wanted by Technical Director of Company with Head Office in West End. Science graduate or girl with some building research or building background. Five-day week, good salary, pension scheme, luncheon vouchers. Apply Box 4613.

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GOOD LETTERING IS ESSENTIAL for Commemorative Wall Tablets, Foundation Stones, etc. Layouts and F.S. templates prepared. Estimates given for the finished work in any material. Renowned as a Lettering Centre since 1934. Sculptured Memorials, 67, Ebury Street, London, S.W.1. Tel.: Sloane 6549. 3010

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A.R.I.B.A. offers services to Architects and Surveyors in London, Surrey and Sussex, to augment growing practice. Box 4707.

ARTIST'S impressions, perspectives, any technique, also other home work offered by retired architect. Phone FIN 0143. 4727

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FOR SALE.

SMALL ARCHITECTURAL AND SURVEYING PRACTICE in South East London, with turnover of approx. £3,000. Suit young architect. Partner in ill-health. Box 4589.

WANTED URGENTLY, unfurnished house with garden to rent by young Architect with four small children and harassed wife at present restricted to top floor flat with no space, amenities or lift. Now in L.A. housing list and fed up with waiting. Any part Greater London considered but West preferred. Please reply Box 4616.

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4 lines or under, 7s. 6d.: each additional line, 2s.

A. J. BINNS, LTD., Specialists in the supply and fixing of all types of Fencing, Gates and Cloakroom Equipment. Harvest Works, 96/107, St. Paul's Road, N.1. Canonbury 2061.

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THEODOLITE (Builders' Level) on Tripod with Measuring Staff extending to 14 ft., £20 or near offer. Also double elephant drawing board on adjustable stand with Allbright drawing machine, £25. A. E. Thompson, 130, Colmore Row, Birmingham. 4715

Educational Announcements

4 lines or under, 7s. 6d.: each additional line, 2s.

R.I.B.A. and T.P.I. EXAMS.—Stuart Stanley (Ex. Tutor Sch. of Arch., Lon. Univ.), and G. A. Crockett, M.A./B.A., F./F.R.I.B.A., M./A.M.T.P.I. (Prof. Sir Patrick Abercrombie in assn.), prepare Students by correspondence. 10, Adelaide Street, Strand, W.C.2. TEM. 1603/4.

WELL qualified LECTURER will coach backward Students in Design and Written Subjects of the Intermediate and Final R.I.B.A. examinations. Individual tuition. London area. Write Box 4734.

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Printed in Great Britain for the Proprietors of "THE ARCHITECTS' JOURNAL" (The Architectural Press Ltd.), 9, 11 and 13, Queen Anne's Gate, Westminster, S.W.1, by HARRISON & SONS LTD., Printers to the late King George VI, London, Hayes (Middx.), and High Wycombe. Editorial illustrations engraved by THE ENGRAVERS' GUILD LTD., Windsor House, 23/26, Cursitor Street, London, E.C.4.