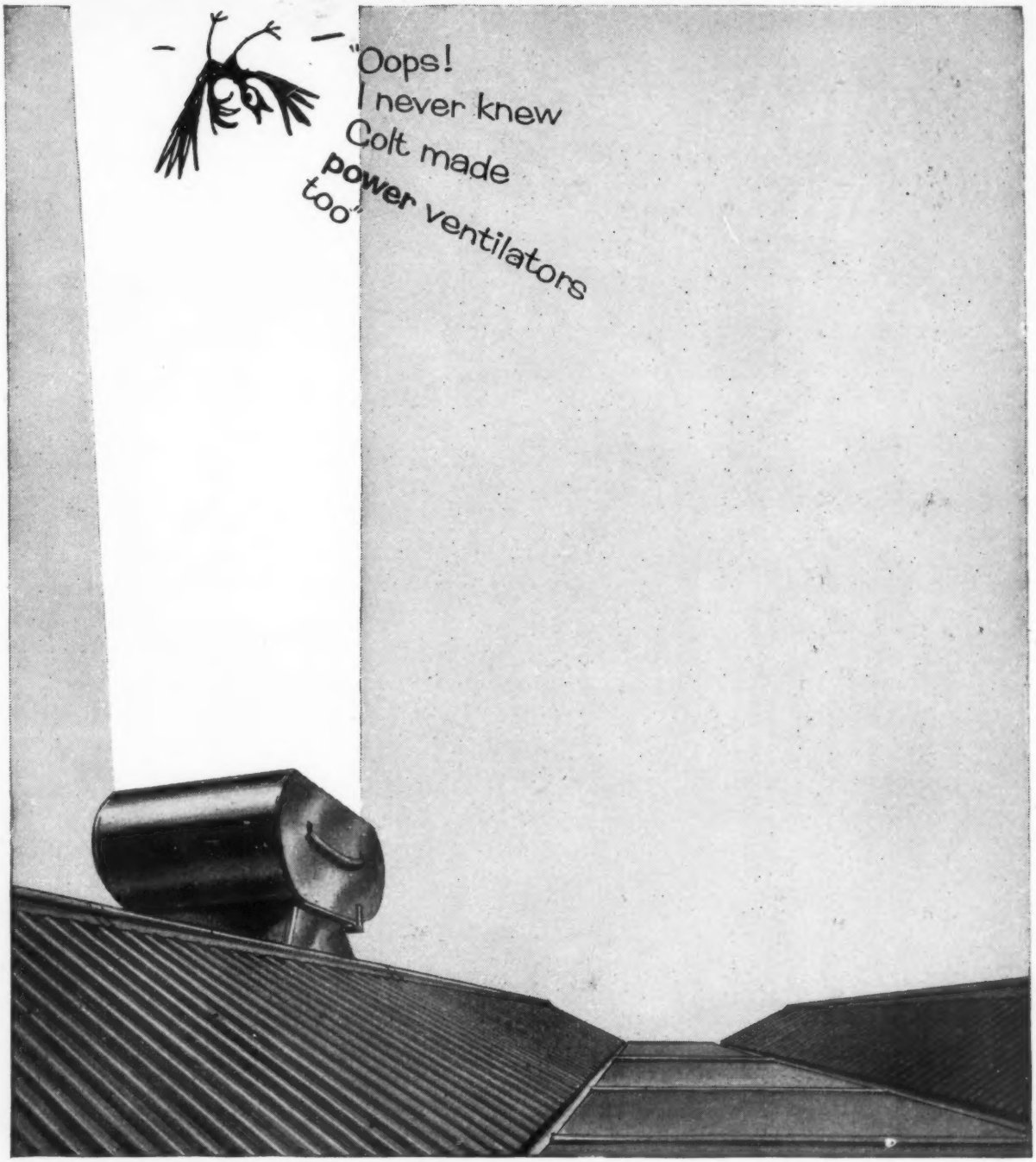
THE ARCHITECTS' JOURNAL for July 7, 1960. Vol. 132. No. 3403. Price one shilling. THE HOSPITAL BRIEF

aj



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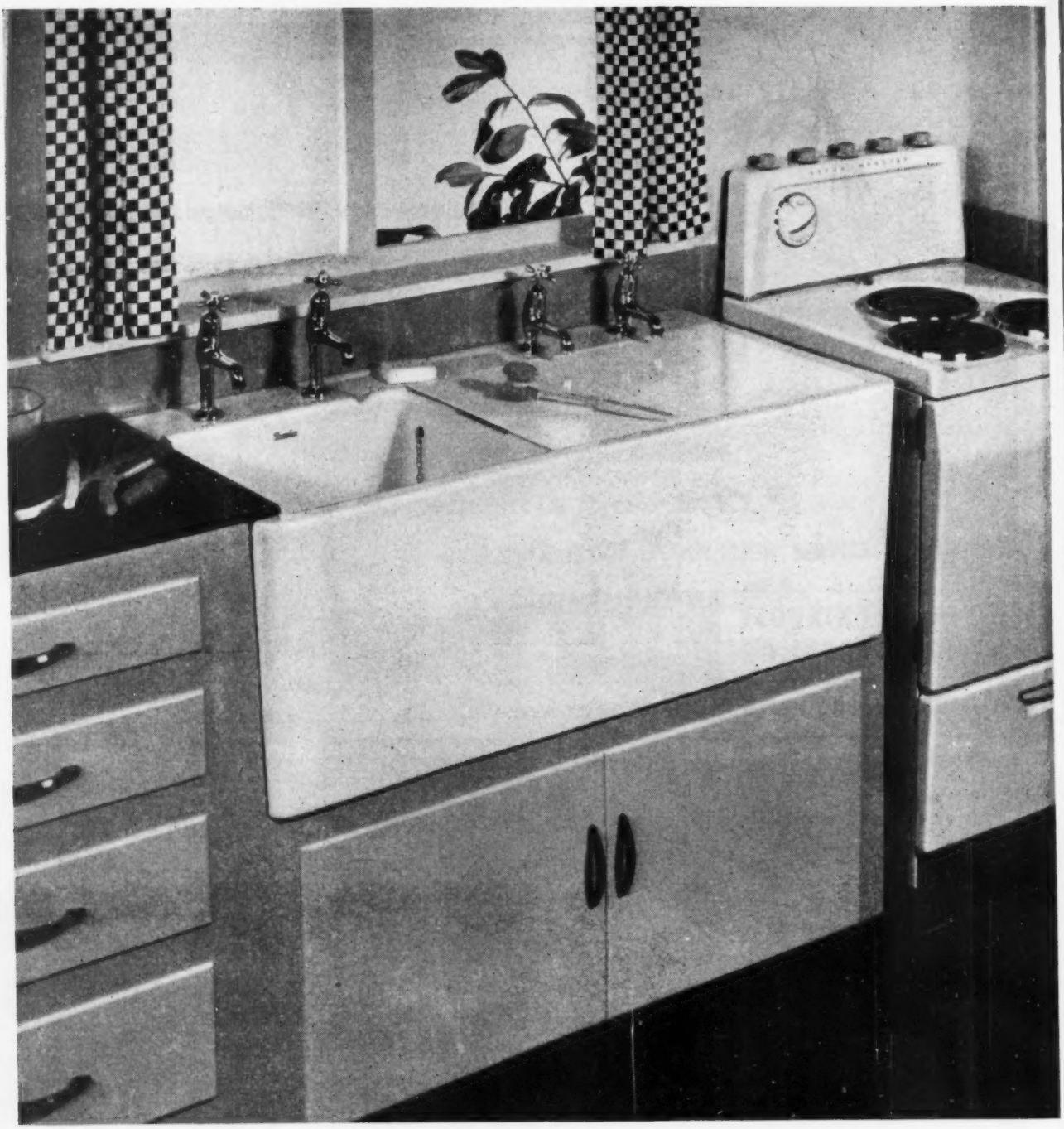

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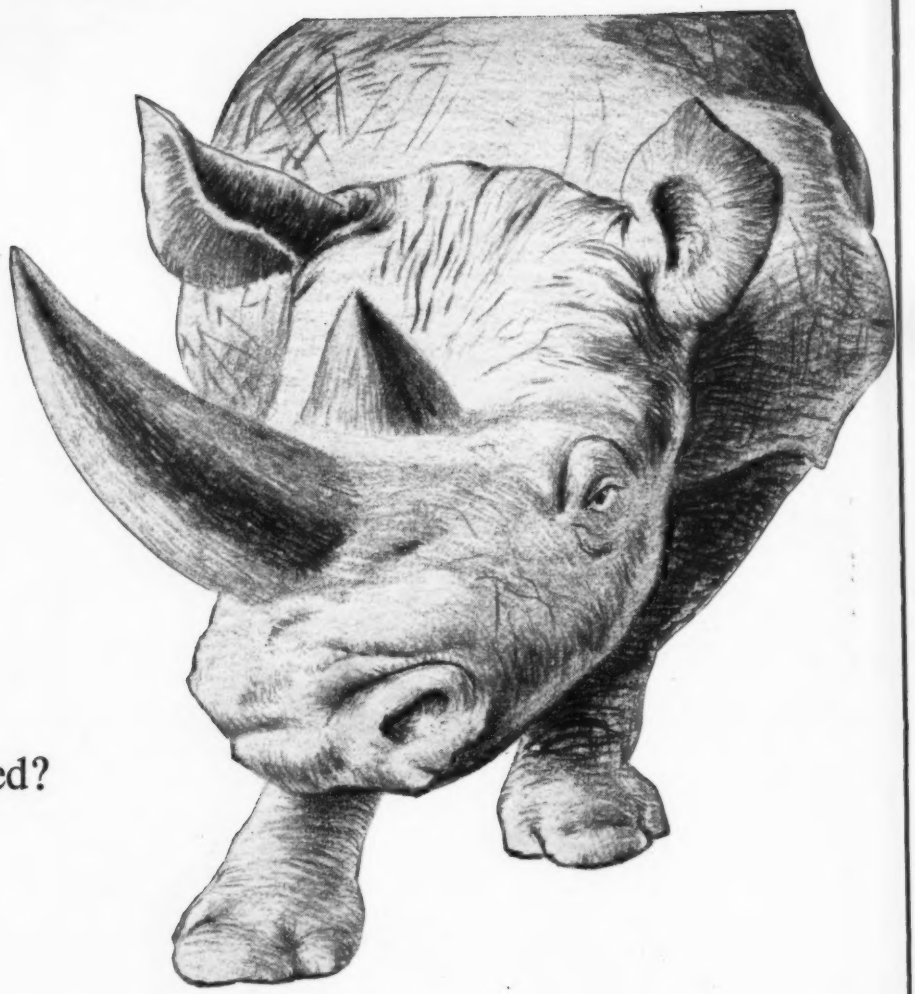

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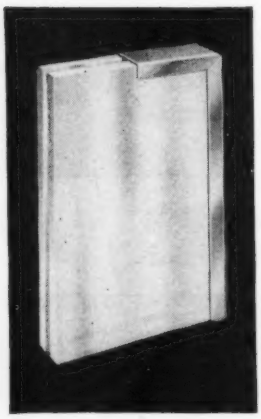

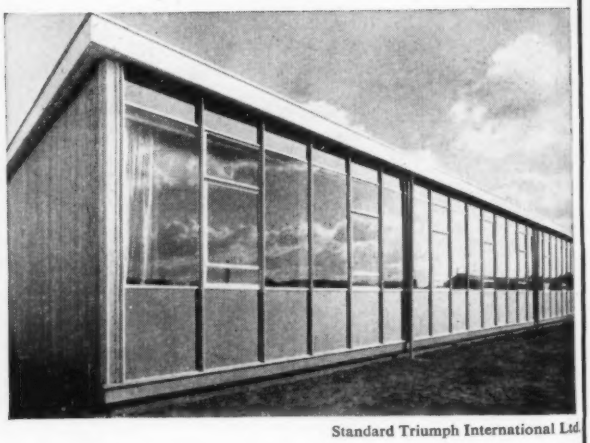

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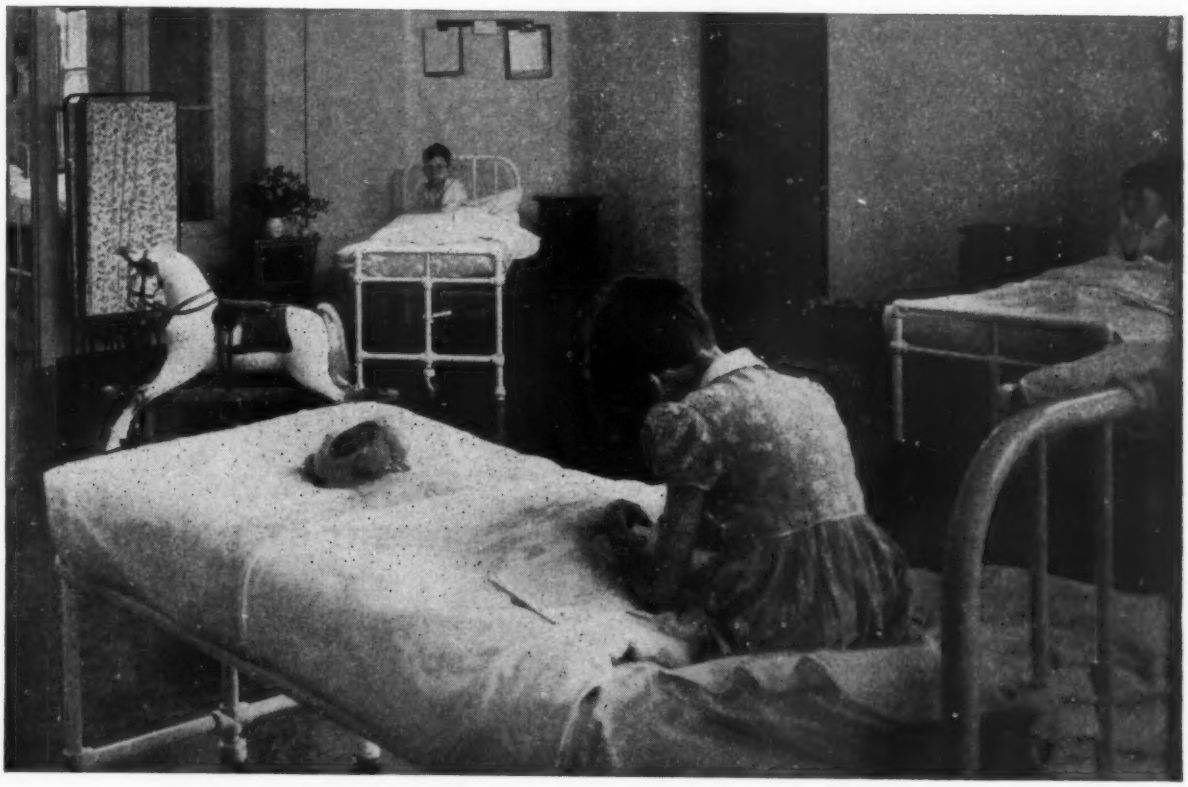

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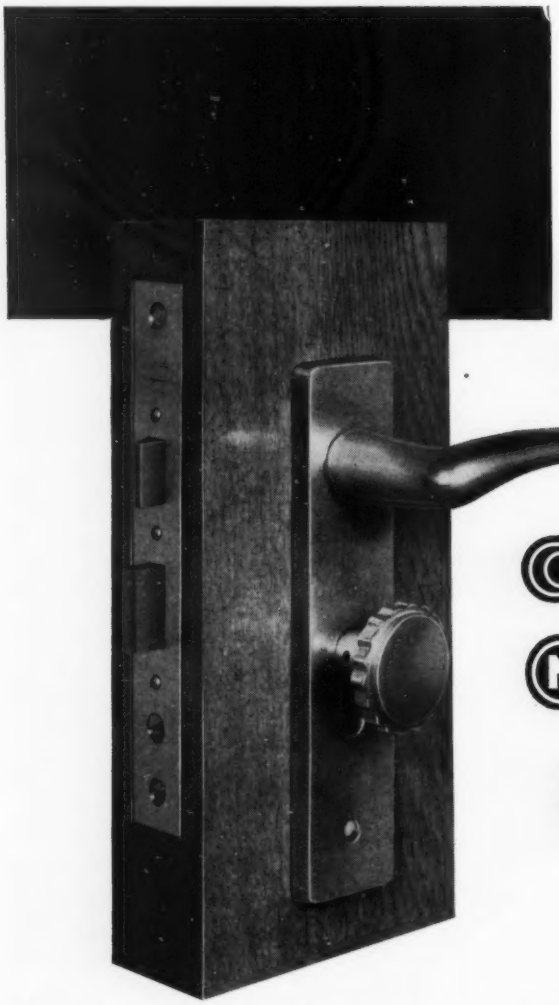

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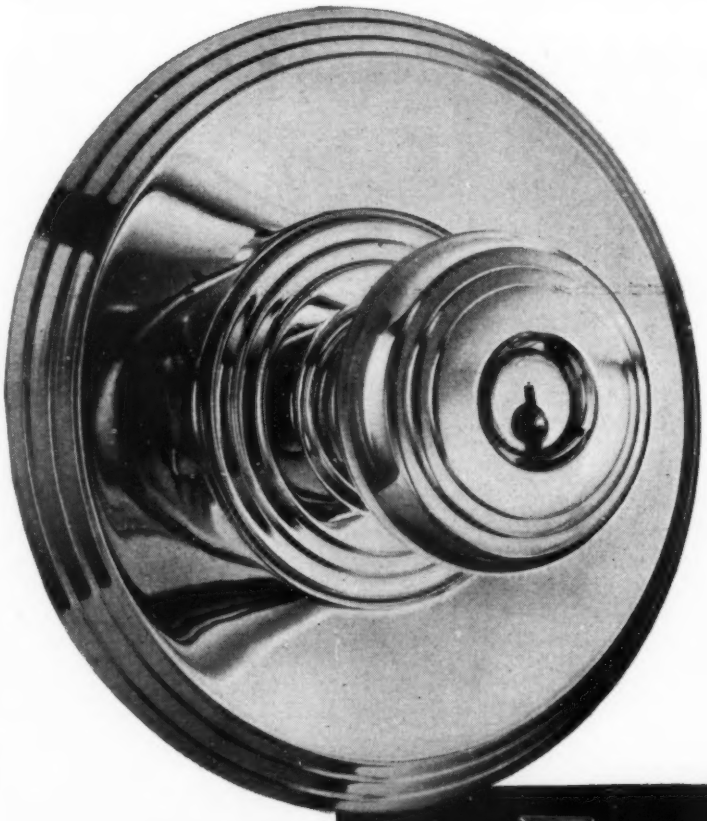

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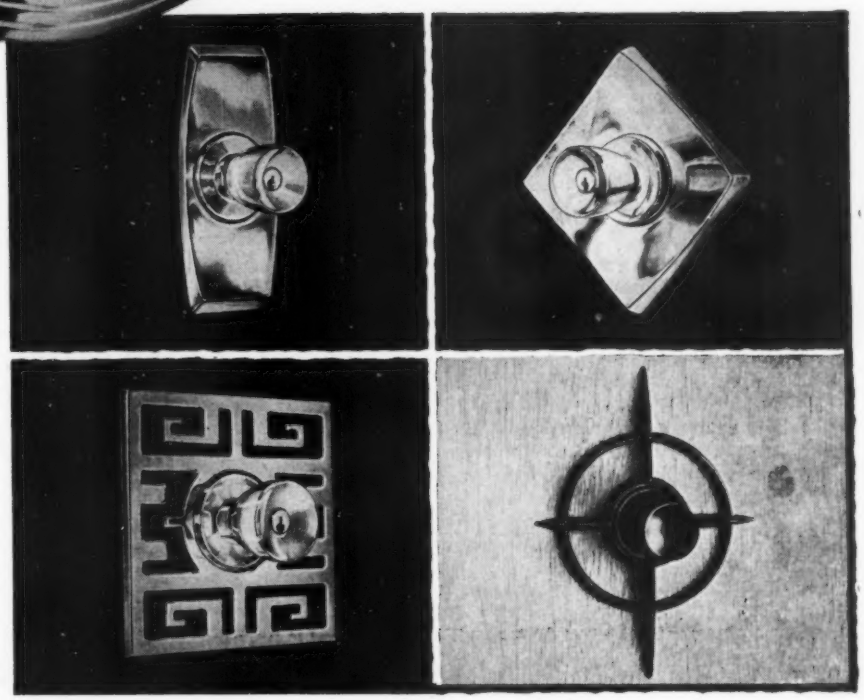

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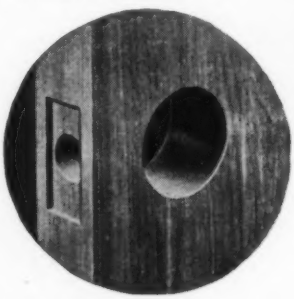

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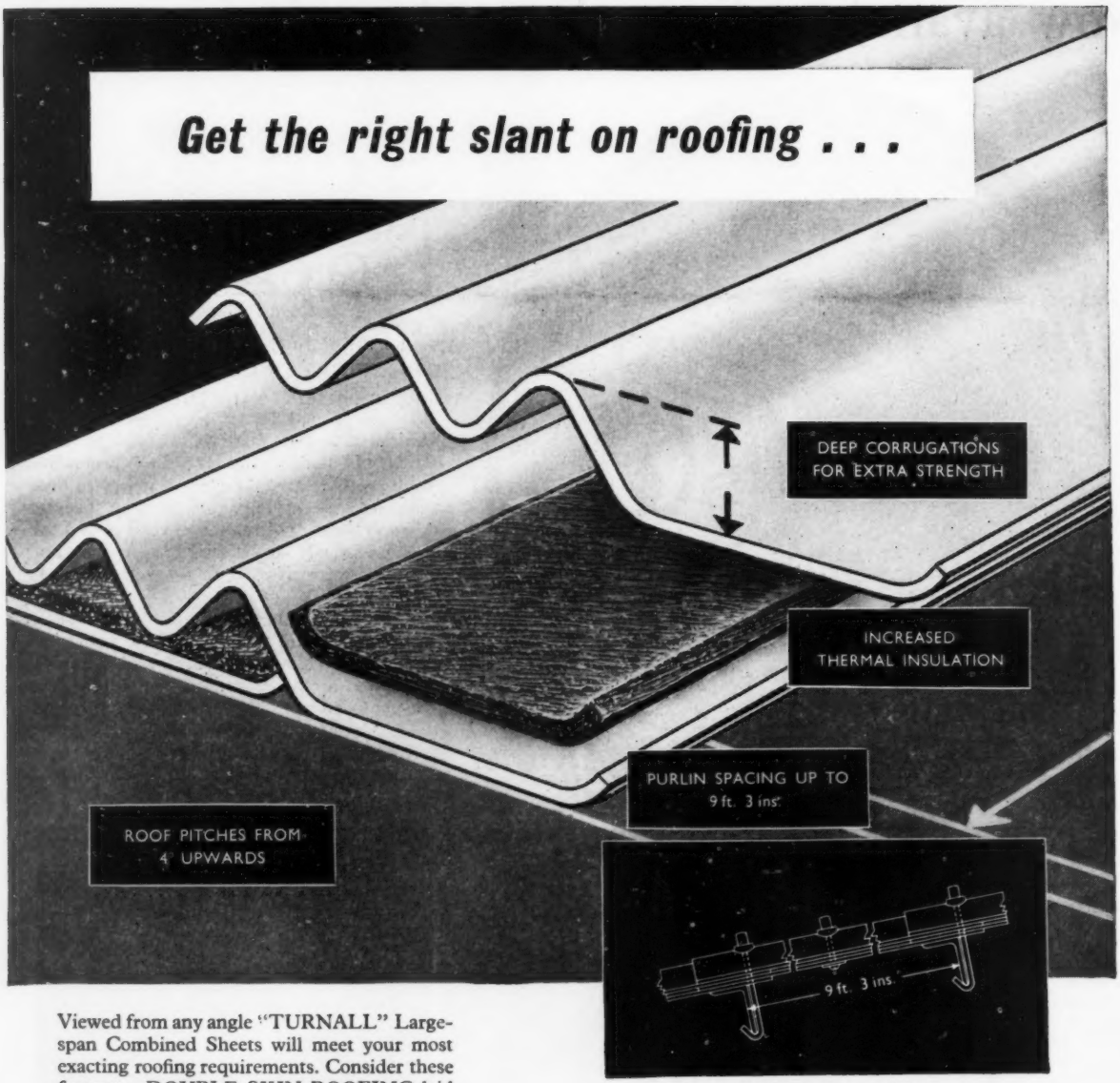

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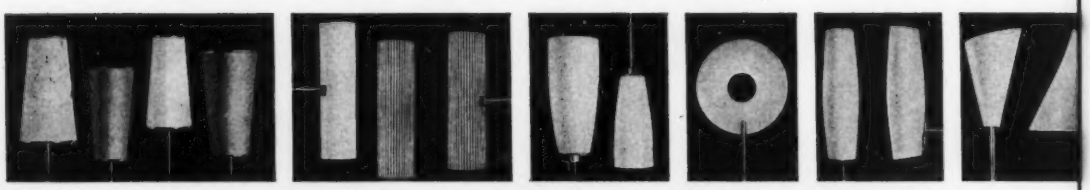
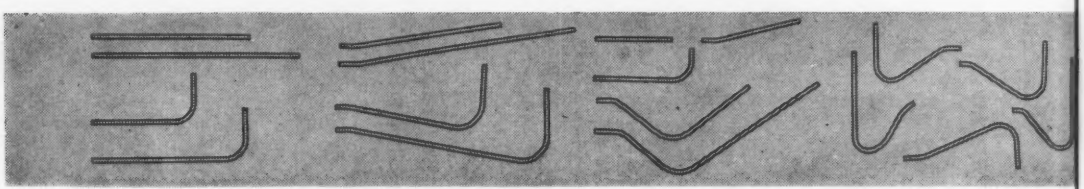
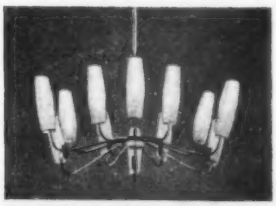


The six types of attachments. Each attachment consists of diffuser, carrier and lamp holder assembly

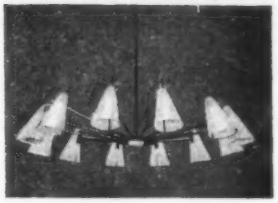


Types of arms available for use with pendant and ceiling fittings

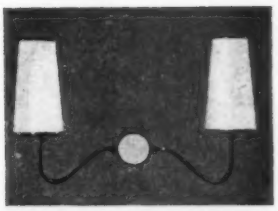
VARI



a selection from hundreds of possible arrangements



up into hundreds of different designs



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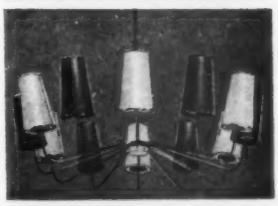

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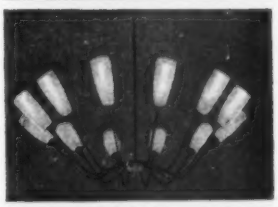

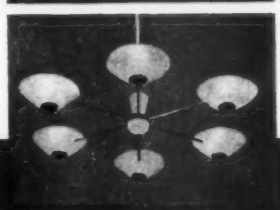

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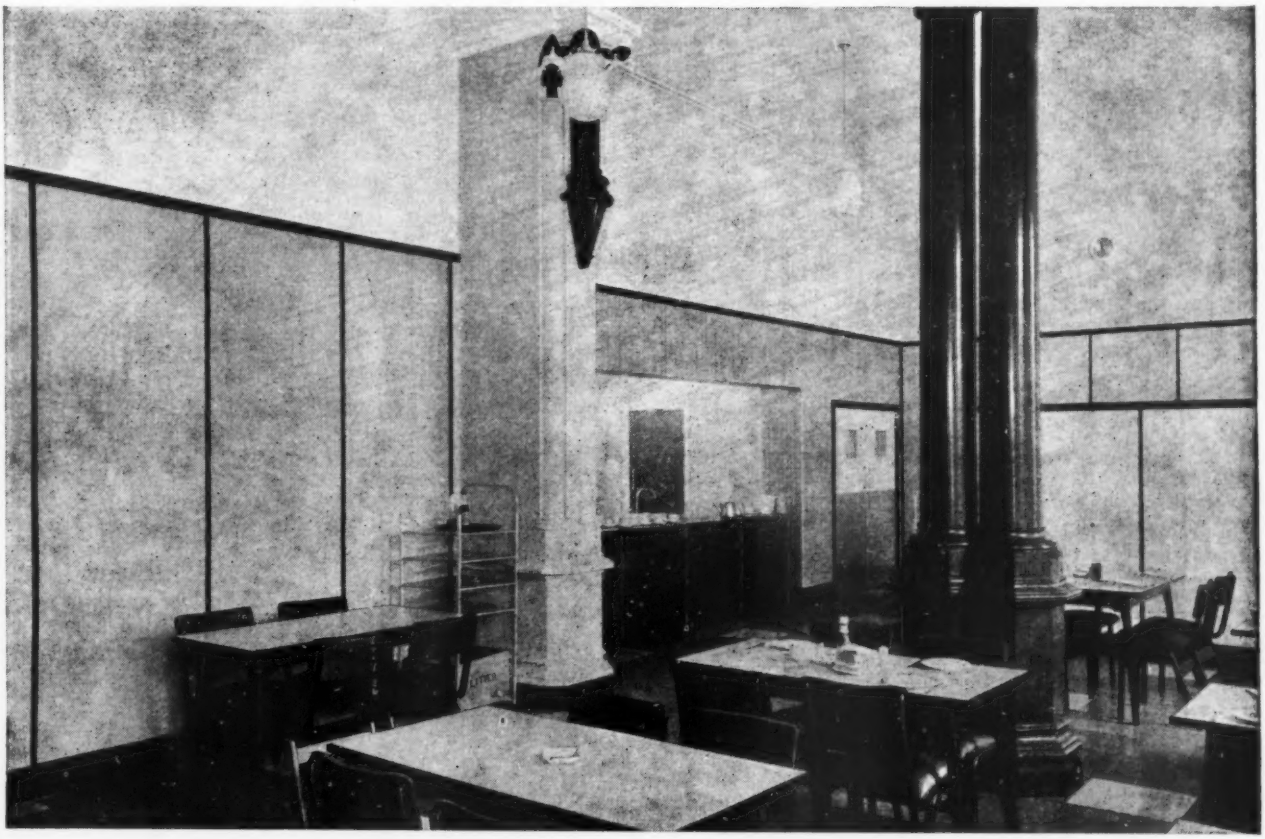

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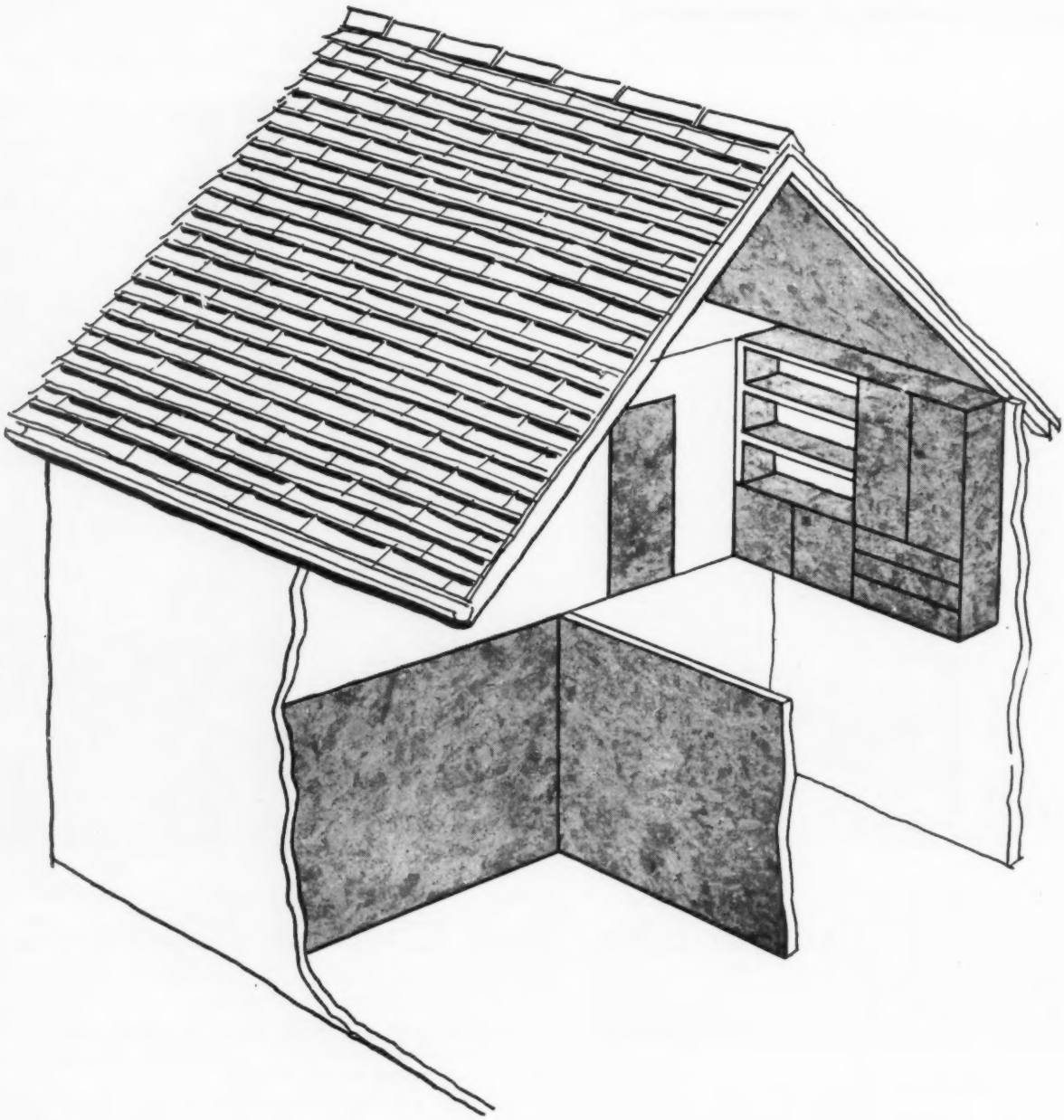

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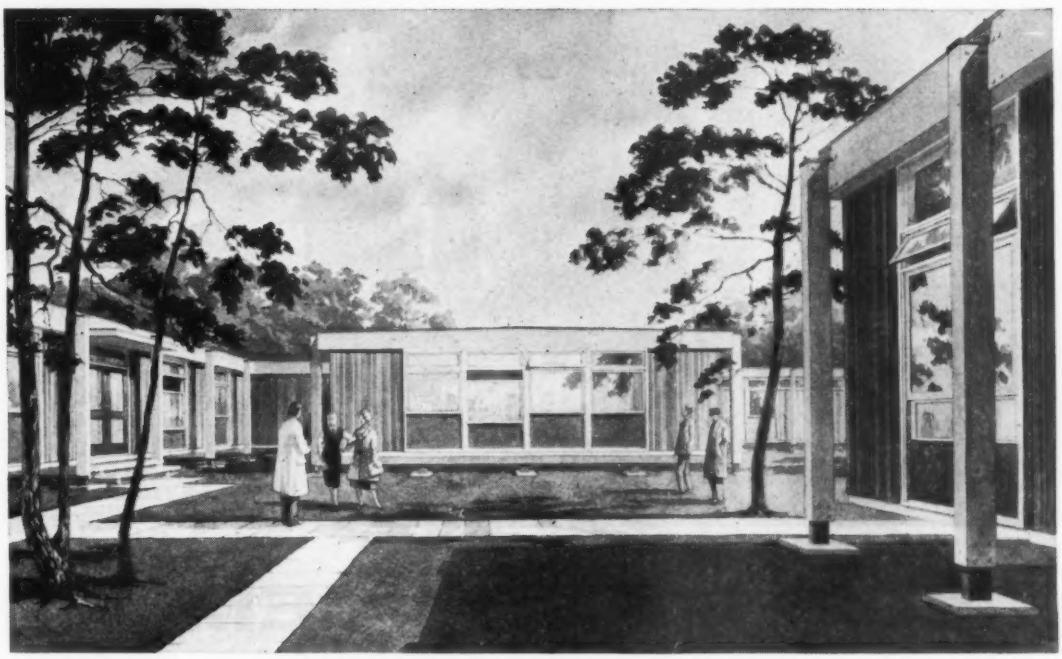

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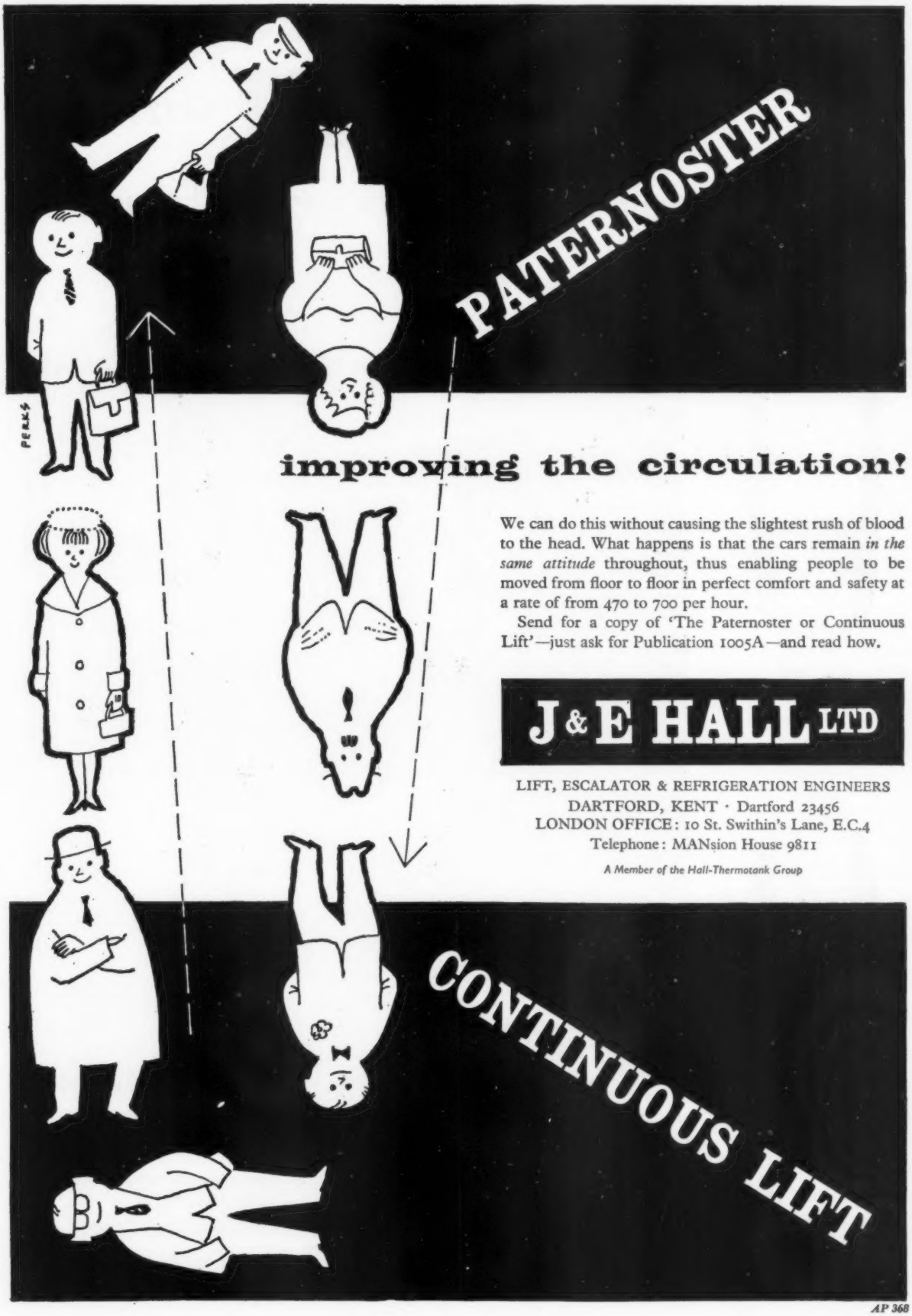

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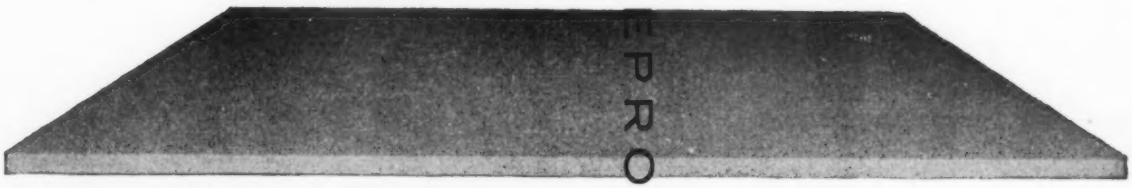

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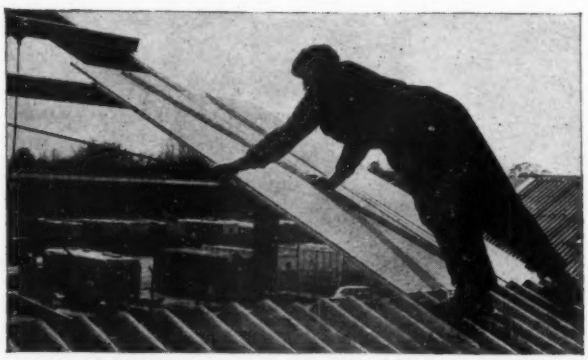

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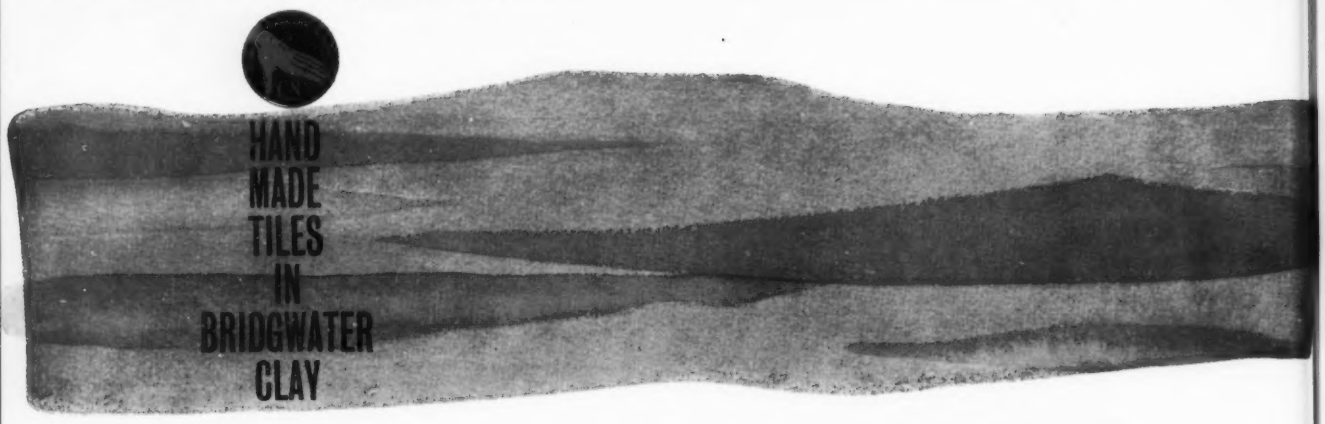

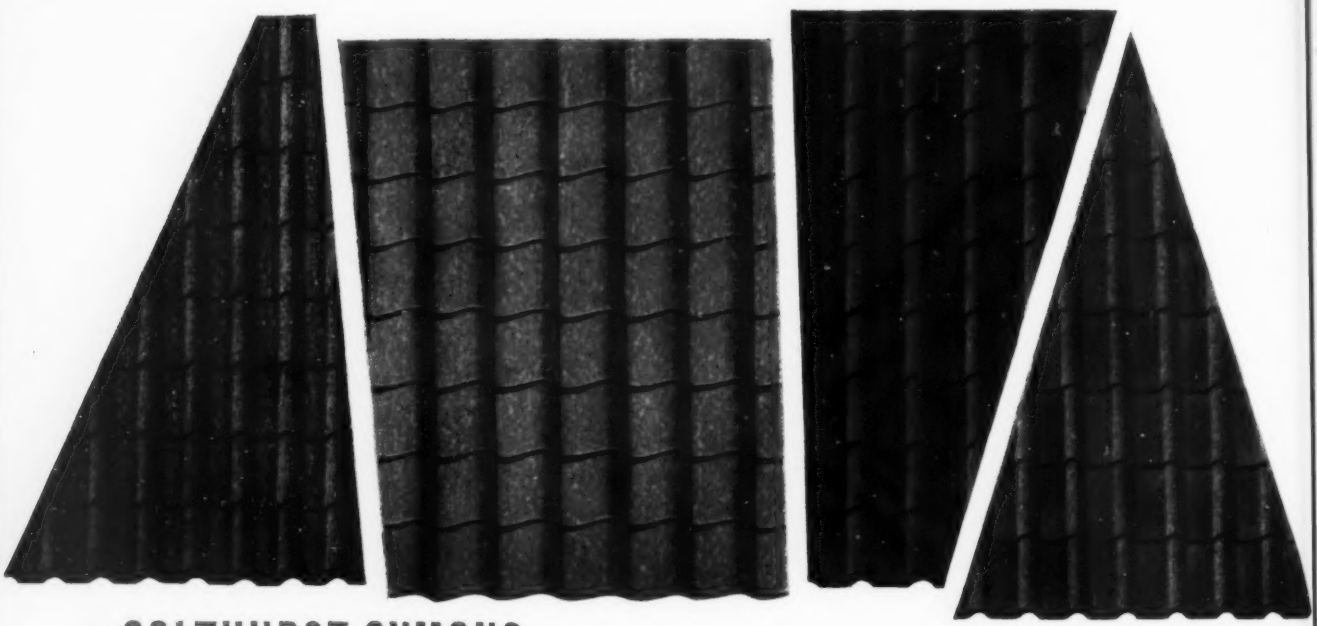

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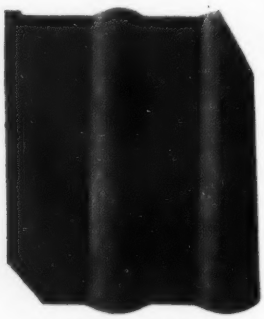

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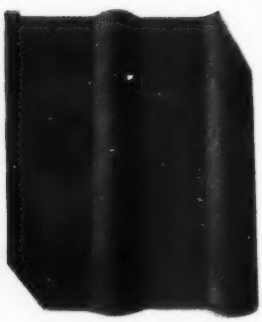

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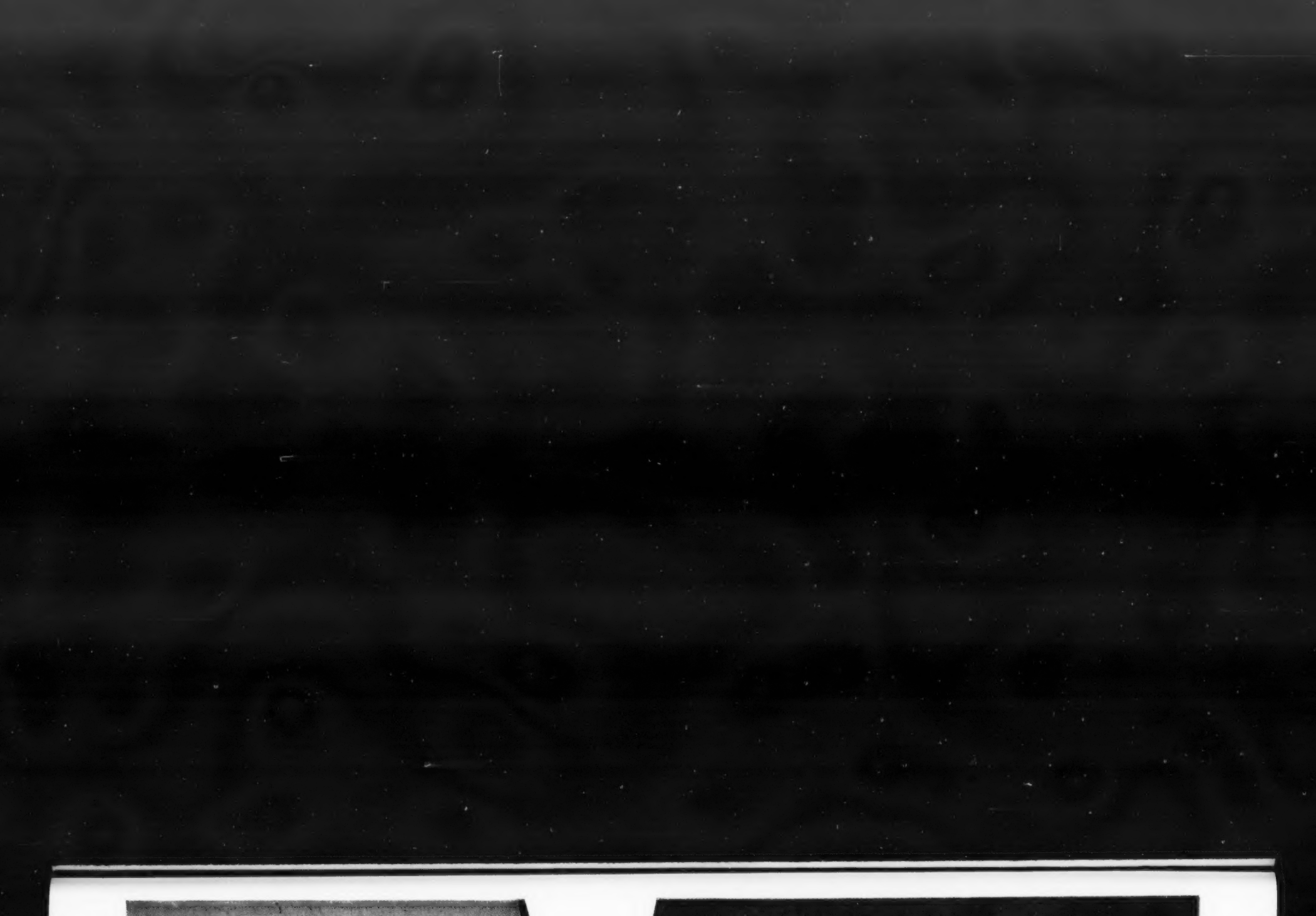

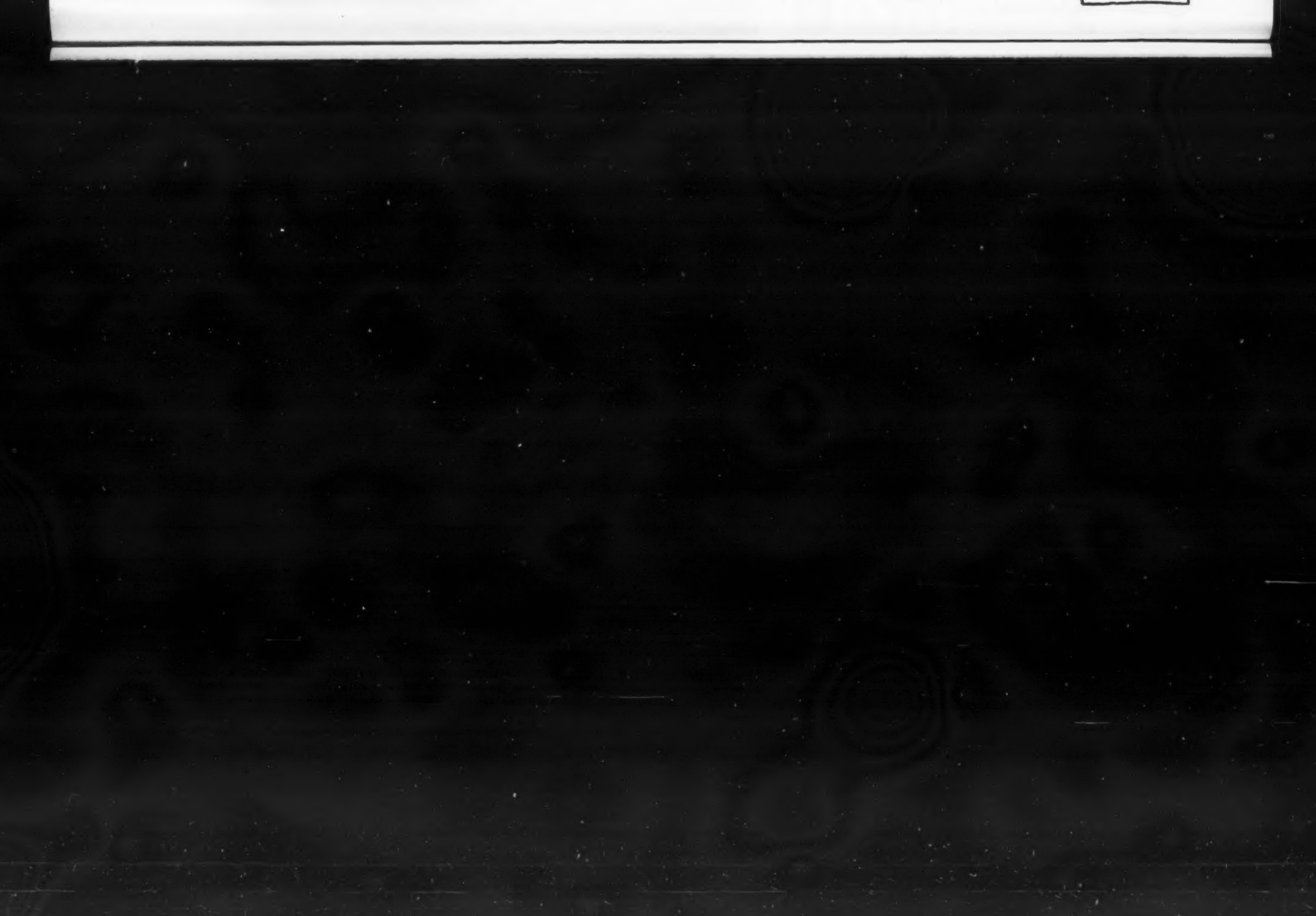

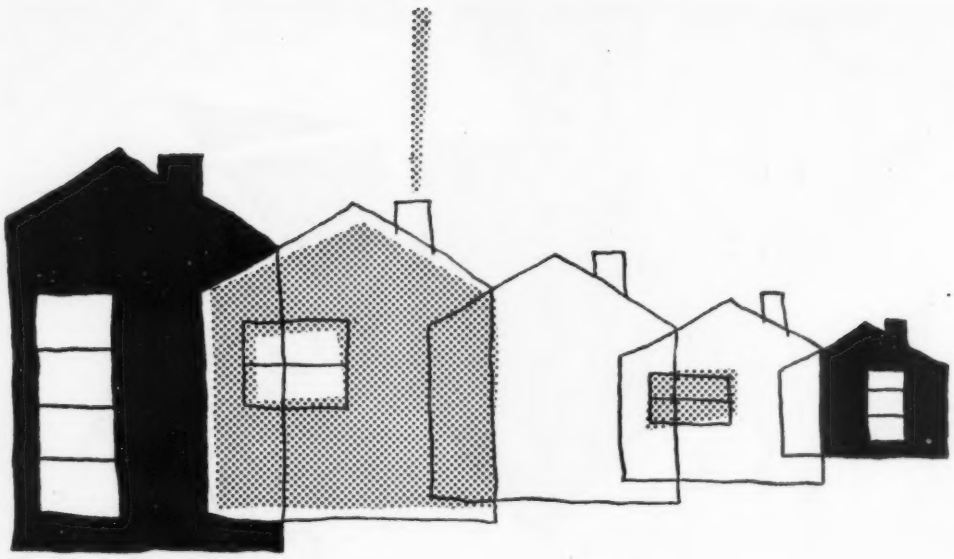

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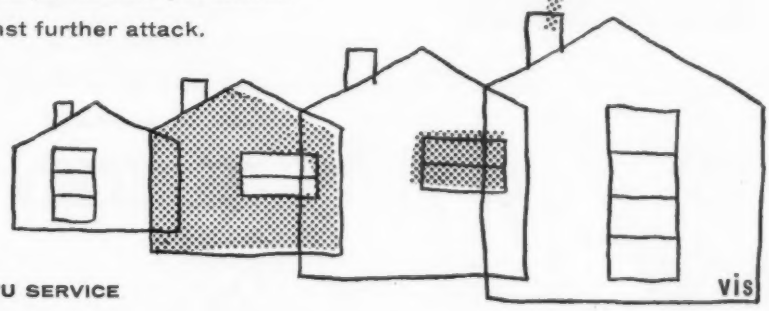

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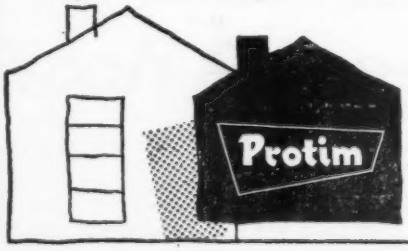

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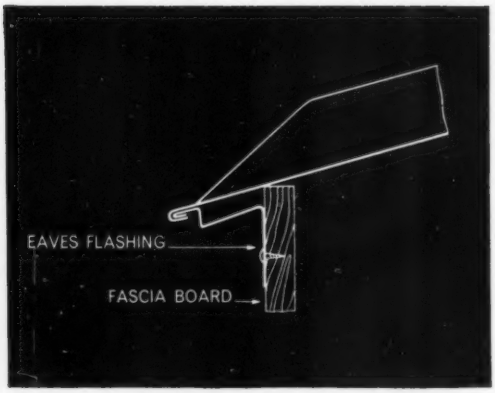

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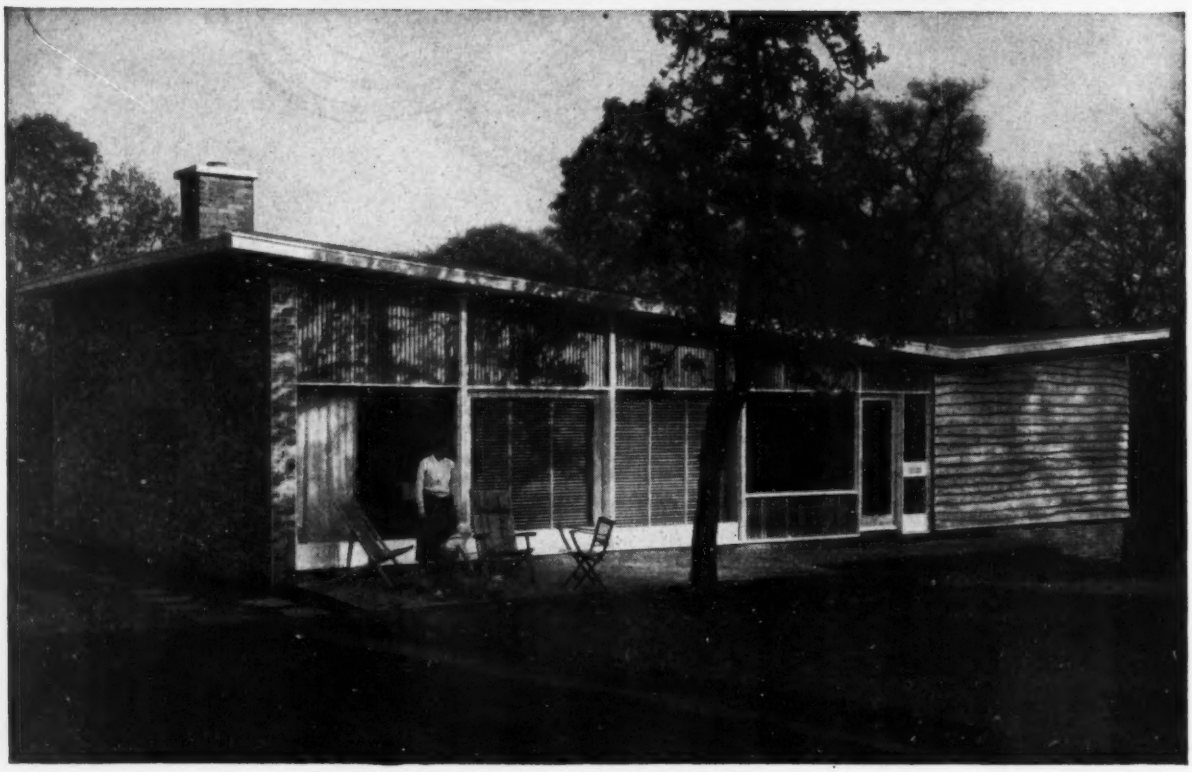

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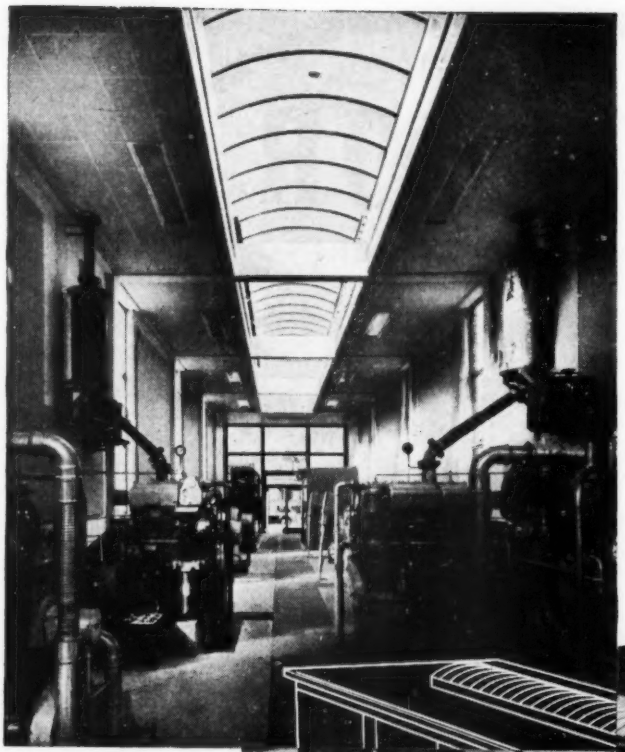

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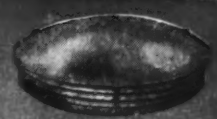

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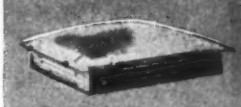

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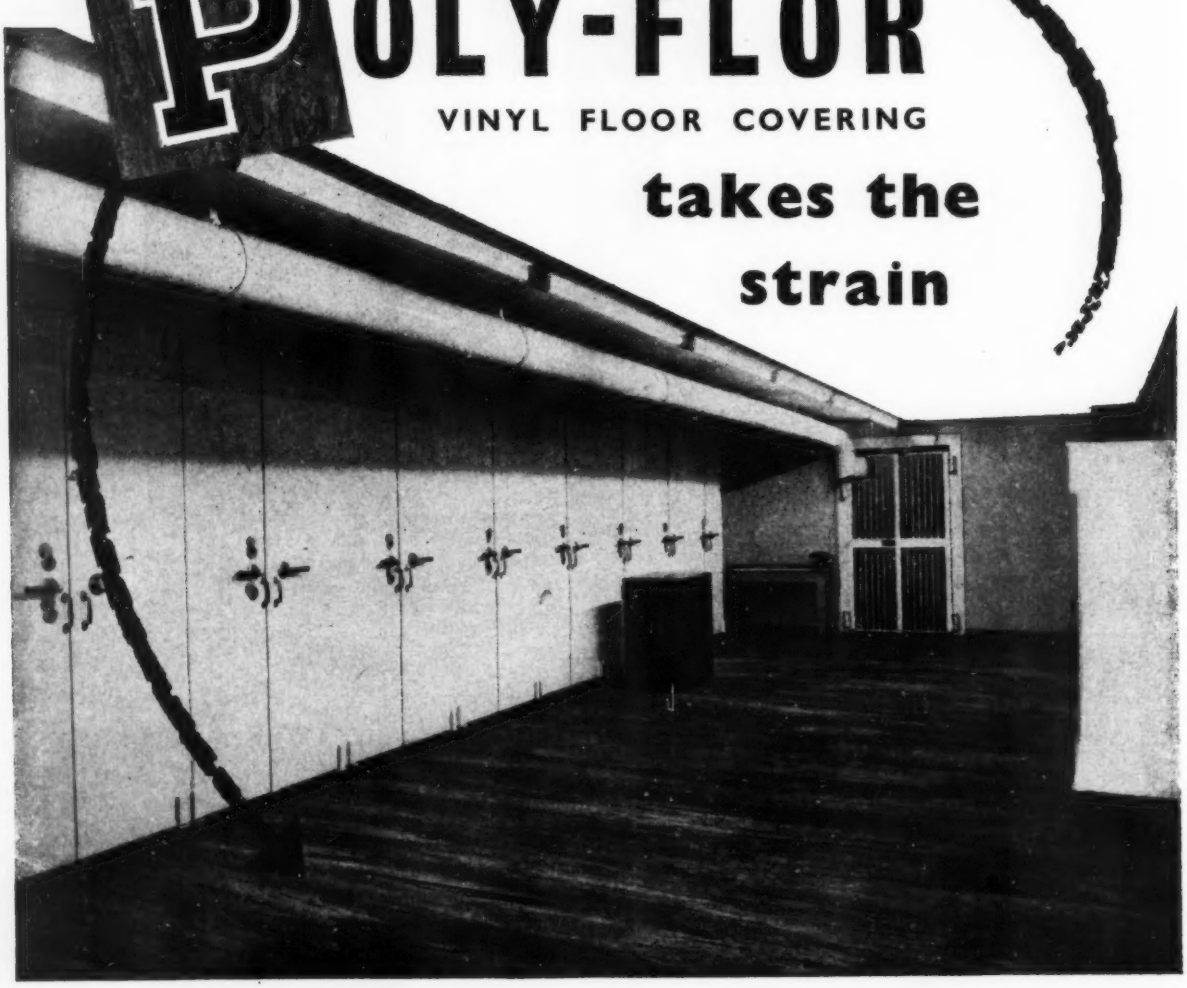

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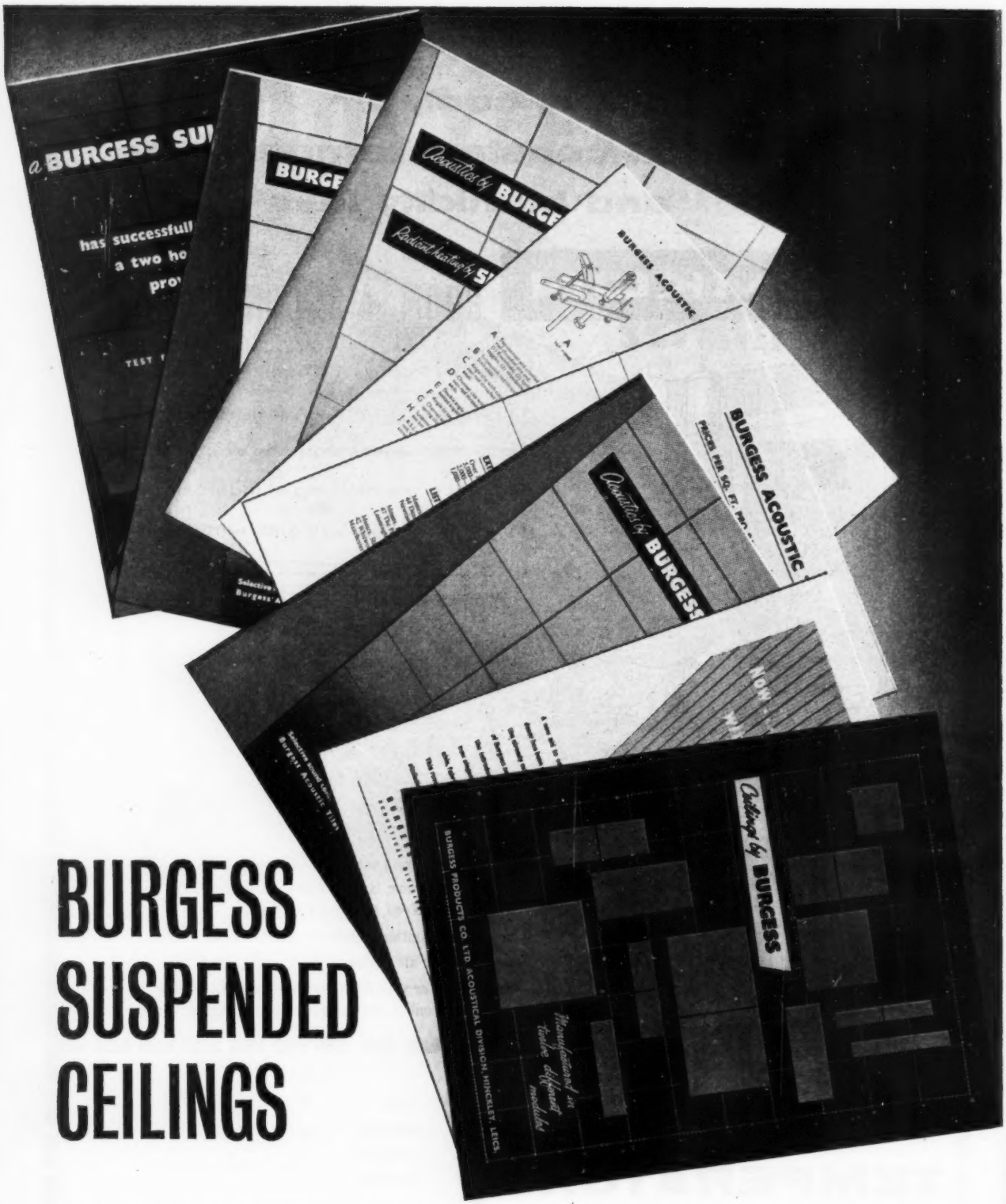

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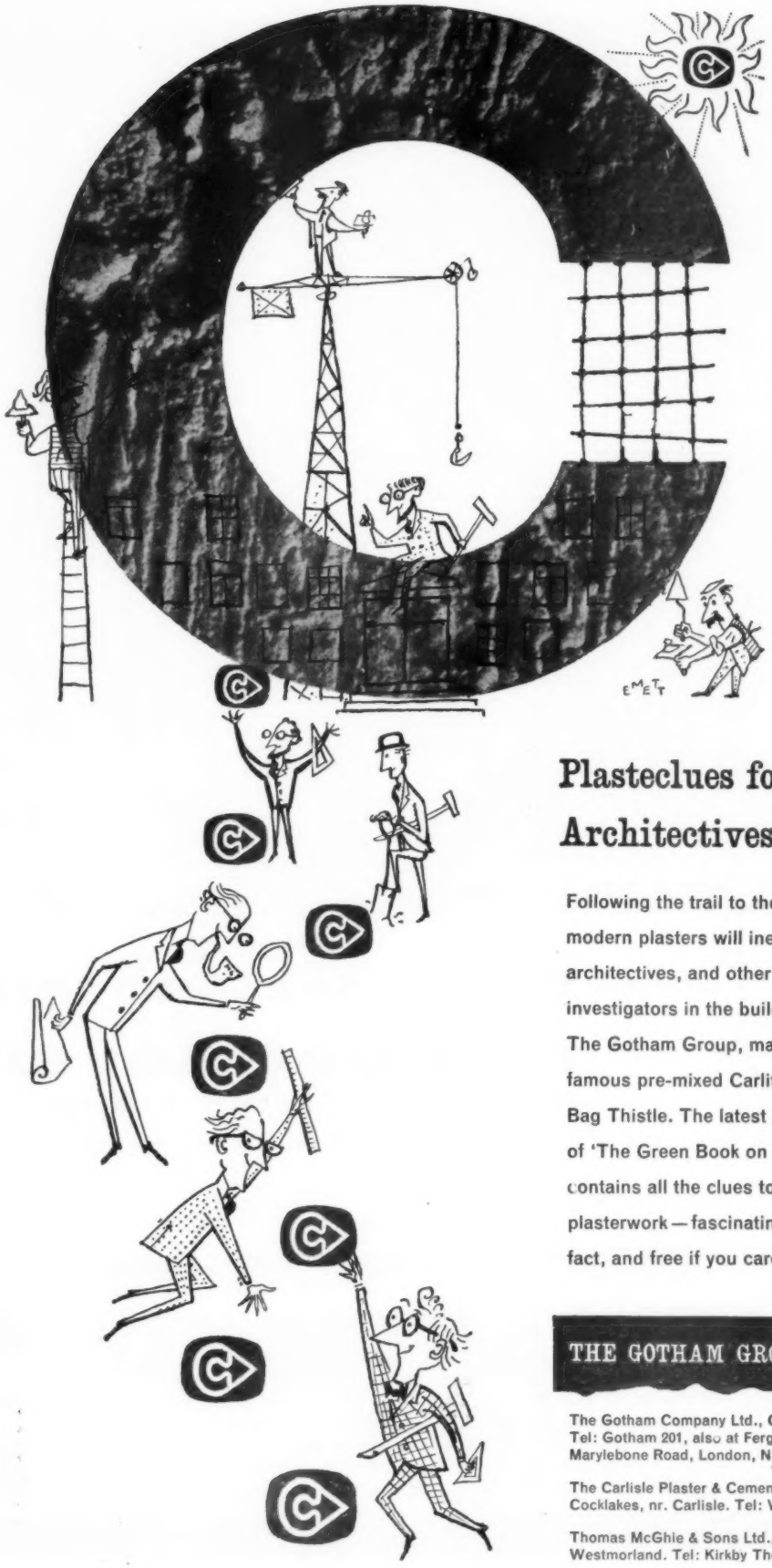

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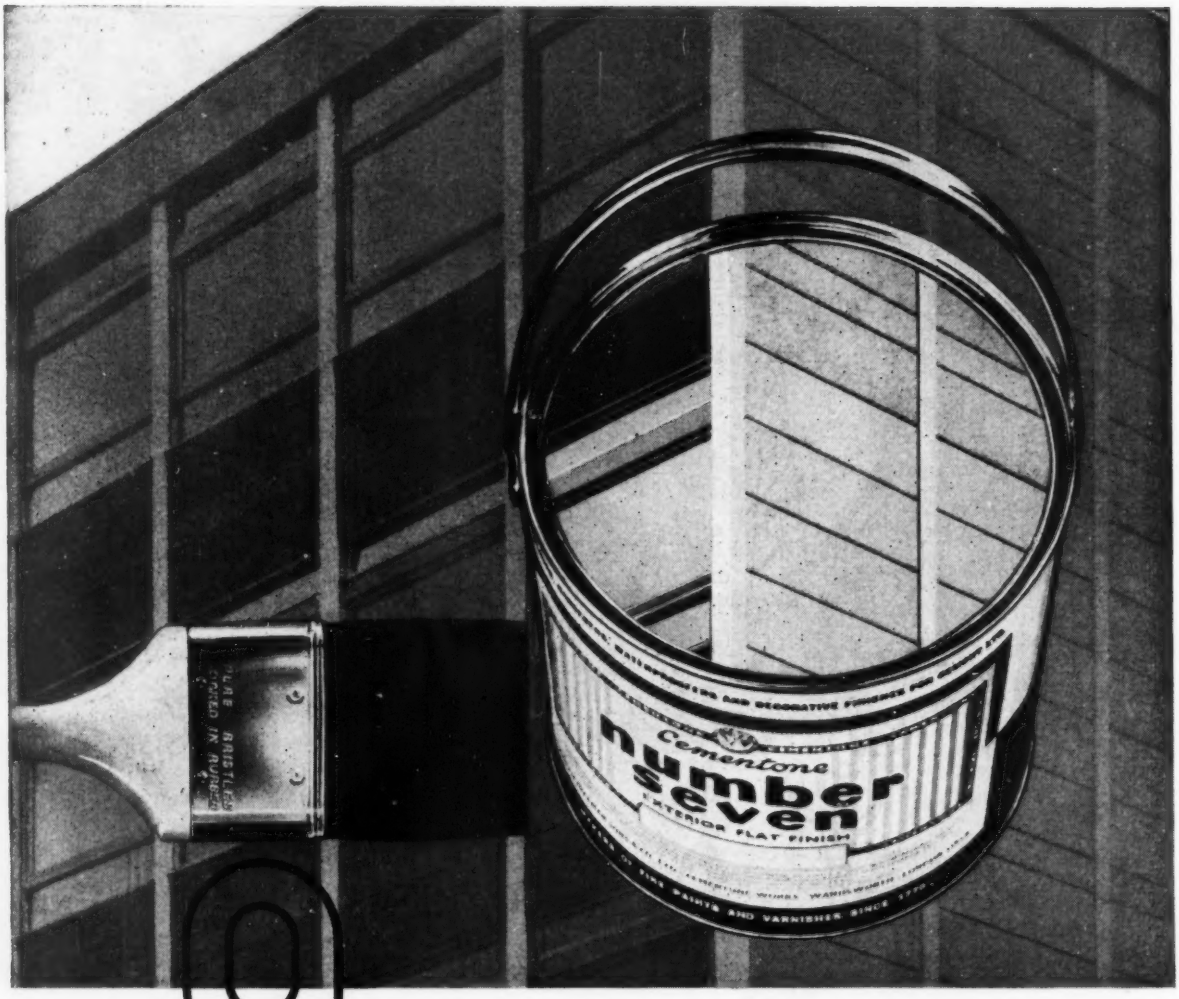

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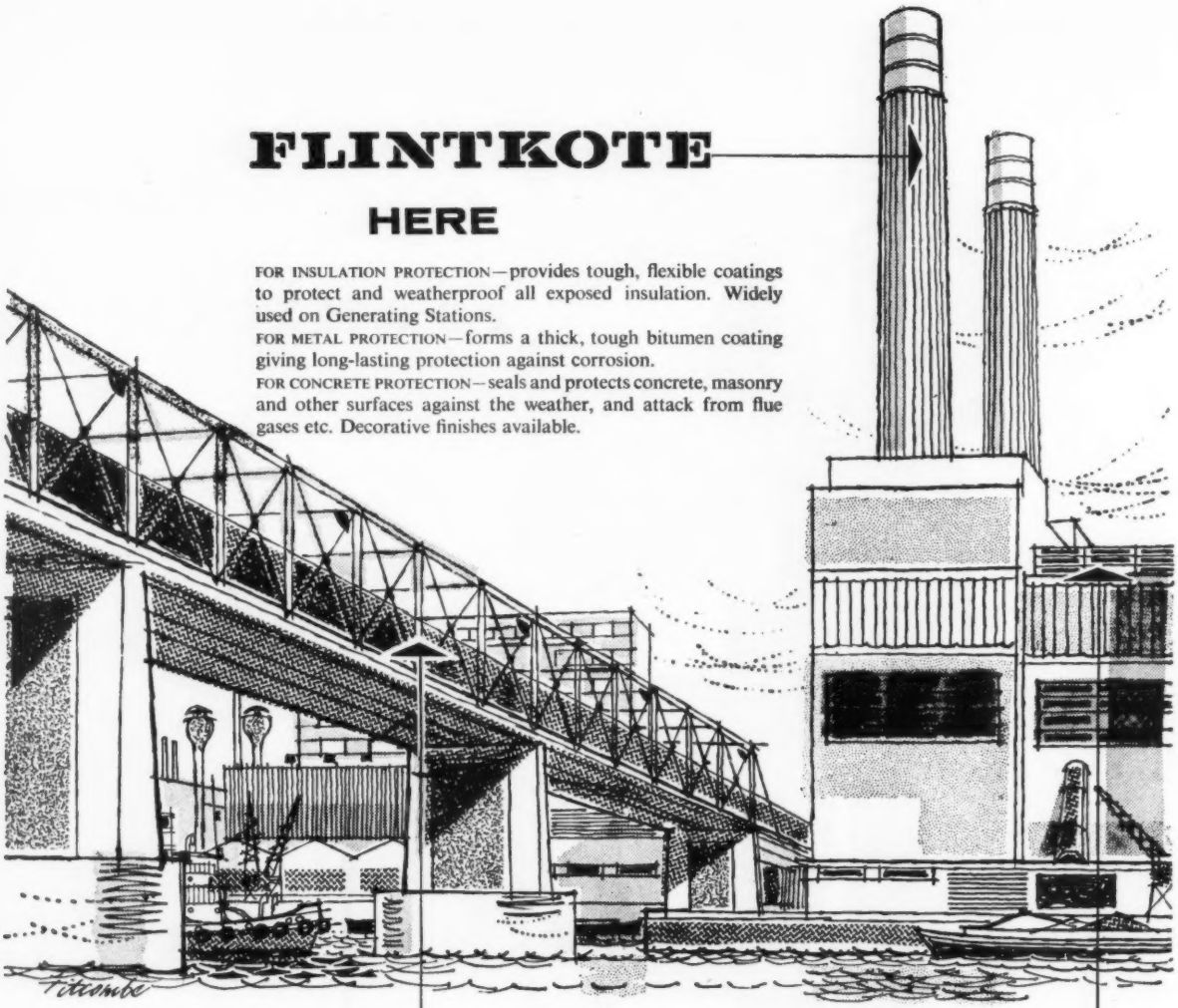

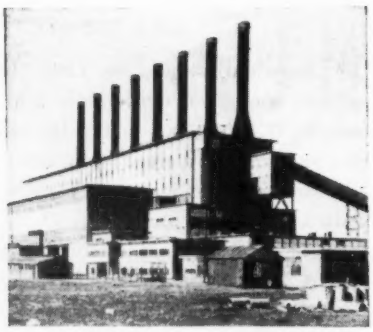

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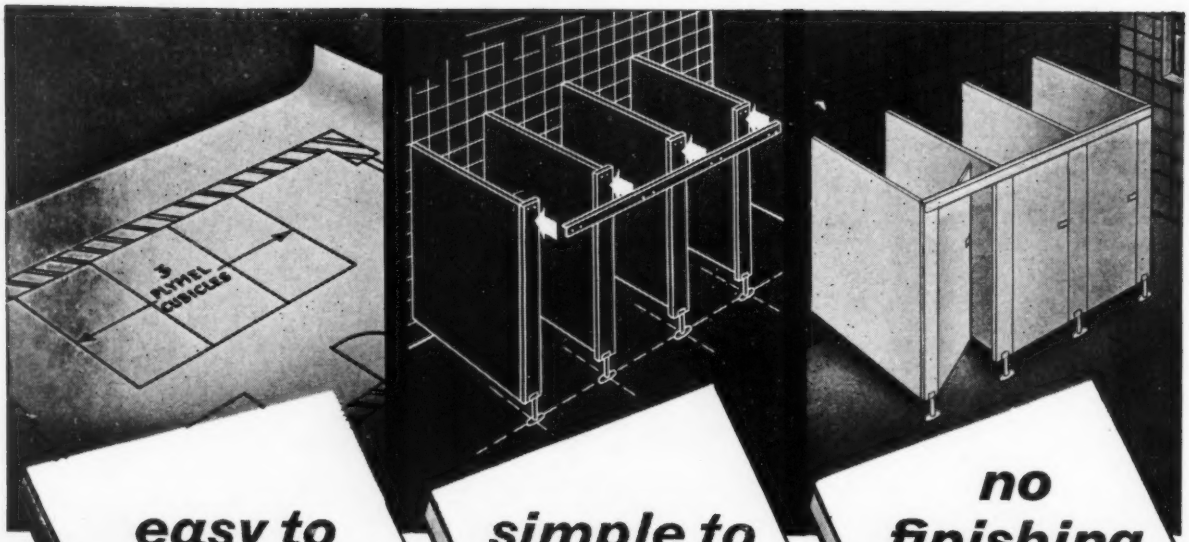

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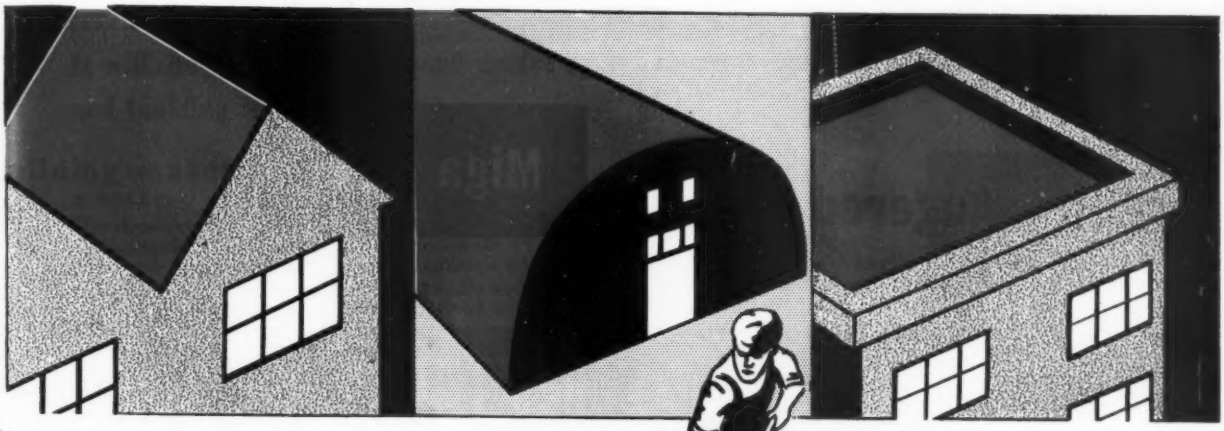

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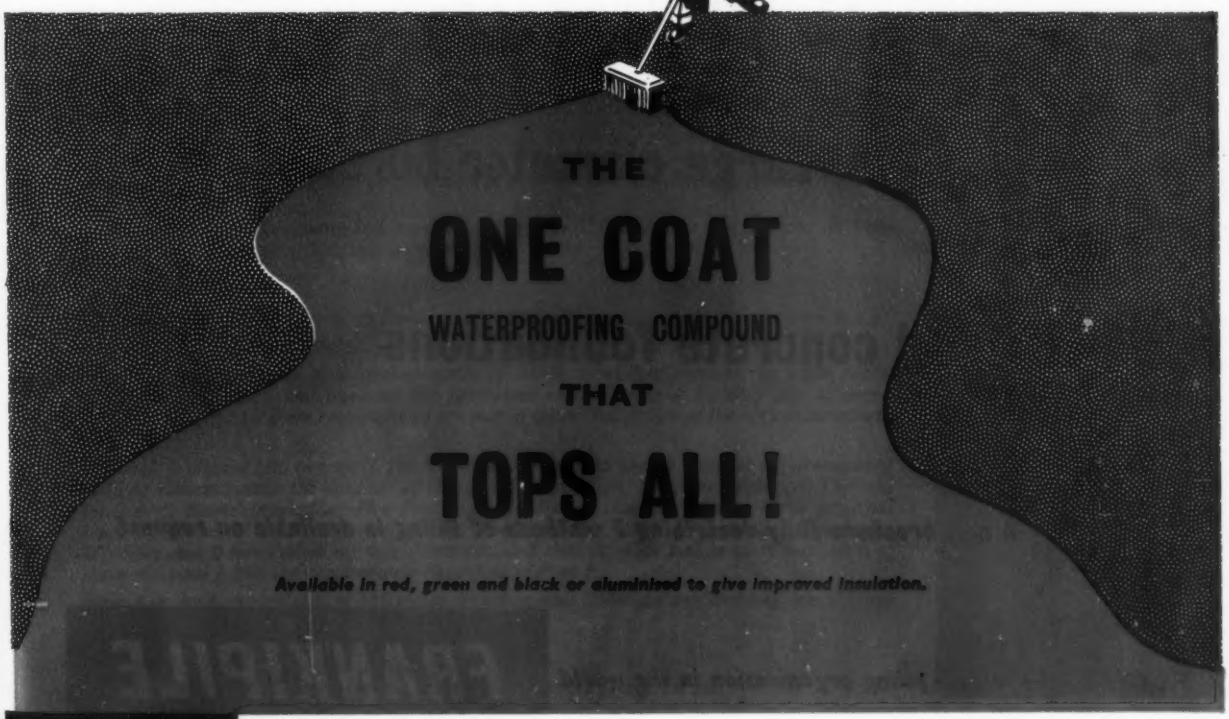

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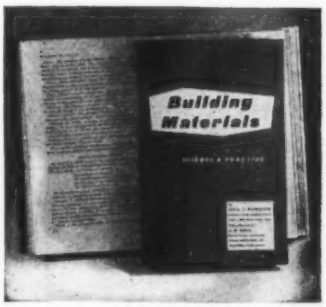

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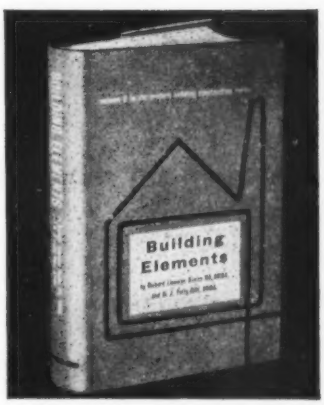

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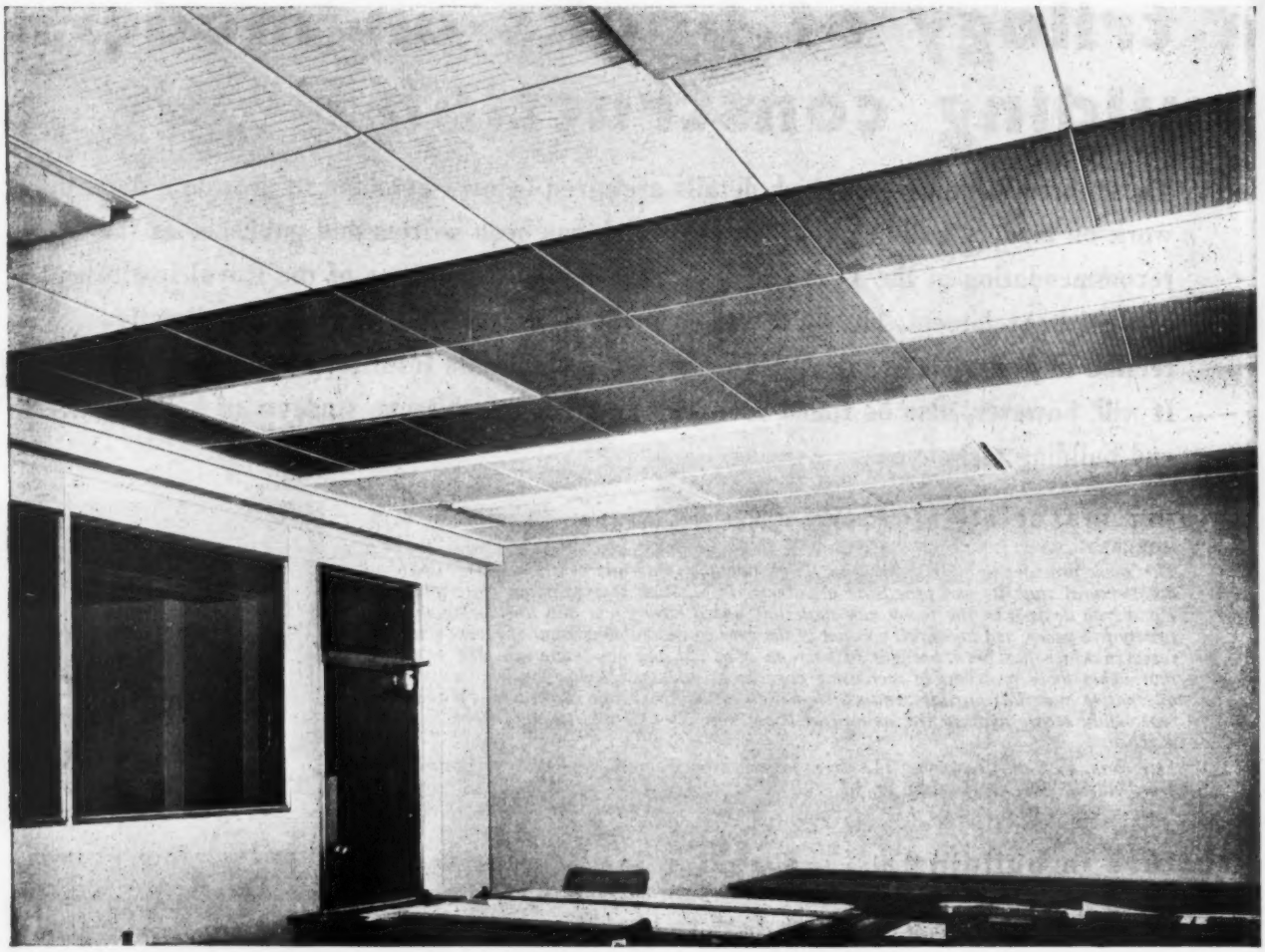

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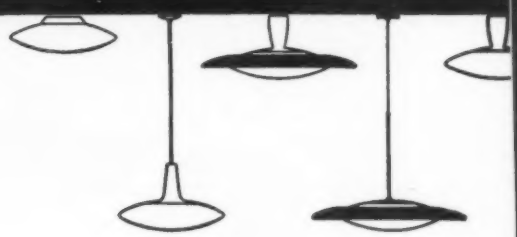

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A new type of Wallspan makes its debut on the tower of Castrol House—a prefabricated Wallspan designed in collaboration with the architect that goes up more quickly than any curtain walling system yet devised. Williams & Williams developed it specially to fit in with a tight building schedule—18 months from start to finish.

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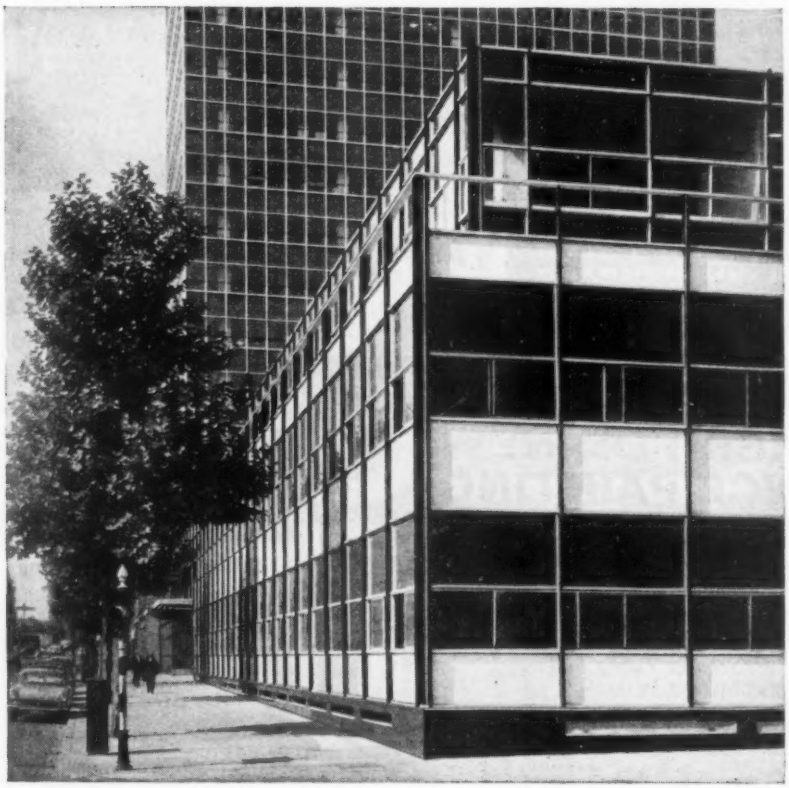
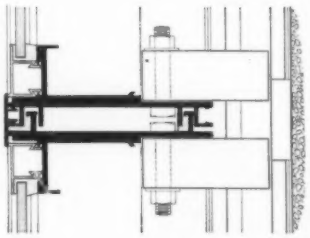
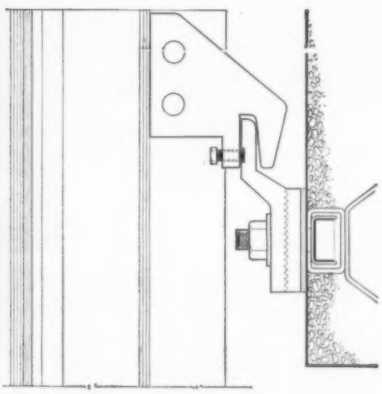
The vertical section shows how the prefabricated Wallspan is literally *hung* on to the frame. It is curtain walling in the truest sense, and although designed in the first place specifically for Castrol House, the system is now generally available—a classic example of co-operation between the architect and the curtain walling specialists.





Horizontal section at infill level. Each half mullion forms the edge of a prefabricated panel. When the two panels are brought together, the joint is sealed with Thiokol mastic and an aluminium capping is then clipped on to seal the joint finally.



Vertical section showing fixing detail. As the floor slab is cast, bolts are built in ready to receive the fixing spigots. These are adjustable vertically and horizontally to allow for slight inaccuracies. Hooks on the Wallspan panels engage over the spigots and are kept firmly in place by compression bolts.

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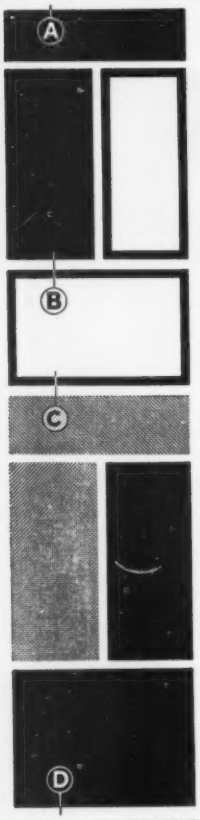

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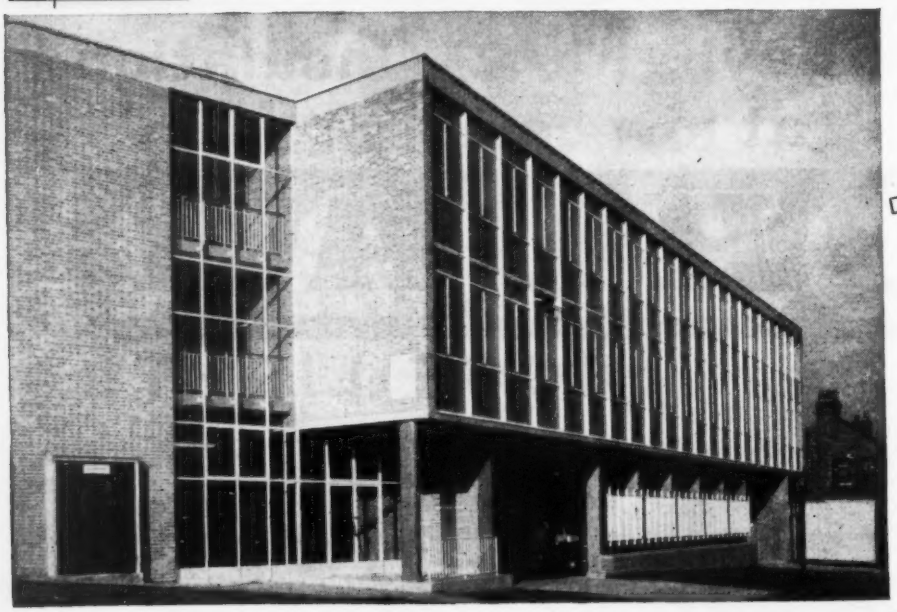

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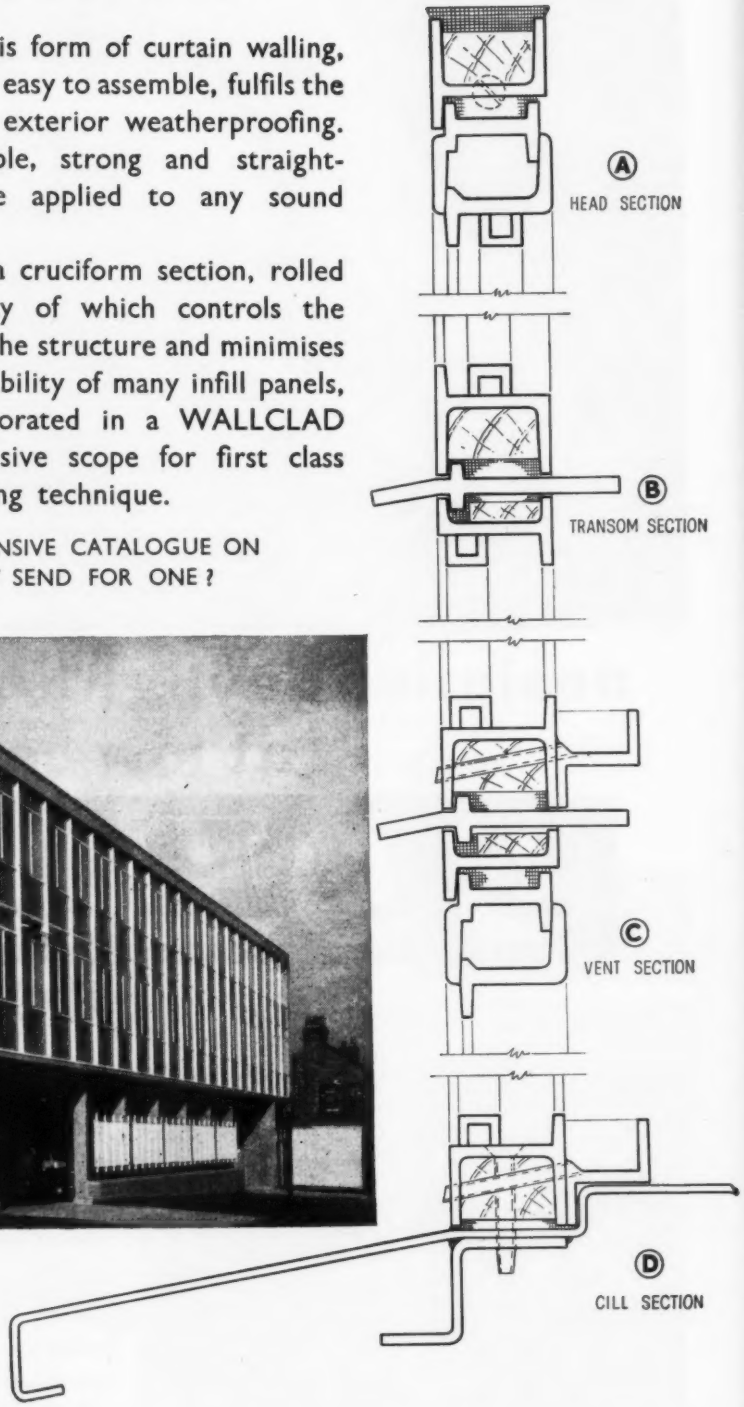

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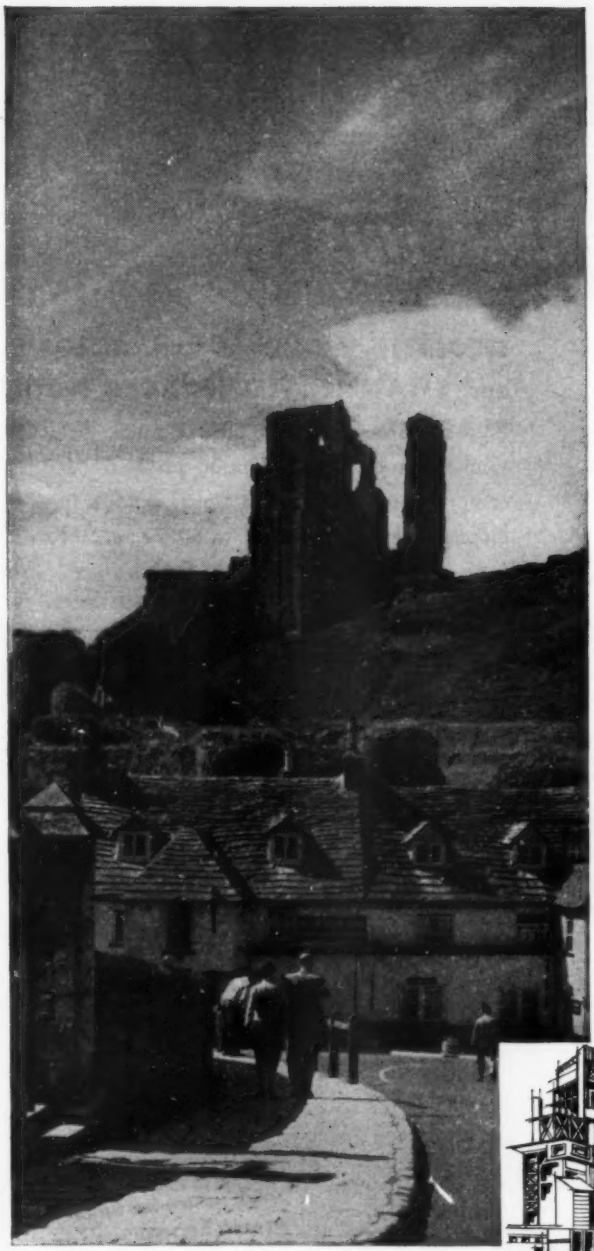

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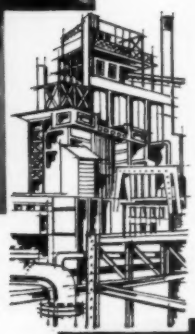

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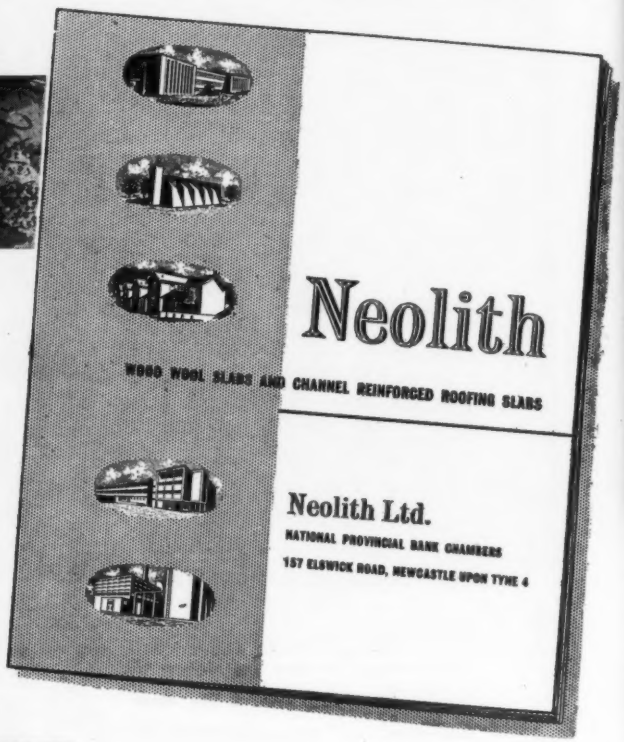

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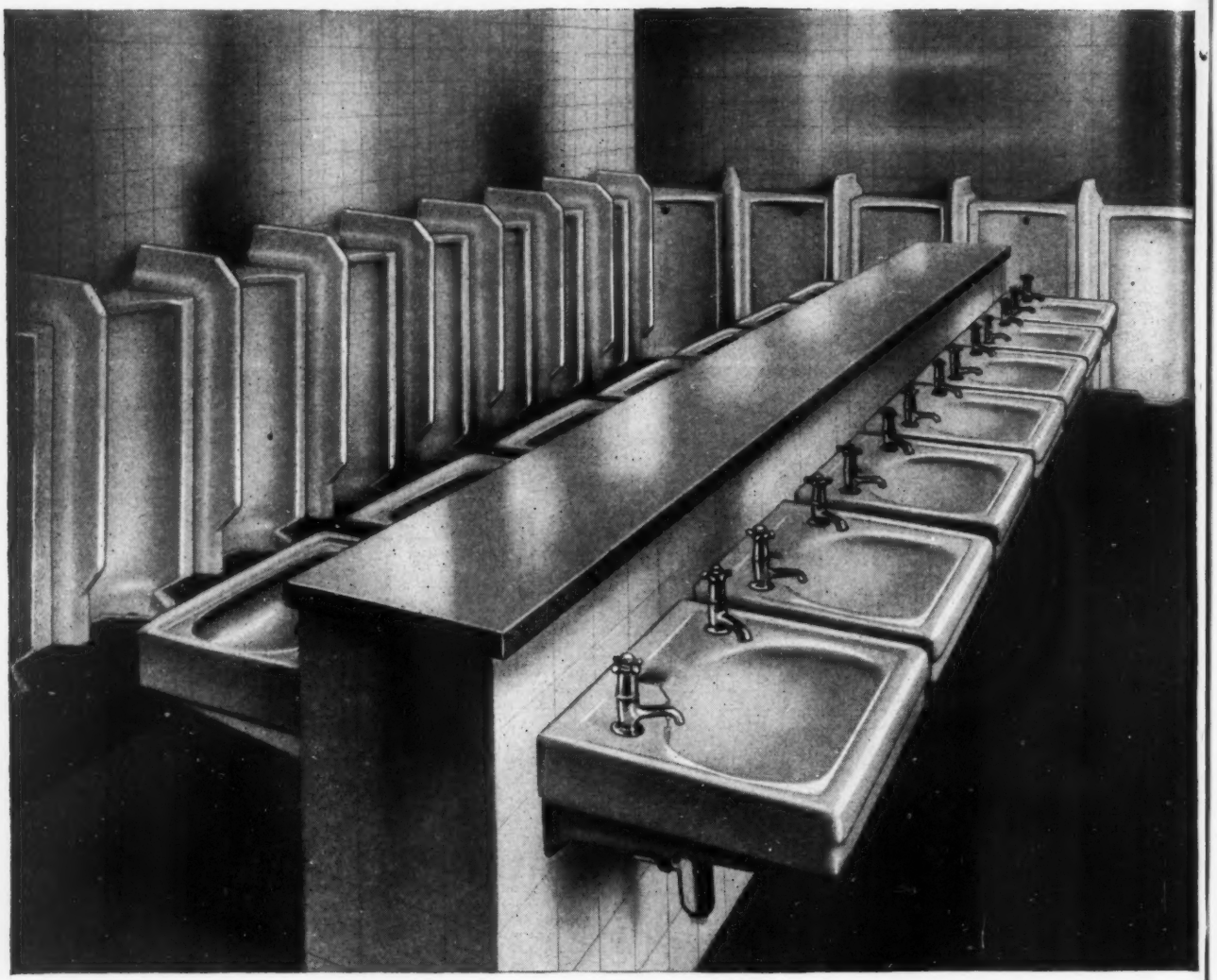

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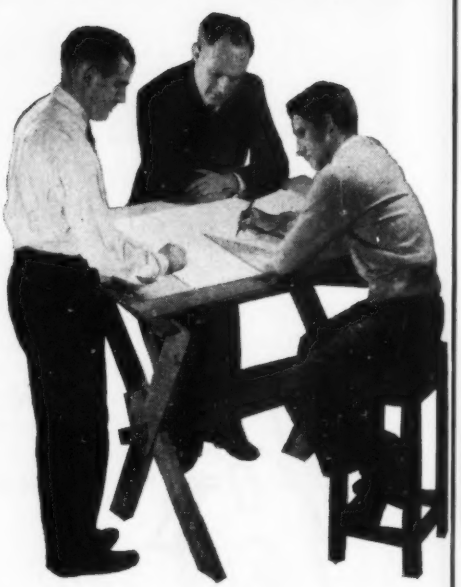

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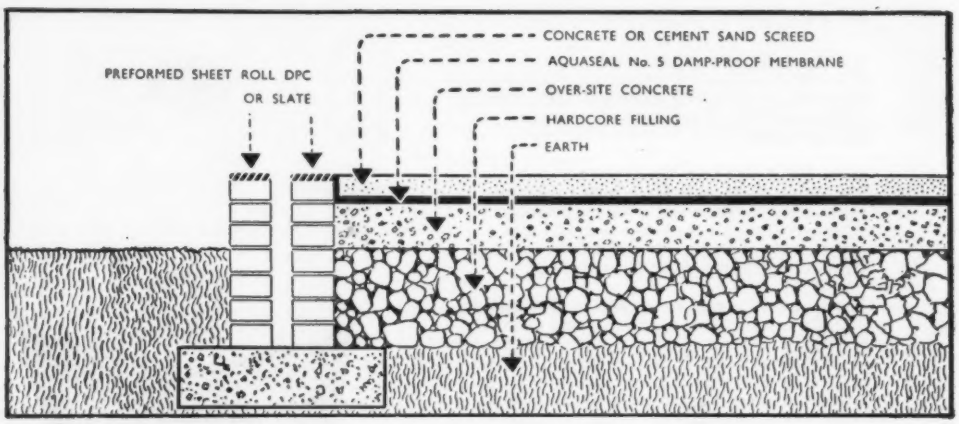

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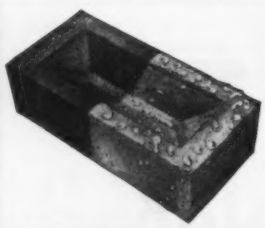

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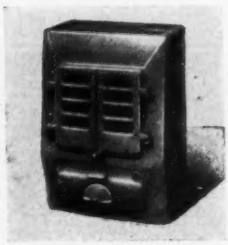

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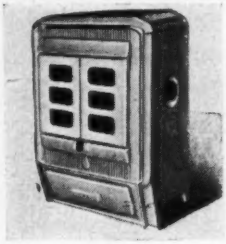

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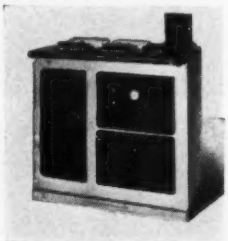

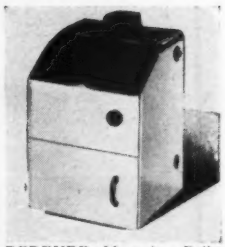

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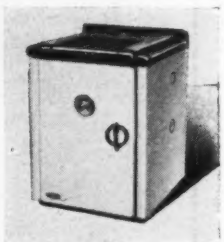

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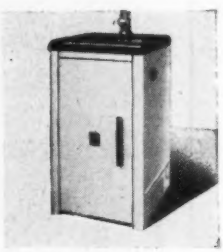

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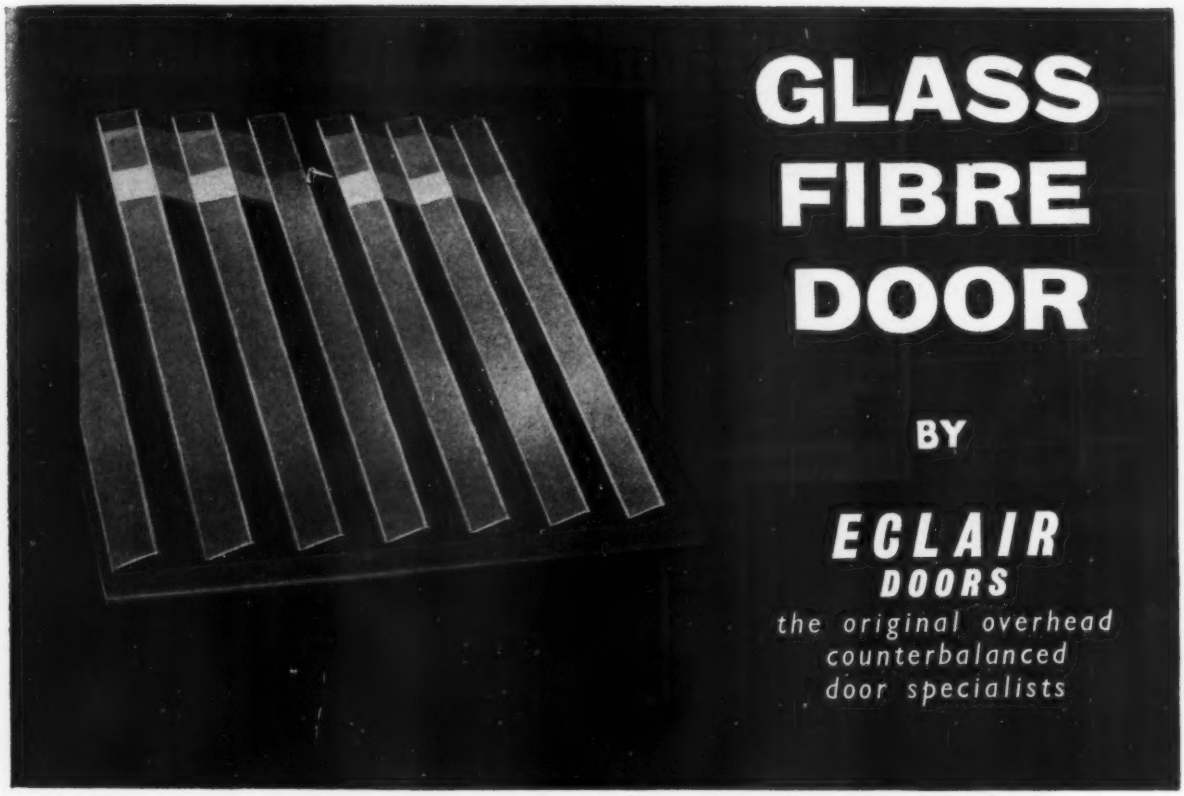

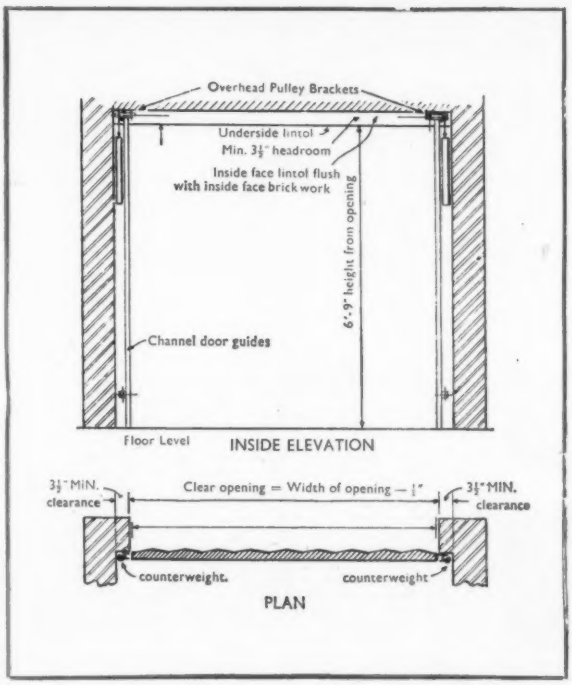

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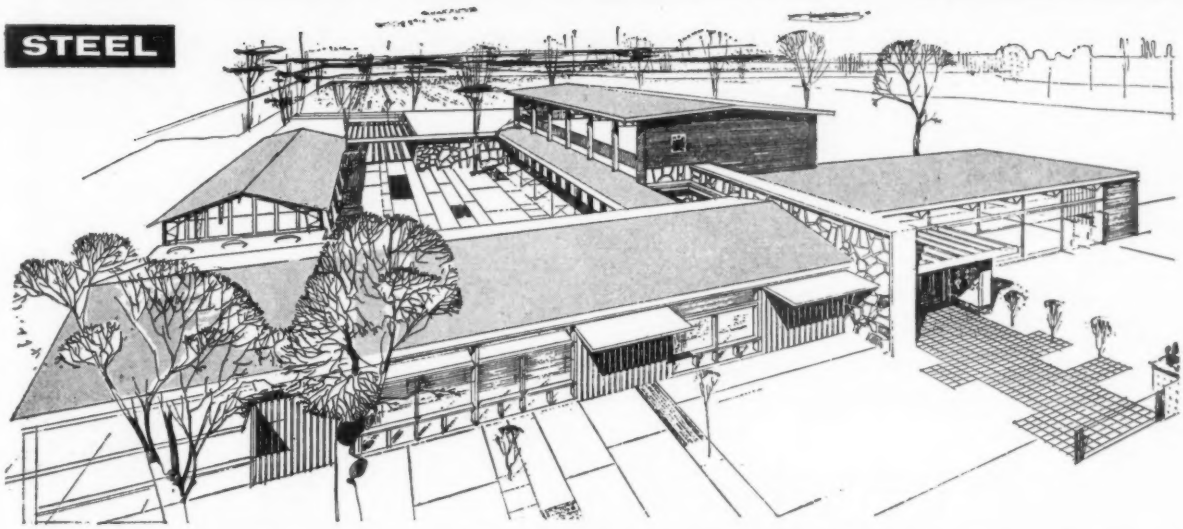

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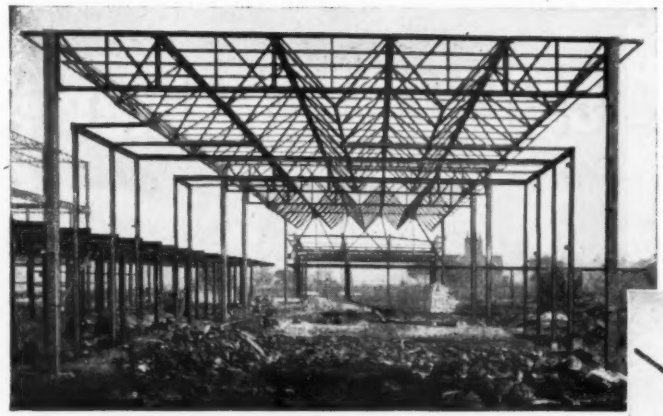

Above: Gravesend Gordon School for Kent County Council. Architect Elie Mayorcas, F.R.I.B.A. Right: Lewsey Road and Ashcroft Schools, Borough of Luton. Architect M. H. G. Blackman, A.R.I.B.A.

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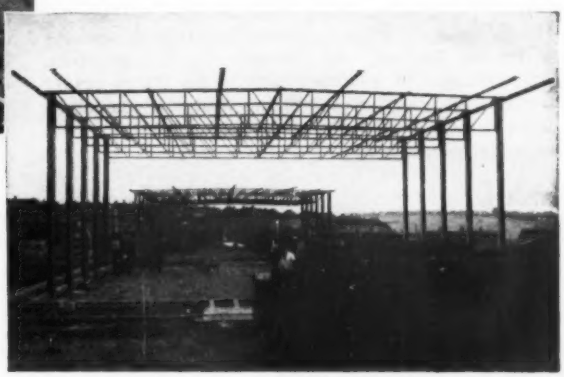

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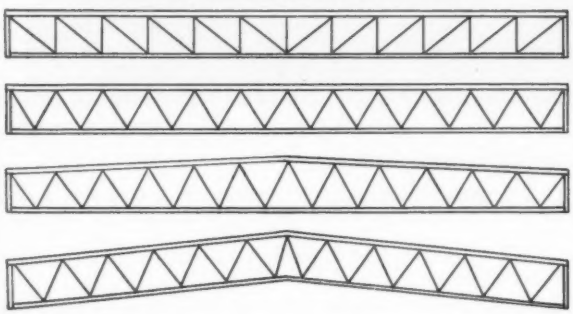

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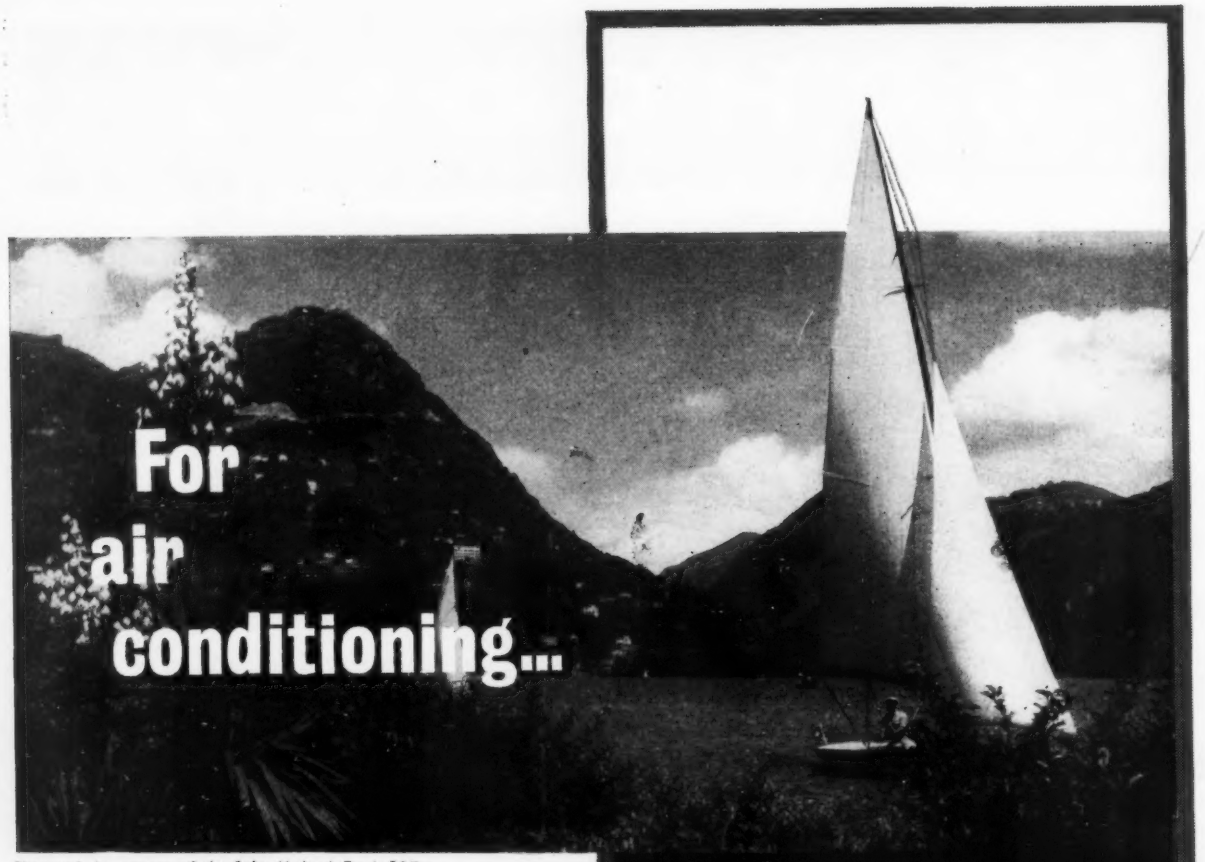

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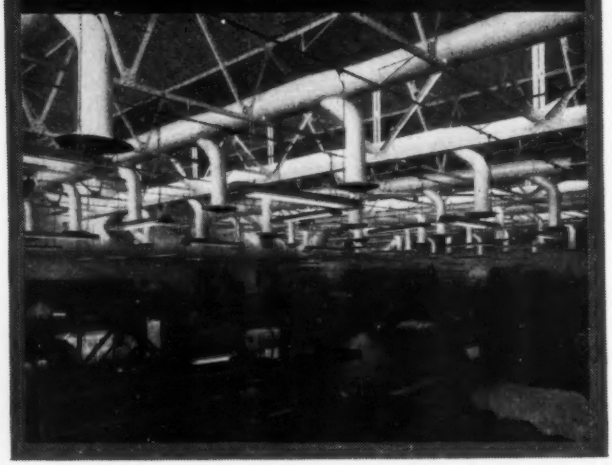

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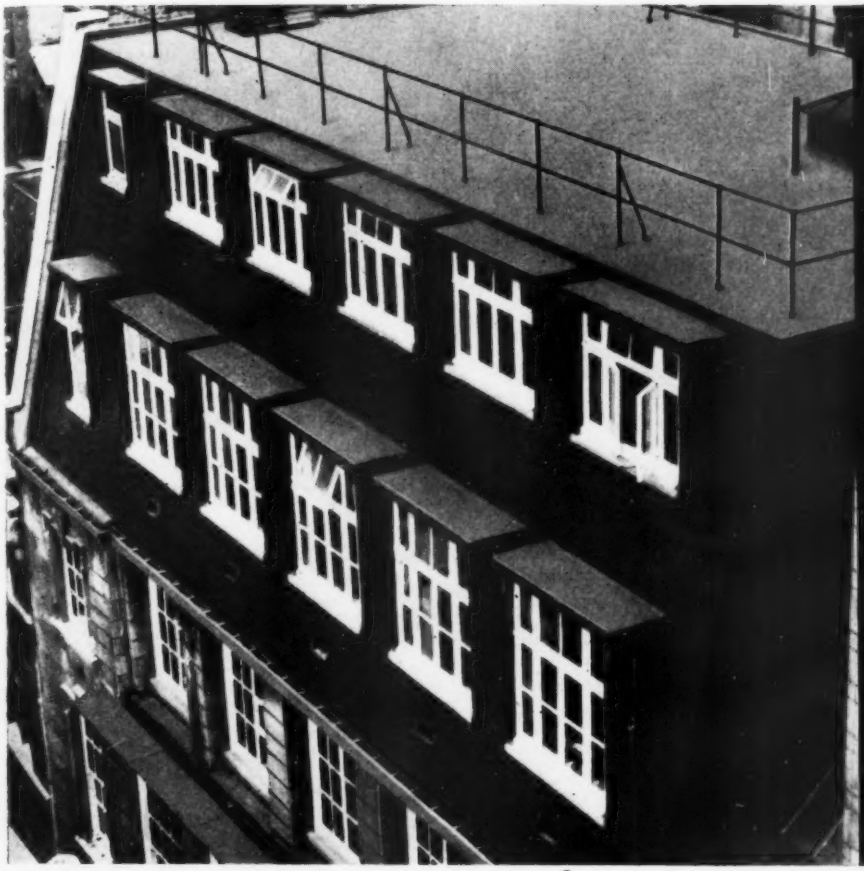

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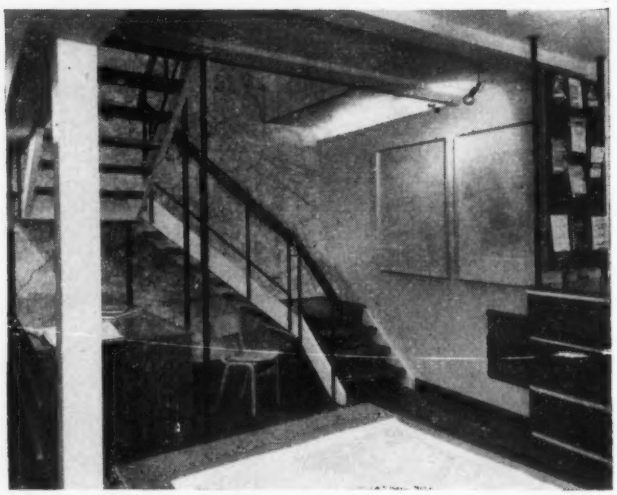

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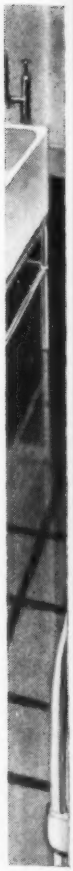

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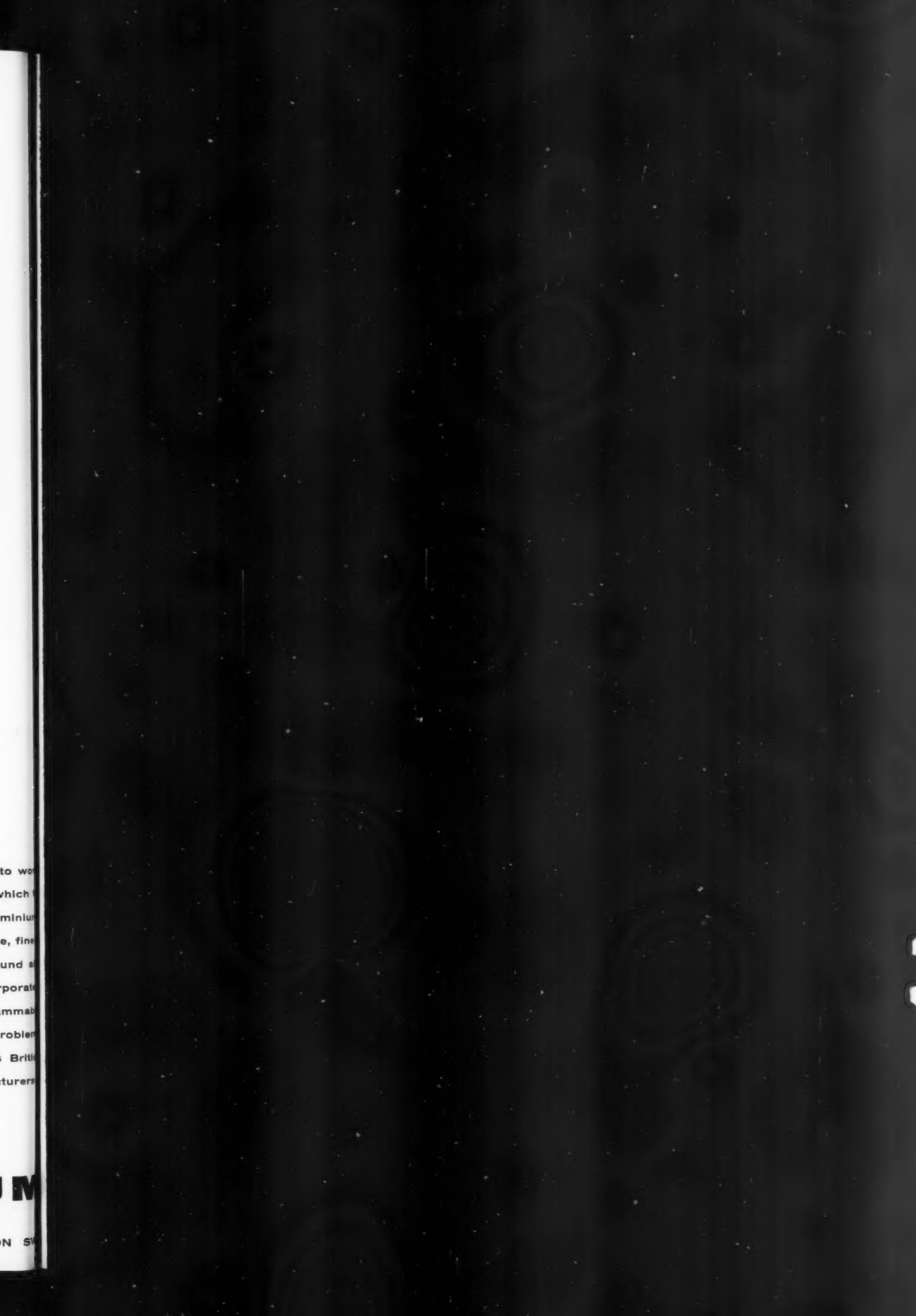

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the hospital brief

Definitions

Clinical. A term which is used to signify direct association with a patient.

Clinical Departments. These departments include Medicine, Surgery, Therapeutics, Paediatrics, Obstetrics and Gynaecology and Psychiatry.

Clinical Investigation. In a general sense any investigation of a patient for purposes of diagnosis and treatment: in a special sense an investigation of a patient using special apparatus or procedures conducted primarily for research purposes: in an extended sense to designate the laboratories of a clinical department in which research on patients is conducted. These patients have been brought from the ward to the laboratory.

Clinical Research. In a general sense research concerned with patients either directly or indirectly by examinations of specimens from the patient: in an extended sense to designate the laboratories of a clinical department in which research is done not involving the presence of the patient, i.e. specimens, drugs, bacteria, etc.

Paraclinical is a term which is used to signify a group of medical disciplines in a university concerned with the scientific aspects of medicine.

Paraclinical Departments. These departments include Bacteriology, Pharmacology, Pathology, Biochemistry and Biophysics. These departments are concerned mainly with teaching and research.

Paraclinical Laboratories. Any laboratory in a paraclinical department.

Diagnostic Laboratories. Any laboratory in which routine tests are conducted to assist in diagnosis and treatment of patients. In non-teaching hospitals the diagnostic laboratories are usually referred to as the Clinical Pathological Laboratory. In teaching hospitals in Scotland the diagnostic laboratories are part of the paraclinical department.

foreword

THE MINISTER OF HEALTH

I am delighted to have this opportunity of congratulating THE ARCHITECTS' JOURNAL on preparing this special issue on the important subject of hospital design and publishing it at such an opportune time. Its appearance coincides with the special course for architects (11th-15th July) and my Ministry's Exhibition on Hospital Design and Building (7th-23rd July), both to be held at the Royal Institute of British Architects. Your issue, like the course, is intended to give the architect who is new to hospital work an insight into the best ideas now current among those who work in hospitals and into the way in which these ideas affect hospital planning.

This is an important and rapidly expanding field. There are already 180 major schemes, which have been approved for the hospital programme, on which construction work or planning is already proceeding. Of these 30 involve the expenditure of amounts in excess of £1 million. In 1961/62 expenditure on hospital construction for the whole country is expected to reach £35 million and the programme will, I hope, continue to expand in the ensuing years.

If this important and expanding programme is to be carried through successfully, it will be necessary during the next few years to double the number of architects on the drawing board at present working on hospitals. With their varying background and experience many architects will have a special contribution to make, but all can play a part.

If this issue helps to interest architects, without previous experience in this field, in the subject of hospital design and building, it will have made an extremely valuable contribution.

Derek Walker-Smith

hospitals: the big re-think

There are two ways in which we can go about the hospital programme. Either we can say that by and large our existing inheritance is pretty good and, with the aid of relatively superficial surveys, we can try to supply its worst deficiencies. Or we can say that the fact of the Health Service, the change in medical technique and the great increase in the cost of staffing hospitals combine to create a situation which is entirely different from that in which our hospitals were conceived and that, if we persevere with these hospitals, we are not only preventing ourselves from giving the service which we know to be right, but are spending even more in conducting this ineffective service than we might have to spend on an appropriate one.

It was the achievement of the Nuffield Provincial Hospitals Trust to show beyond reasonable doubt that this second view is the right one. Unfortunately, all the indications are that the first view is the one most likely to be adopted. For the BMA the problem is seen mainly as a quantitative one, i.e. of so many more beds at £4,000 per bed, on the assumption that most of those existing would be retained. Successive Governments appear to see the problem in much the same light, considering that their duties to the Health Service will be discharged if, each year, they make a slightly larger allocation for hospital maintenance and rebuilding without enquiring too closely into how it is spent. One reason for believing that this is the accepted view is that neither the Government nor the BMA have undertaken the basic research which would be necessary to carry out a radical solution. What is so surprising to the layman is the unscientific way in which those who have the gravest responsibilities appear to go about their business. The attitude of the Government is to leave it to the Regional Boards to state their wants. This would be reasonable if it were known that the true nature of the hospital revolution—social, medical and technical—were well appreciated by the Boards. But this certainly is not so. In general it is good that central government should delegate responsibility; but it is not good when there is a job of fundamental reorganization to be done. We dread to imagine what would have happened to the schools rebuilding programme if the Ministry of Education of the day had not insisted on a basic rethinking of the educational problem and had not given an exceptional lead on how it was to be answered.

Hospitals are immeasurably more complex than schools. We think of them as places where people are healed; but they can also be places where people are taught and where scientific research is done. Further, as they house a complete community, they comprise all the special functions which such a community will want.

With such a many sided programme in prospect, it is disturbing that the fact-finding machinery is so hap hazard. Where would we be now, but for the Trojan work of the Nuffield Provincial Hospitals Trust and, at a more modest level, of the King Edward VII Hospitals Fund? But it is very wrong for Government to *depend* on voluntary agencies. There are three Government

bodies directly concerned in the Hospitals programme: the Ministry of Health, the Department of Health for Scotland and the University Grants Commission. Of these, the first two have belatedly set up architects' development groups, but on a scale which is so small that they can only scratch at the surface of the problem. With a programme in view which may well rise to the BMA's estimate of £75 million per annum, it would surely be worth while organizing a research programme which would be substantial enough to study not only the economics of building (important though this is) but the economics and technology of the whole range of hospital activities.

THE EDITORS.

introduction

It is agreed on all hands that we are at the beginning of a large hospital building programme. According to a report in *The Times* "the most critical factor in this programme . . . is the shortage of hospital architects." To overcome this shortage, the RIBA is holding a course for hospital architects next week* and this issue is the JOURNAL'S contribution to the same end.

It would have been pleasant if this contribution could have taken the form of providing data which would carry the reader a long way towards telling him how to design a hospital. Unfortunately, existing information on the subject does not permit any such treatment: for, despite the invaluable work of voluntary organizations such as the Nuffield Provincial Hospitals Trust and the King Edward VII Hospital Fund, hospital research and development are still at a comparatively early stage.

It would also have been pleasant if we could have given a fully homogeneous, comprehensive coverage of the subject; but the hospital, as a contributor points out, is no longer a single building "type" as this word is traditionally understood. Instead it is a compact of almost every kind of building known to man: there are the specifically medical departments, the wards and the clinics (and many kinds of each); but there are also laboratories, nurses' homes, the laundry, the pharmacy, the kitchens, the animal house and much else.

To add to the complexity of the subject many of these functions are taking on the industrial characteristics of sequence control and automation.

Unable to cope with all departments, we have in the main limited ourselves to those which are typical of the hospital (and, therefore, relatively unfamiliar to those used to other kinds of work) and about which something worthwhile can be said. We have called the issue "THE HOSPITAL BRIEF" rather than "Hospital Design," because we feel that the current state of knowledge does not go much further than this. The most pressing problem at this moment is to find out what exactly is wanted. Later, if things go well, we can show how it is to be supplied. Because of this emphasis on the brief, the greater part of the contributors are not architects but clients. Their contributions vary considerably according to their personal standpoint, to the amount of reasonably sure fact which is known about their subject and to the degree of acceptance which their views command among medical people. At one end of the scale Brigadier Welsh who writes on Central Sterilization can go so far as to give a typical layout, for Central Sterilization is now an accepted technique; prototype installations have been built in this country and much is known: at the other end of the scale is Professor Platt who writes on Catering, for on Hospital Catering the primary battle has still to be won. Professor Platt is, therefore, out to make a case for revolutionary proposals and not to show exactly how to design for them. In hospital design this question of reform is important, for in recent years our concept of the hospital has been radically changed by two key realizations; so radically, indeed, that views which do not take them into account are worse than useless.

The first of these realizations concerns the nature of the healing service. It has been pointed out that our present hospital arrangements—the number of beds, their location, their division as between different specialities—are largely based on history and on chance and do not reflect the real need. The point is well illustrated by the vexed question of the number of beds to be provided. Everyone since the war has been deeply impressed by our long waiting lists. These lists lead people to believe that a large additional number of hospital beds is wanted. Closer study, however, has shown that this is not necessarily so and that the chief reasons for long waiting lists are not that there are too few beds in all, but that they are in the wrong places and that many of them are being occupied by people (e.g. the very old) who could be better treated in some form of hostel accommodation if this were available. Again, the medical régime which prevails in the majority of our hospitals tends to keep patients too long in bed: a policy of "early ambulation," when applied, does much to reduce the length of waiting lists. But hospital beds are only one aspect. The key questions are the size and scope of the diagnostic and consultative services and how to make it possible for extensive research to be carried out within the hospital. The National Health Service has given us an opportunity to plan comprehensively, using the best medical techniques and its promise is not to be fulfilled by patching up the deficiencies of the existing piecemeal legacy.

The second realization concerns the economic standing of the hospital. The hospital service, if it is to use our medical knowledge to the full (and it is inconceivable that our society should permit it to do less), is inherently expensive. J. K. Johnston in his article points out that the annual cost of running a hospital amounts to about one-sixth of the first cost. The idea of a hospital which we have inherited is an idea formed at a time when all kinds of hospital labour was relatively cheap and when, in consequence, the first cost of the building was relatively more important and had to be kept low. Today it is quite the other way. In the total cost of the hospital service, the first cost of the building is a relatively unimportant item. This has a double bearing: in the first place, it provides an overwhelming case for rebuilding virtually all our hospitals, since, by doing so, we can, over the years, show savings in staffing which would far offset the capital expenditure; and in the second place, as regards the individual hospital, it means that all labour-saving devices—the centralizing of services, pneumatic tubes, mechanical handling—must be examined at the start, since their use is likely to underlie all hospital planning.

The sixteen articles which form this issue are studies in their own right with no necessary connection with one another. Readers may, however, notice that a high proportion of the contributors live in Scotland. In fact, nearly all have been concerned with the formulation of the brief

* A further course is to be held by the Nuffield Foundation in Oxford in the autumn.

INTRODUCTION (continued)
for one particular hospital, Ninewells Hospital, Dundee (architects: Robert Matthew and Johnson Marshall). They have been concerned either on the client side or as consultants or as people with special experience whose assistance has been sought. This association in a common project gives a certain natural cohesiveness to the whole and this has been reinforced by the fact that one of the contributors, Alan Wightman, the architect charged with preparing the brief for Ninewells, has helped with editing the issue. Indeed, without his help this special issue would not have been possible.
It is, we feel, right that the issue should be centred round a Scottish example for, in hospital building, Scotland is a few jumps ahead of England. The Nuffield Foundation's first ward unit was built at Gourock (architect: Richard Llewelyn Davies) and the first new hospital to be completed incorporating these principles of ward design was the Vale of Leven Hospital, Dunbartonshire (architects: Keppie and Henderson). There is, therefore, in Scotland, some practical experience of ideas which in England are still only being discussed.

THE HOSPITAL AS A WHOLE

the hospital function

PROF. THOMAS McKEOWN

The idea of a hospital, such as it has been handed down to us, owes its form as much to history as to the functions it serves. Criticising this form, Thomas McKeown, Professor of Social Medicine at Birmingham University, points out that the traditional division of hospitals into acute, mental, and chronic, results in the mixing of patients with different needs, in unnecessary staffing difficulties and in the duplication of facilities. He also criticises our current concept of healing for its isolating the hospital from the home, for its tendency to let the hospital take over services better provided by the general practitioner and for its separation of curative and preventive medicine. To correct these faults he proposes a concept of the hospital community based on an accurate assessment of needs, on continuity between home and hospital and on close co-operation between general practitioner and consultant. Such a concept, he maintains, must convert the hospital from being the vast institutional building that we know into a complex of smaller buildings preserving the human scale and a domestic atmosphere.

It is not the fault of the architect if hospital planning has developed within a fairly rigid framework. Inevitably he has accepted the conventional view of the role of the hospital, which is based on tradition and apparently endorsed by contemporary medical opinion. The purpose of this article is to show that the traditional concept is quite unsatisfactory and to suggest ways in which it should be modified. Since the main grounds for this view are that the present hospital system cannot provide for the needs of all patients, the changes must be initiated by medical people. But for the realization of the possibilities which removal of traditional restrictions will permit, we must rely upon the architect.
The central issue can be stated simply. Hitherto the hospital has been conceived as a single building providing a full range of services for selected classes of patients. Research and planning have therefore been focused on subjects such as ward lay-out, central services and economic size. However, the most intractable problems confronting hospitals cannot be solved by internal modifications. They are rooted in the separation of acute, mental and chronic hospitals from one another, and in the relative isolation of hospital from domiciliary services. A solution will require removal of the traditional divisions between the major classes of hospitals and a new and more intimate association between hospital and community. Let us now consider the reasons for these views.

The Relationship between Hospitals
A well-established feature of the hospital tradition is the separation of acute, mental and chronic hospitals. These three types are usually on different sites, and when they are on a common site are separately staffed and administered. This sub-division does not correspond to the medical, nursing and social needs of patients, and is wholly attributable to historical circumstances.
The three major classes of patients originated at different times and as different problems. The object of the asylums was originally to protect the community from the supposed risks of the insane, and the methods adopted for this purpose were penal in character. The object of the Poor Law Authorities was to make admission to an institution a condition of public assistance, and the foundation of hospitals for the chronic sick was an un-looked for complication of their decision to house the destitute. Until recently it was only in the general hospitals, which inherited the tradition of the voluntary hospitals, that investigation and treatment of disease were recognized as the primary object of institutional care. As a result of these circumstances the three systems were usually established on different sites and were financed, administered and staffed separately.
The first disadvantage of separate hospitals is mixing of

patients with different needs. Since segregation was not based on medical assessment, patients in each of the three classes of hospital were heterogeneous in respect of need. Those in chronic sick hospitals—the mentally defective, the psychotic, the senile, the infirm, the venereally infected and the chronic sick of all ages—had in common only the fact that they were destitute. Those in mental hospitals exhibited the full range of mental and physical illness. And even in general hospitals isolation from other facilities frequently forced retention of patients not in need of hospital care, who were admitted, or retained after investigation and treatment, primarily for social reasons.

Since 1948, when all hospitals were placed under the same authority, there has been some improvement, particularly in hospitals for the chronic sick. But the mixing of patients with different needs continues, and is indeed unavoidable under the traditional partition which has been retained in the National Health Service.

Recently the needs of all Birmingham patients in hospital were assessed, and the Table shows their distribution between four classes:

(1) Those needing the full resources of a modern hospital—skilled nursing, laboratory investigation, surgery, etc.

(2) Those needing limited hospital facilities, essentially simple nursing care without mental supervision, because of physical illness.

(3) Those needing limited hospital facilities, essentially supervision and training, because of mental illness.

(4) Those needing no hospital facilities and retained chiefly for social reasons.

Type of Hospital Facilities Needed by All Birmingham Hospital Patients

Hospital Group	*Total*	*Hospital facilities needed* *Full*	*Limited without mental supervision*	*Limited with mental supervision*	*None*
General and Special	100% (2,936)	96·8 (2,841)	1·6 (48)	0·5 (16)	1·1 (31)
Chronic sick	100% (1,338)	34·0 (455)	43·7 (585)	16·3 (218)	6·0 (80)
Mental	100% (3,555)	12·9 (459)	1·7 (59)	73·0 (2,596)	12·4 (441)
Total	100% (7,829)	48·0 (3,755)	8·8 (692)	36·1 (2,830)	7·1 (552)

This classification is based upon an appraisal of the needs of each patient by the physician responsible for his care. The Table shows that there are still substantial numbers of patients in chronic hospitals who need the facilities of acute or mental hospitals, and in mental hospitals who need the facilities of acute or chronic hospitals. Those in acute hospitals are more homogeneous in respect of need.

The second disadvantage of separate hospitals is the difficulty of staffing. Under present circumstances it is impossible to attract enough doctors and nurses to mental and chronic hospitals, whose services are in consequence far below the standard expected in acute hospitals. So long as the hospitals are isolated they must depend on recruitment of staff prepared to devote themselves exclusively to these services and the difficulties will remain. They can be overcome only by placing the hospitals close enough to the acute hospitals to make it possible for the same staff to serve both. This view rests on the belief that most doctors and nurses would be prepared to make a contribution to the care of the mentally ill and chronic sick, particularly if this obligation were acquired naturally in the course of training. They will not do so if it means cutting themselves off from their main interests.

The third disadvantage is the artificial division into acute and chronic. Today's distribution of services gives the impression that patients fall naturally into two classes according to whether they need short term or long term care. This results from the fact that within a few weeks of admission patients in general hospitals are expected to die, to get better or to get out, whereas duration of stay in mental and chronic hospitals is often unnecessarily prolonged because of inadequate services. It is not possible to say what the distribution of patients would be in respect of duration of stay under adequate services, but it is certain that it would be much less conspicuously bimodal than it is today.

A further disadvantage is lack of flexibility. Divided hospitals cannot respond readily to changes in the size and character of the institutional population. For example the isolation of hospitals for tuberculosis and other infectious diseases has made it much more difficult to transfer staff and buildings to alternative use when they are no longer required for their original purpose.

Lastly, independent hospitals must provide a full range of services. Hence it is not possible to economize by pooling resources or to vary the design and equipment of buildings to make them complementary to one another.

Hospital and Community

There are three undesirable trends in the relationship between hospital and other medical services. They are towards: (*a*) isolation of hospital from domiciliary services; (*b*) provision of all curative services from hospitals or from clinics based on hospitals; and (*c*) separation of curative from preventive medicine.

In countries like ours doctors engage almost exclusively in either hospital or domiciliary work. This arrangement has many disadvantages, of which the most serious is perhaps that it restricts a logical development of services. In obstetrics, for example, there are good grounds for believing that the proportion of institutional deliveries should increase and the mean duration of stay in hospital should decrease. With separate administration and staffing of domiciliary and insitutional midwifery these developments are impeded. Similarly in the case of the mentally ill and aged sick, patients cannot be divided simply into institutional and domiciliary classes; they require a complex pattern of care which would cut across the traditional boundaries. Yet another disadvantage of separation is that doctors outside hospital tend to lose touch with the technical advances of medicine, whereas those inside, seeing only highly selected patients, may lose touch with reality.

A second significant trend, as yet more evident in Russia and the United States than in Great Britain, is towards provision of all curative services from hospitals or clinics based on hospitals. Where there is no link between domiciliary and institutional work, and where the means of investigation and treatment are located in hospitals, this trend is almost irresistible, and Fox* suggests that unless it is arrested general practice as we now know it will become extinct. If health depended mainly on a battery of technical procedures there might be little to regret in this change. As it does not there is a strong case for preservation of a personal medical service, and the conditions essential for its survival merit close scrutiny. Among other things it almost certainly requires continuation of some form of domiciliary medical practice.

The constitution of the World Health Organization states that the prevention and cure of disease should be one.

* Fox, T. F., *Lancet* (1960) i, 743.

THE HOSPITAL FUNCTION (continued)

Yet they have always been apart, and the trend in countries as different as Great Britain, the United States and Russia is unquestionably to keep them so. These two aspects of medicine are under separate local administrations and are almost invariably practised by different doctors and nurses. The tradition was established early in the century, when public responsibility was extended from environmental to personal health services, but was restricted to preventive procedures. This made prevention of disease a public charge, but left cure a private one. In Great Britain all services are now publicly financed, but preventive and curative medicine are still separate.

The disadvantages of this arrangement are self-evident. It is illogical to assign the preventive services for an individual—pregnant woman, pre-school or school child—to one doctor and the curative services to another. But perhaps the most serious feature of dual administration and staffing is that they make it very difficult to establish a far-sighted system of priorities. There are many diseases—chronic bronchitis is an excellent example—for which only preventive measures can provide a satisfactory solution. Yet in the choice between that which is urgent but relatively ineffective and that which is effective but less urgent preference is inevitably given to the immediate problem. If this awkward decision is forced on a common administration preventive medicine may receive the priority which it merits.

A balanced hospital community

Let us now summarize the main features which should characterize the hospital if it is to avoid the disadvantages referred to above. In order to distinguish it from the concept of a hospital centre which was current in the thirties—essentially a number of independent buildings on the same site—it is referred to as a balanced hospital community.

(1) All types of patients should be cared for on a common site in approximately the proportions in which they occur in the institutional population.

(2) The centre should consist of multiple buildings of varied size, design, equipment and permanence of structure, each adapted to the needs of the class of patients to be admitted.

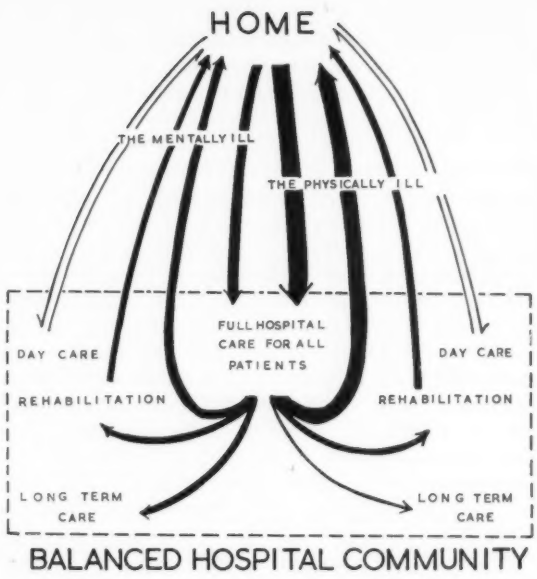
(3) Patients should be classified strictly according to their medical, nursing and other needs and placed in the unit most suitable for their care.

(4) Medical and nursing services should be provided by a common staff.

(5) The relationship of the hospital centre to the community around it should be much more intimate than hitherto.

The implementation of the first four proposals would result in elimination of two features of the hospital tradition: the segregation of patients according to criteria (acute, mental, chronic) which do not correspond to their medical needs; and the concept of the hospital as a single independent building providing a full range of services. The fifth proposal would lead to a new relationship between hospital and domiciliary medical services of which the essential features would be: (*a*) an important role for domiciliary practitioners within the hospitals and for consultants outside them; and (*b*) a close link, with a view to later amalgamation, between the curative services provided by hospitals and general practitioners and the preventive personal services provided by local authorities.

The diagram shows the organization of medical services at the centre. All, or nearly all, in-patients would enter the unit which provides full hospital facilities, and after



BALANCED HOSPITAL COMMUNITY

investigation and treatment most of them would return home. Some, however, although no longer in need of the full resources of the hospital, would require rehabilitation—using this term in the widest sense to include such activities as retraining and learning a new occupation as well as physiotherapy—after which they could return home. Another group of patients whose medical needs or social circumstances prohibited their discharge would need long-term care: washing, dressing, feeding, etc., in the case of the aged; or an organized community life in the case of the mentally-ill; or simple hostel facilities in the case of some patients who could be discharged if they had a suitable home. They might include patients working in the community while residing in hospital. Finally, there should be day-care of patients treated or cared for during the day while continuing to live at home. If this unit were not available almost all such patients would have to be admitted as in-patients.

The mentally-ill and physically-ill patients are shown separately in order to stress that both are fully catered for, and in spite of differences, have common needs.

The balanced hospital community and the architect

So far the changes in hospital organization have been recommended solely on functional grounds. Not the least of their attractions, however, is the opportunity which they offer to the architect for a much needed transformation in the appearance of hospitals.

The hospital is still a forbidding place, leading people to think that health depends primarily on treatment of the sick.

An interpretation of the reasons for the decline of mortality since the eighteenth century leads to quite a different conclusion. The marked improvement in health is attributable primarily, not to what happens when we are ill, but to the fact that we do not become ill. And the main reason why we do not become ill is because we live in a healthier environment. It is to environmental services, and the favourable trend in the standard of living, that we are largely indebted for our better health. Medical history, like common sense, suggests that in designing services we should seek to promote prevention of disease rather than its cure, domiciliary rather than institutional care, and, within the hospital, a wide range of activities of which complex investigation and treatment of established disease is only a part.

Against this background the hospital should find a more effective and a more modest place. A considerable part of its work should be directed through out-patient and day care towards making admission unnecessary, and by an intimate relationship to domiciliary practice towards making it possible to retain the personal character of the medical services which the predominance of the hospital now threatens. Services for in-patients should extend from highly technical procedures through a wide range of rehabilitation services to humane hotel keeping. Indeed, the only obligation which remains unchanged through all advances in medical knowledge and changes in the concept of public responsibility, is to care for the dying and to comfort the relatives of the dead.

If the hospital is to fulfil these multiple requirements a change in its appearance is essential. As conceived today it looks like a factory, which is indeed in some respects what it is. For acutely ill people brought in when they are unconscious and discharged almost as soon as they can walk this may not be a serious criticism. But for the substantial number of patients who are ambulant, and for those who must be trained to adapt their work and their lives to some degree of physical or mental impairment, the general character of the hospital scene is of first-rate importance.

This should be domestic rather than institutional. This change can be made by reducing the scale of buildings, by introducing variety of structure and design, and by separating hospital buildings by other amenities—shops, restaurants, amusements, etc.—at present conspicuously lacking. While, therefore, the case for multiple buildings rests primarily on functional grounds, they would give the architect the opportunity to apply town-planning principles to a problem with which hitherto he has been restricted to the possibilities of a single building.

the teaching of medicine

PROF. R. B. HUNTER

The " teaching hospital " is a complex of buildings in which two separate but related units, the medical school and the hospital, must be organised as a single whole. Discussing the planning problem which this raises, Professor R. B. Hunter, Dean of the Faculty of Medicine at the University of St. Andrews, warns against " embedding " the medical school so closely that change is inhibited. The primary source of anxiety is the Research Department of the Medical School for this is likely to grow in size and to undergo radical change in its requirements. Professor Hunter singles out other " growing points " in the hospital and describes some of the planning criteria to be met by such items as the radiology department, the library, and the animal house.

A hospital is an institution constructed for patient care and also in these modern days for clinical research. A medical school is primarily designed for the teaching of students, for clinical investigation and for laboratory research.

Two concepts have influenced medical school and hospital design in the last two decades. One is that the medical school, with its full-time staff, should be more closely associated with the university, and the other, that it is essential for clinical departments of medical schools to have their research resources and teaching facilities near the patients.

Strenuous efforts have been made in the United States and in Britain to put the main teaching hospital of the medical school on the university campus. This has on occasion had a serious effect on the hospital because it has been restricted by the special needs of the university and its comprehensive service to the community has thus taken second place. This is evident in many university hospitals in America, but in Britain the medical schools have to be linked closely with teaching hospitals run by the National Health Service.

The medical school has three main functions. Firstly, it has to train the student in the scientific basis of medicine, and for this requires laboratories and up-to-date teaching facilities. Secondly, the staff are responsible for introducing the student to the practice of medicine and are required under the regulations of the General Medical Council to ensure that their students achieve a certain competence in the practice of medicine before they graduate. This requires an introduction to all forms of modern clinical practice. Thirdly, the school requires facilities for postgraduate clinical and laboratory teaching and for research work on patients and on animals.

The second of these requirements is really most important, because the construction of a hospital to meet the needs of the medical faculty for research is endangering the carrying out of this responsibility. In the United Kingdom this is an academic point because, perhaps fortunately, the Health Departments decide on the content of the hospital, and they will not allow any teaching hospital construction which does not contribute directly to community care. The modern concept is to " embed " the medical school and the hospital in such a way as to ensure that all the complex requirements of both are met. The problem requires the highest degree of collaboration between the university staff and the regional hospital board or board of governors.

The first study by any planning group concerned with creating an " embedded " medical school and hospital is to pin-point areas in the medical school and in the hospital where growth and change are expected and which require special study. There is a very great temptation to do a tidy job by just fitting neatly together the demands of heads of departments in the school and hospital but in fact some of these demands may have to be strenuously resisted by the planning staff because the very neatness of the arrangement asked for is almost certainly ensuring difficulty for the future.

What then are the points of importance in design? First it should be realized that two communities are living together but at any one time only a proportion of the

THE TEACHING OF MEDICINE (continued)

members of either of these communities is going to work in or require access to the other. Nurses are not going to go into the medical school, medical students studying laboratory subjects should not have to traverse the hospital area, the laboratory research worker requires easy access to the library and to the animal house. It is also important that the patients and their relatives visiting the hospital do not inadvertently enter the medical school. What one means by this is that the circulation problem of the hospital and the medical school must be studied separately and made satisfactory for their primary purpose and then cross channels or circulation links must be created between the medical school departments and the hospital through which the various persons requiring access to the other can go.

The Growing Points of the Hospital

Even a superficial study of hospital design will indicate that the main circulation problems are created by centralized facilities. Unfortunately these are also the points where expansion is taking place. For example, the whole trend in hospital practice is to remove laboratory investigation of the patients from the side room of the ward which was adequate 20 years ago, to a central laboratory department; to remove the radiology of the patient which many years ago was done by each department to a central radiology department, and make these resources available not only to inpatients but to outpatients. Such central facilities are required potentially by all patients. To deny adequate circulation and expansion provision to these because medical school departments wish close association with the hospital is little short of disastrous.

Kitchen requirements have not increased to the same extent because one can control reasonably well the number of patients who have to be fed, but laundry requirements have increased and the provision of drugs, materials, dressings and all the complicated paraphernalia of modern therapeutics has given rise to greater needs and the inevitable expansion of central chemical and instrument stores.

The provision of central suites of operating theatres effectively decides the area where the wards of the professor of surgery must be in the hospital. To do this and still achieve the close association of the wards with the university department of surgery and that in turn with the other clinical departments will almost inevitably create a situation where a compromise solution has to be accepted.

The departments mentioned require to be in a central position in the complex of buildings because demands are being made on them by all the departments of the hospital. The radiology department is particularly difficult from the point of view of circulation because the patients have to go there in person.

The Relationship of University Clinical Departments to their Ward Units

In the past ten or fifteen years in Britain, with the growth of clinical research and in particular cardio-vascular and pulmonary dynamic studies of patients, it has been found convenient in many places to take over rooms or side wards in patient areas and to turn these into laboratories of the university department. Another trend has been to see special outpatients who are the subject of study, in the departments. This has led some to believe that the more closely you " embed " the university clinical department with its clinical charge the better.

It is important to distinguish, however, between the three functions of a clinical department. These are administration, patient investigation, and clinical research. The first two of these should be reasonably close to the wards, but the third should be as far away as possible. This makes for difficulty because the department must remain a single whole and because the costly serviced laboratories, to be economical, should be grouped with those of other clinical departments.

The answer seems to be to keep the department detached from the wards, but with easy access between the ward and the patient care section.

The Growing Points of the Medical School

Undergraduate teaching requirements are unlikely to demand a great expansion in the medical schools of this country during the foreseeable future. Medicine, unlike science, does not anticipate a greatly increased number of undergraduate medical students, so that this part of the medical school does not present too great a problem. In addition to the usual lecture halls, library and teaching laboratories, there should be a demonstration room on the ward in which teaching on an individual patient can be done with some privacy and without disturbance to other patients; thus the patient can be brought to the students and not vice versa. There should also be a tutorial room on the ward where the student can study case records, etc. The only new idea is that the student-teaching laboratories should be away from the clinical departments in a separate area of the school—and in an area which is closely linked with the library and the students' common room. It is very necessary to do this to prevent student traffic through research departments and also prevent student access to the hospital through the clinical departments.

University Research Facilities

The expanding areas of university medical schools in Britain at the present time result from the great increase in full-time research staff and in postgraduate teaching and research training. There is a worldwide trend to put more money into medical research, both clinical and laboratory, and university departments must be capable of the greatest degree of flexibility in expansion and redistribution of the facilities for doing research work. One of the problems of the " embedded " hospital and medical school is adequate provision for this expansion. It is made more difficult by the fact that money is easier to get for staff and equipment than building. How does one provide for this new building in an " embedded " school? There is only one answer, do not " embed " too closely! This is particularly so because laboratories of the clinical departments must be just as closely linked with their own specialized instrument rooms, cold room facilities and the like as they are with patient investigation facilities.

A modular design should make it possible to redistribute laboratory, instrument room, storage accommodation and office resources. Provision of adequate office accommodation in university departments employing full-time staffs is the type of facility which is underestimated and leads to the serious situation that working laboratory space is taken over as office space, and if instrument room facilities, storage facilities for equipment, particularly bulky items of equipment are underestimated, then again the vital laboratory space is unable to be used for its proper function because instruments are stored in a working area.

One of the most important decisions which has to be made in the medical school and central services area of the hospital is whether they are to be designed on the one- or two-corridor principle.

The latter assumes mechanical ventilation with tempered air or full air conditioning and probably offers the only way of accommodating the complex neatly and yet flexibly.

The Library

The medical school library is another expanding point and therefore the library itself must not be too closely linked with other medical school or hospital facilities but it must be in an area where expansion is possible. Its main connections are with the student area and full time university departments. I would have thought it wise to provide one or two stack rooms below the main library and on top of the library put some facilities such as a major lecture theatre which can be moved to another part of the complex of buildings without creating circulation problems.

Central Animal House

The first problem concerned with this is its location and there are two sites which have mainly been used. One is on the roof and the other the basement. All the evidence that I have collected would support the concept that the animal house should be in the basement or a separate building opening on to all floors in the research area of the school. This minimizes the risk of flooding damage. It also reduces the problem of taking animals to the animal house because a special entry in the basement or separate building can be used and vehicles carrying animals can be drawn up here away from any patient or student area.

To be satisfactory, the animal house must be fully air-conditioned. Without this, temperature changes in closed rooms will kill animals such as mice if there happen to be too many animals in the room. An animal area requires somewhere between 12 and 16 air changes per hour to provide adequate ventilation and keep down smell and if this is done by forced ventilation then all that happens is that great draughts of contaminated air go into other parts of the building where air changes may only be 6 or 8 per hour.

Another point is the staffing and administration of the animal house. It is desirable in a research centre that the whole range of animals is available to any research workers who may need them. A great deal of research time and money has been wasted in the past by people using new breeds of animals which they do not understand and getting some laboratory technician accustomed to looking after small animals to look after large animals about which he knows nothing. The care of animals and the bringing of them to the correct physical state for experimental work should be the responsibility of a permanent animal house staff headed by a graduate in veterinary medicine.

Departments, particularly experimental surgery, should have laboratories and operating rooms allocated to them in the animal house area and small animal rooms for feeding experiments given over to some particular departments when required.

the control of hospital infection

DR. T. SOMMERVILLE

Hospital infection which, until a few years ago, all imagined to have been permanently mastered by antibiotics, has re-emerged as a subject of special anxiety. In this paper Dr. T. Sommerville, Senior Lecturer in the Department of Bacteriology at Queen's College, St. Andrew's University, describes the nature and causes of hospital infection. Some of these causes, such as overcrowding and too much movement in the wards are of a kind which will be much reduced by good planning in the general sense, but others call for specific measures. In the last part of his paper Dr. Sommerville says what these are in respect of the operating theatre, the ward, the outpatients and the laundry.

The study of the history of the prevention of any communicable disease teaches that even after the principles of prevention have been clearly established on a scientific basis, there follow periods of success and periods of failure in the application of the principles of prevention. The periods of failure are usually associated with a lack of interest in the problem often because it is tacitly assumed that it has been solved. This principle of cyclical interest in preventive medicine is well illustrated by the varying attitude to the problem of hospital infection in the last fifteen years. The evidence from medical history suggests that the problem of hospital infection in ancient and mediaeval days was insignificant. This was probably largely due to the small size of the hospital in ancient and mediaeval times. Urbanization in the 18th century led to the building of a large number of general and special hospitals in the towns of Great Britain. The rapidity of increase of the population in the towns during the Industrial Revolution resulted in gross overcrowding of the wards of the hospitals and the direct outcome of the overcrowding was the occurrence of outbreaks of hospital infection notably puerperal sepsis and wound infection. The most important single factor causing outbreaks of hospital infection IS OVERCROWDING.

Antiseptic and Aseptic Techniques

The discovery of the germ theory of disease in the 19th century stimulated the development of the concept of antiseptic and later aseptic techniques in the prevention of hospital infection. The application of these techniques in surgery and midwifery in the last decade of the 19th century and in the period up to the 1939-45 War met with astounding success. It is commonplace to hear older surgeons say today " I don't remember that surgeons before the war had any bother with wounds going septic due to infection with staphylococci." This clinical impression can be accepted as factually true, and in my opinion there are a number of factors to account for the change in the frequency of wound infection in surgical wards since the war. Chief of these has been the assumption that the use of antibiotics had finally solved the problem of wound infection. This attitude of mind resulted in a lowering of the standards of aseptic techniques. This however is not the only explanation for the reappearance in hospital practice of outbreaks of wound infection. Another important factor in the situation is the increase in the turn-over of patients in hospital since the introduction of the Health Service.

THE CONTROL OF HOSPITAL INFECTION (continued)

This increase in turn-over of patients in hospital has all too often resulted in overcrowding in the wards. The failure of antibiotics to solve the general problem of hospital infection and the particular problem of wound infection has aroused special interest in the problem of cross infection during the last decade. This has stimulated a re-examination of hospital design, methods of disposal of excreta, sterilization techniques, ventilation systems, laundry methods and systems of food preparation.

Sources and Methods of Transfer of Hospital Infection

In all types of hospital infection in this country man himself is the source of infection either during the acute phase of the infection, during convalescence or as a chronic carrier of the causal agent of a disease. In tropical countries however in certain diseases the reservoir of infection is present in animals and the method of transmission is by insects.

Staphylococcal disease in hospital can manifest itself in a variety of clinical forms covering wound sepsis in the surgical wards, skin sepsis in new born babies, breast abcess in mothers, food poisoning in all types of wards and pneumonia in the medical wards. The germ staphylococcus is ubiquitous in the hospital. The sources of infection are either acute skin infections caused by the staphylococcus, and small boils on the hands of the staff are a particularly important source of infection, or chronic nasal carriers of the organism. The effect of the widespread use of antibiotics in hospitals has been the emergence of resistant staphylococci which have become colonised in the noses of the medical and nursing staff. The methods of transmission are:—

(*a*) by direct contact from the source of infection to the site of introduction of the germ in the patient, commonly skin or wound.

(*b*) indirect contact from the source to the hands of staff or instruments and so to the site of entry of the germ in the patient.

(*c*) by air transfer from the nose of the chronic carrier to the upper respiratory tract of the patient during coughing and sneezing;

and (*d*) by dust transfer from clothes, bedding, etc., to the susceptible patient.

In dysentery the source of infection is the patient who is either suffering from the disease in a mild or acute form or is convalescing from the disease. The method of spread is by indirect contact from the faeces of one patient who is infected with the specific germ of dysentery to the mouth of another patient who becomes infected and develops the disease. If, for example, bedpans are inadequately sterilized a patient may have his hands contaminated by the germ and subsequently contaminate his food or feeding utensils with the germ.

A serious type of puerperal sepsis is caused by a germ known as the streptococcus, which also is the cause of sore throat and scarlet fever. The source of infection in puerperal sepsis is often a member of the medical or nursing staff who may be either suffering from a mild sore throat or be a chronic carrier of the germ in his or her nose or throat. The method of transfer of the germ is either by indirect contact or by air or dust transfer.

To recapitulate and summarize the natural history of hospital infections in this country it can be stated:—

(*a*) that the source of infection is man

(*b*) that man can shed the germ to his environment without realizing that he is doing so, particularly if he is a chronic carrier

and (*c*) that transfer can occur from the source to a patient either by direct contact, indirect contact, air transfer or dust.

Principles of Prevention of Hospital Infection

There are three ways of preventing hospital infection: by controlling the sources, by controlling environment to prevent the transfer of causal agents of disease and by increasing the immunity of patients. Of these the first and the last hardly affect the architect and will not be considered here. The control of environment, however, is very much his concern. Methods of doing this include aseptic techniques in major and minor surgery to prevent direct and indirect contact spread of germs, efficient sterilization of instruments, etc., ventilation to prevent air spread of germs and the control over dust. The last of these is most important and is to be achieved mainly by reducing the nurses' movement to a minimum. Work study, therefore, not only makes the nurse's job easier, but reduces cross infection.

Principles of Sterilization

The aim of sterilization is to destroy all forms of bacterial life. Bacteria may exist either in a vegetative phase which is easily destroyed by heat and chemicals or a spore phase which is much more resistant. The time required for effective sterilization, therefore, is the time required in the sterilization procedure to ensure the complete destruction of all spores.

There have been two distinct trends in sterilization practice in hospitals in recent years, namely the centralization of sterilizing facilities and the introduction of automatic, high pre-vacuum, high-pressure sterilizers. Both these trends should be encouraged because of the aid which they give in the prevention of hospital infections. The generally accepted recommendation for the time period for sterilization in these new types of sterilizer is 3 minutes at 274°F. and 15 minutes at 250°F. It is important to stress however that before a new sterilizer is brought into use it should be subjected to test for efficiency by the bacteriologist, and the time period of sterilization established for each sterilizer.

Application of Principles of Prevention of Hospital Infection to Subdivisions of the Hospital

It is not the aim in this section of the essay to discuss the detailed planning of the different subdivisions of a general hospital from the point of view of the prevention of hospital infection but rather to define policy decisions which will inevitably determine the detailed design of the different sections of the hospital. It must however be emphasized at the outset that it is the attention to detail which will determine the success or failure of a scheme in relation to the prevention of hospital infection. Limitations of space have determined the didactic approach to presentation.

(*a*) *Operating Theatre Suites*

(i) dressings, towels and gowns to be supplied by the central sterile supply department

(ii) sterile syringes to be supplied by the central sterile syringe service

(iii) sterile fluids to be supplied by the central pharmacy

(iv) instruments to be sterilized in a modern pre-vacuum high-pressure sterilizer in a room adjacent to each theatre

(v) a system of ventilation in which two zones exist, a "clean" zone under positive pressure and a "dirty" zone

in which the patient is prepared for operation and in which he is placed on a trolley and taken to the anaesthetic room in the "clean" zone
and (vi) a system of air ventilation in which filtered air is circulated throughout each operating theatre in the suite.†

(*b*) *Wards*
It is necessary to provide in the ward unit:—
(i) single rooms for the isolation of suspected cases of hospital infection in which barrier nursing can be conducted
(ii) a treatment room in which wounds can be dressed, and minor medical procedures can be conducted. The requirements of this room are virtually those of a small operating theatre
and (iii) a dirty utility room in which dressings, and soiled and "foul" linen can be collected for removal. No sluicing should be carried out in the wards as this is responsible for the dissemination into the air of enormous numbers of potentially pathogenic bacteria.

(*c*) *Outpatient Department*
From the point of view of the prevention of hospital infection the essential requirement in the outpatient department is the avoidance of congestion and overcrowding. The achievement of this aim depends on a well-organized system of traffic flow aided by an appointments system.

(*d*) *Laundry*
A desirable aim in the organization of the laundry is the avoidance of contamination of the washed items after the completion of the washing process. This is largely an organizational problem in which separate staff should be employed for the handling of clean and dirty items of linen and clothing. This is taken up in the article on the laundry.

Application of Principles of Prevention of Hospital Infection to Special Problems
Food preparation and excreta disposal call for special mention in connection with the control of hospital infection. Outbreaks of food poisoning are all too common in hospitals. The principles and methods of prevention of food poisoning which have been defined for industrial canteens, etc., are equally applicable to hospital kitchens. Special attention should be given by the architect to the access to facilities for hand washing.
The disposal of excreta from bed pans is a problem which has not yet been satisfactorily solved. The position is so unsatisfactory at present that it may emphasize the need for new ideas if I leave the question open in the hope that it may stimulate a study of the problem by minds fresh to it.

Special Problems of Hospital Design in the Tropics
All the comments that have been made so far on hospital infection are equally applicable to hospitals in the tropics, but in addition consideration would have to be given to the problem of diseases transmitted by insects such as mosquitoes. Mosquito transmitted diseases include not only malaria which in many countries is now adequately controlled but also a whole welter of short-term fevers such as dengue and sandfly fever. The methods of control in so far as they involve the architect include screening and the use of contact insecticides such as D.D.T. This latter method of control would necessitate the consideration of the types of finish which would be used for walls and floors.

General Conclusions
The problem of the control and prevention of hospital infections has been greatly hampered by poor hospital design. Good hospital design will not by itself solve the problem but it will do much to aid in its solution. The aim of this general essay is to stimulate ideas which when analysed must be translated into good functional design. In preventive medicine, and hospital architecture is now a branch of preventive medicine, attention to detail is all important.

† This is also discussed by Professor Douglas. See page 32.

the influence of administrative costs on design

J. K. JOHNSTON

Over the life of the hospital building, running costs will exceed first cost by many times. This fact is of great influence in the hospital brief, justifying an exceptional initial outlay to effect long term saving. Considering this aspect, J. K. Johnston, Deputy Secretary to the Scottish Eastern Regional Hospital Board, discusses the reduction of the work effort by planning based on work study and by the use of mechanisation; the reduction in staff and equipment made possible by the centralisation of specialised services, and by equipment designed to spread the work load.

Productivity and efficiency are the keynotes of modern industrial enterprise, and they have a major influence on the design of new industrial undertakings, if they do not entirely determine it. Although the analogy is not complete, similar principles apply to hospital planning. The industrial undertaking must keep its costs of production low enough to permit the manufacture of a marketable commodity at a competitive price; it is at least as important to hospital authorities and to the community as a whole that the running costs of hospitals should be kept as low as may be consistent with the provision of a satisfactory service to the patient. This must be one of the prime objectives in new hospital planning.
A new teaching hospital costing say, £6 million to build, might require as much as £1 million a year in running costs at present rates of expenditure; every six years the hospital would use up as much money as it cost to provide it—a most unusual relationship between capital and recurrent costs. Of these recurrent costs, between 60 per cent. and 65 per cent. would go on salaries and wages of staff alone. Almost certainly this vast sum is higher than it need be, for it is based on the use of staff in buildings that generally were not designed for present day functions or conditions of work—most were undoubtedly designed and built as hospitals, but in days when labour of all kinds was cheap and when some of the resources now available to the doctor and the nurse for the treatment and care of patients did not exist. It is probably in the field of staff

ADMINISTRATIVE COSTS (continued)

employment that intelligent planning can assist most significantly in saving recurrent costs.

If this objective is to be achieved, the first step in the detailed planning of a new hospital must be a study of the intended functions of the hospital for the purpose of securing the maximum degree of co-ordination between the functions and the most efficient system of work for each. In such a study the possibility should be examined in relation to each activity of:

(*a*) reducing the effort or man hours required for it, to the extent of eliminating the activity altogether, if that should prove possible;

(*b*) combining or centralizing it with other like activities;

(*c*) spreading the work load to prevent peak demands.

These classifications are not mutually exclusive, nor do they form a completely exhaustive list; they provide a useful framework for this article, but within its limits it is possible to look at the implications of only the first group in any detail.

Reduction of Effort

The reduction of the man hours required for any activity may often require an increase in the initial capital cost of the scheme, but this need not always be so. For example, it costs £600 a year, in round figures, to man an entrance to a hospital from 9 a.m. to 5 p.m., and about £2,500 to man it 24 hours a day. The figures themselves help to illustrate how desirable it is from the point of view of economy in running costs to have as few manned entrances to the hospital grounds and buildings as possible. Other considerations pull in the opposite direction; it is, for instance, undesirable that visitors to the hospital should enter it at the same place as casualties. Competing demands of this kind have to be reconciled, and a solution not immediately evident to the hospital administrator may well be provided by thoughtful architectural design.

Work Study

It is well known in industry that productivity can be increased by reorganizing work processes so that the amount of movement required of the workman is restricted to a minimum. There are some departments of the hospital, such as the laundry, where this lesson can be applied directly because the work processes involved are, with certain qualifications, precisely the same as those in the comparable industry. On the other hand, standards prescribed for some special clinical purpose may impose a need for greater movement than seems on general grounds to be necessary. The Cohen Committee in its report on cross infection in hospitals recommended that there should be 12 feet between bed centres in wards where the risk of cross infection was high, although seven to eight feet as a maximum had previously been considered adequate.

In general, however, so long as any prescribed medical standards are observed, the wards and departments should be designed internally so as to ensure that the staff in the performance of their duties throughout the day have to travel as short a distance as possible. It was formerly common practice for the service rooms in wards—ward kitchen, sluices, bathrooms, etc., to be situated at one end of the ward, or some at one end and some at the other. Ward units based on the findings of the Nuffield Investigation into Hospital Design have shown how the walking distance of nurses within the ward can be reduced by locating these rooms in a position central to the beds served. In some American hospitals the same result is achieved by a rather different architectural interpretation. This particular example is of the utmost importance because of the relative shortage of nursing staff which most hospitals will probably continue to experience, but there is room for investigation of the applicability of the same principle in other departments of the hospital. In the performance of their work hospital staff have to move about not only within their own department but between that department and others and, from the limited viewpoint of this article, the time they take in doing so costs money.

Where goods alone have to be moved there may, as suggested below, be other solutions, but where patients have to be transported or staff themselves must necessarily move between departments, the architect must seek to locate associated departments as close together as possible. This is not difficult where there is a simple association, *i.e.*, a relationship between only two departments, but almost invariably the association of departments within a hospital is complex, *i.e.*, an inter-relationship between several departments. The Radiodiagnostic Department serves all the wards—although some much more than others—the Out-Patient Department, the Casualty Department, and the Operating Theatre Suite. In the past, local radiology facilities have been provided in some of these departments, but recent developments in radiological equipment tend to emphasise the desirability of a single centralized service for the whole hospital. In such a case an assessment must be made of the volume and frequency of the traffic from the various user departments and of the relative urgency of the traffic when it occurs. The major consideration in selecting the location of the department must be the safety and comfort of the patient, which may depend among other things upon the speed with which the service can be provided, but, without prejudice to that principle, economy in the time spent by staff transporting or accompanying patients must also be taken into account.

Mechanization and Automation

The methods considered so far do not necessarily require more capital outlay. Where capital investment seems necessary to eliminate work, it is amply justified where a clear reduction in recurrent costs is obtained. It may also be justifiable if recurrent costs are not reduced, even if they are slightly increased, for account should be taken of the difficulty experienced by the hospital service in recruiting suitable labour in conditions of full employment. Over a period of twenty years, the employment of one adult male worker at the lowest rate of pay costs about £10,500. A system of mechanization that replaced only four such workers would be justifiable if the capital and running costs of the system over the same period were no higher than £42,000; and at this level of expenditure systems of mechanization or automation become practical possibilities.

This is a field of enterprise in which hospitals in Britain have been slow to follow the example of hospitals in Europe and the United States, and indeed of industry here and abroad. This apparent tardiness is in part, perhaps, due to conservatism, to an unwillingness to rely on the machine in a service so intensely personal as that provided by a hospital, but it is much more attributable to the difficulty of adapting existing buildings for systems of automation. In new hospitals the opportunity must not be lost of designing for automation wherever it can be shown to be reliable, economical and in all other respects suitable for hospital purposes. There are in fact many hospital functions for which standard systems of automa-

tion can be adapted and several for which special equipment has been or is being developed.

Where goods of any kind have to be moved, the use of conveyor belts and pneumatic tubes must receive consideration. For production departments such as the laundry and the kitchen, the potentialities of the conveyor belt system are obvious, both within the departments and for transport of goods to the user departments. It is, however, interesting to find from recent press reports that experiments are being undertaken at present into methods of sterilizing operating theatre instruments that involve the use of conveyor belts between the theatre and the sterilizing room. These experiments are concernd with the problem of wound infection in operating theatres rather than with economy in the use of labour, but they show that a system such as the conveyor belt, more readily associated with the factory than the hospital, may have applications in the medical field; and the experiments, if successful, could have a notable influence on the design of operating theatres in the future.

The pneumatic tube system, like the conveyor belt, may yield economies by transporting mechanically articles appropriate to its capacity that at present have to be transported by staff. Experience in the United States suggests that the principal distribution centres for such a system are likely to be the Central Records Department, the Radiology Department, the Pharmacy (for some of its supplies (and, possibly, the diagnostic laboratories. But apart from any economies in manpower obtained, one important consequence of a rapid despatch system such as this is that the central distribution departments need no longer be very close to their customer departments, at least for this purpose; they may still require to be close for other purposes, particularly if, like the Radiology Department, they receive patients, but in general it seems that the employment of the system may help to ease the competition for the central position on the hospital site claimed for so many departments.

Apart from mechanical systems such as these, a brief reference must also be made to automatic equipment now being developed, such as the auto analyser for use in biochemical laboratories. A machine of this kind can perform the work of several technicians: with the number of biochemical investigations continuing to increase, its effect on recurrent costs may be not so much as to reduce expenditure as to avoid or limit further increases, which is just as important; its effect on design may similarly be to avoid as great an increase in laboratory space as might otherwise have been necessary.

And finally in this section, surely there must be hospital purposes that could be served by the photo-electric cell? As things are, trolleys and beds are moved about the hospital by hand: doors are left open to facilitate their passage: ventilation and heat control are lost and, imperceptibly, costs are higher than they need be. The photo-electric cell, or some comparable contrivance, could solve this problem. Probably there are other less obvious problems for which it would provide an excellent solution.

Centralization of Functions

Centralization of functions is the sort of phrase that might be expected to fall easily from an administrator's lips: it savours of the neatness and tidiness dear to his heart! There are nevertheless sound practical reasons why in any new hospital, and indeed in existing hospitals where the opportunity to adapt occurs, the possibility of centralizing a variety of functions should be examined. The development of new aids in medical practice tends to be uncoordinated: a new device or procedure is sponsored in one department, adopted in another, and soon in several departments there are little sections of the same kind. Each may be using relatively expensive equipment, each anxious to have special staff to operate it, and all together costing more than they need and operating less efficiently than they might. Such a system cries out for centralization in the interests both of efficiency and cost.

Centralization, where it is practicable, facilitates:—

(*a*) the employment of skilled staff for the supervision of specialized processes and of intricate and expensive equipment;

(*b*) the provision of very expensive equipment or other facilities that no single unit could properly justify for its own purposes; and

(*c*) in general, the most efficient and economical use of capital investment in plant, services and space.

In return for these benefits it involves a surrender of authority, a readiness to share the service with other users. This is often the main stumbling block, and if it is to be overcome, the centralized service must be so organized as to assure all users that their reasonable requirements will be met efficiently and conveniently.

The Central Sterile Supply Department, about which Brigadier Welch has written elsewhere in this journal, is a typical example of a service centralized primarily in the interests of increased efficiency through improved supervision. In the new teaching hospital to be built at Ninewells, Dundee, a central sterile supply department is to be provided to serve that hospital, with 700 beds, and also a group of other hospitals in the vicinity with a total of 1,300 beds. This increases the recurrent costs directly incurred at Ninewells, but reduces the total recurrent costs that would be incurred for the combined group if sterile supply departments were provided in some of the other hospitals.

This kind of centralization in one hospital of a service provided for several others may be expected to extend in the future, not only in the scope of the services covered but possibly also in the area served. Group laundries are already fairly common, as are group stores for general hospital supplies; sterile supply departments are being planned in some regions to serve very considerable areas; and it is possible that catering services may be developed along similar lines. Services of this kind present an additional design problem—the location within the scheme of one or more disproportionately large units with ready access to a main road system.

Spreading the Work Load

There is room left for only a passing reference to this most intractable of hospital organization problems—the tendency for activity in many departments to be much higher at some periods of the day that at others, and for those periods in different departments to coincide; and the resultant tendency for accommodation, services and staff to be related to the peak demand rather than the average. When the peak recurs consistently about the same time it is reasonable to enquire whether means cannot be found to spread the work more evenly over the day.

Sometimes this is possible. In his article on "The Hospital Laundry" Mr. Lusk has shown how sequence control enables the laundry's steam requirements to be spread more evenly, with resultant economy in operational costs. An appointments system for out-patients is essentially a method of avoiding peak loads, with the merit that, properly organized, it provides greater comfort and convenience for that patient as well as some reduction in the amount of accommodation necessary.

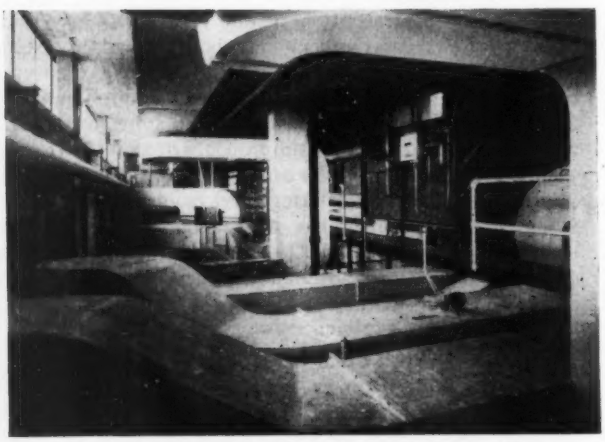
ADMINISTRATIVE COSTS (continued)

Sometimes it seems that nothing can be done. The midday meal is an essential feature of daily life, and it will always have to be served soon after midday; but one wonders whether it need necessarily always be prepared and cooked immediately beforehand. Developments in deep freezing and electronic cooking are bound ultimately to have an impact on hospital catering methods, unless it is shown that these developments have detrimental consequences on dietetic grounds. The ultimate effect could be to spread the work of the kitchen staff evenly over a normal day shift, regardless of the hours at which meals are served: the potential economies of such an arrangement are considerable.

In routine affairs, it is legitimate to look to the possibility of change to provide easier work, better service and lower costs, in the future if not now. But in all this it must ever be recognized that some things are beyond control: the relief of human suffering is subject to no time-table, the birth of a child to no working rule. The hospital exists only for purposes such as these, and above all else it is purposes such as these that must be served by the administrator's organization and the architect's design.

planning for services

SEAN MULCAHY



Services floor at Altnageloin Hospital, Londonderry.

The high cost of hospital staffing and exacting technical requirements have made the hospital one of the most elaborately serviced buildings of our time. Pointing out that their total cost can amount to between one-third and two-fifths of the whole, Sean Mulcahy of the firm of Steensen, Varming and Mulcahy, lists the points at which servicing is likely to influence plan and structure, discussing, as he does so, certain practical conclusions suggested by his firm's experience. He finishes by urging that on larger projects the structural and mechanical engineers and the architect should run a joint office.

Extent of Services

The importance of services in a modern hospital can best be emphasized by simply stating the cost, somewhere between one-third and two-fifths of the total. If building costs entailed in housing services are taken into account, the cost exceeds half the total.

By and large the function of services is primarily that of labour saving. Central heating saves the laborious firing and ash disposal of open fires, water distribution saves the labour of carrying buckets, telephones save the labour of messengers. Again, by and large, the major components of services can be broken into four common parts:

1. Source (boiler, storage, tank, fan, transformer).
2. Distribution (pipes, ducts, cables).
3. Outlet (heater, tap, socket).
4. Control (thermostat, damper, switch).

Space and Access

In themselves the design of services presents no great difficulty. This will seem strange to most building planners, who share one common conviction—that services are badly handled. The problem does not lie in calculating the right pipe size or material. It lies in establishing the users' requirements at outlets and controls, and in accommodating the source and distribution elements within the building in such a manner that maintenance and alterations can be carried out easily and tidily.

Apart from the great intensity of services within the modern hospital, three other factors have considerable bearing on the planning of the services:

1. The rapid changes in medical science, cost of labour and higher standards of amenity, all resulting in requests for additional services and outlets during the life of the building.
2. The hospital contains within it, every conceivable activity, industrial, commercial, residential, academic, each demanding appropriate services and, what is more difficult to achieve, appropriate control. The latter need calls for a very diverse distribution.
3. Because of the need for cleanliness, distribution of services must be enclosed and yet accessible for extension and maintenance.

The problem is one of space and access and the problem in planning is that of establishing the minimum space requirements at an early stage. It is here that the greatest misunderstanding arises between architects and engineers. At a relatively early stage of planning the architect can establish room dimensions and layout and expects the engineer to state the space requirements for services. On the other hand, the engineer can only accurately establish plant room sizes and duct space at the very completion of design, indeed, not even always then as manufacturers' plant dimensions vary and it is the practice to allow the contractors latitude in plant manufacture subject to performance not dimension.

Major central plant items such as boilers and transformers should if possible be housed in a separate building, the final dimensions of which should be established at a late stage of design and the construction of which should be easily capable of extension. Basement plant areas should be generous and the excess, if any, over plant requirements

can usefully be used for storage. Roof-top plant rooms should be of light construction readily expandable and independent of structure. Horizontal distribution by and large can be taken in the false ceilings of corridors and ancillary rooms, where head room can generally be less than in the main rooms which define the floor to floor heights. It is imperative that the structural engineer is aware of this flow of services distribution to ensure that the runs are not blocked by structural beams.

Vertical distribution presents the greatest difficulty as it interferes with room layouts. Late stage adjustments are difficult and they restrict future flexibility. If the corridor line can be established for both immediate and future use, it is extremely useful to allow a double skin wall with near continuous vertical way through the structural slab. The area not used for doorways and services can usefully be used for storage and equipment recesses.

The matter of space for services is so vital that it is worthwhile repeating that it is impossible to establish accurate minimum requirements at an early stage. It is disastrous to under provide and generally feasible to over provide in such a way that use can be made of the excess space, while it lasts. It may be of interest to consider the floor areas taken by services in the proposed stage 1 design for St. Thomas's, a 13-storey ward and laboratory block with low outpatient and theatre section. Total area 190,000 ft. sq., central plant 9,800 ft. sq., local plant 16,300 ft. sq., lifts 6,000 ft. sq., major ducts 2,500 ft. sq., minor ducts 1,700 ft. sq. Area taken by services very nearly 20 per cent. of the total.

Maintenance

The maintenance of services differs radically from building fabric which is primarily a surface matter, to do with cleaning, painting surface wear, generally evident and accessible. The service pipes, ducts and cables are subject rather more to internal ailments of corrosion, blockage, mechanical and thermal fatigue. Thoughtful design and preventive maintenance can do a lot to reduce the incidences of these ailments, but in most cases it is not practical to use materials which will not require replacement in the lifetime of the building structure and fabric. Unfortunately again, the answer is space. For maintenance, access is equally important and can save on duct space. Demountable ceilings are extremely useful and have been proved not to be bacteria-harbouring even when perforated. In this connection it is worthwhile considering a grid of vertical distribution ducts external to the building with external access. This system has been employed on laboratory buildings in Denmark.

Factors in Planning

In themselves services are very flexible and there are few restrictions on the manner in which pipes, ducts and cables can be run, provided access is available to them. The major exception is that of soils and wastes which have a very limited horizontal travel. This element more than any other will establish a grid of vertical distribution ducts and the degree of flexibility. Early co-operation between the engineers and architects on the layout of sanitary fittings can do a great deal to simplify plumbing and to relate the layout to the vertical distribution grid.

The influence of services on the issue of whether to build high or low can be summarized thus: though the horizontal runs occasioned by building low are more expensive the fact that lifts can be dispersed with more than off-sets the difference. Apart from this, building low greatly reduces the space needed for vertical distribution of services and as, at the same time, it makes it easier to locate new plant where it is wanted when functions change, it is generally considered preferable.

Internal Rooms—The use of internal rooms is perhaps the greatest factor in achieving a compact plan of a complex function and it is here that modern services make the greatest contribution to modern hospital design.

Modern high velocity ventilation systems can give satisfactory control, greatly reduce duct sizes, and strangely enough simplify eradication of noise in that the intense high pitched frequency of high velocity equipment is easier to deal with than the gentle low frequency rumble of low velocity equipment. Fluorescent lighting can substitute for daylight both in quality and cost in a manner in which tungsten lighting could not. It should be noted that the artificial daylighting of rooms must be to a higher intensity than night lighting in order to reduce the contrast between day lit and artificially lit rooms.

There is much to be said for the basic mechanical ventilation of wards particularly in urban situations or tall buildings where natural ventilation is attended by the evils of noise and draught. By employing a basic rate of perhaps two air changes, windows can be kept closed in winter and at night. Unless a very much higher ventilation rate and refrigeration is installed, it is imperative that windows be opened during summer or warm weather. One would hesitate at this time to recommend imposing a sealed ward on British patients and staff. Whereas for office buildings and schools the economies of double glazing are uncertain, for these sections of a hospital where heating is required 24 hours a day, as in wards, the case is very much stronger. Unfortunately the cost of double glazing varies so greatly with design and panel sizes that an individual assessment is required. The likely optimum solution is to keep opening sections to a minimum size in single glazing and fit double glazing to the fixed sections.

The importance of view and orientation in the acute hospital has been greatly exaggerated. It may be better to give the patients a view of the nurses' home or the central services intake, and to orientate the building to suit the function and the installations. Large glass areas should be avoided on the South-West aspect. Rooms relying fully on artificial ventilation should avoid glazing between the South-West and West aspects, and areas such as operating theatres and sterilizing rooms relying on artificial ventilation and where "wild heat" gain is a problem, should avoid glazing on all but the north elevation. The entire fabric, including the roof, should be highly insulated against solar heat gain. Reflective surfaces, ventilated cavities and roof water sprays are all helpful.

Lifts.—The modern hospital contains the many elements of ward treatment, para-clinical and clinical laboratories, research and teaching facilities and central service department, all seeking an intimate relationship with one another and resulting in an intensive and complicated traffic problem. The vertical compact building is a possible solution provided adequate lift services are installed.

Hospital lift traffic falls into four main categories:—

1. Patient traffic generally accompanied and transported on bed trolley or wheelchair.
2. Visitor traffic causing very high peaks at limited hours.
3. Supplies traffic, both clean and dirty, to and from central services.
4. Hospital personnel traffic which is continuous in all directions and at all times.

In general ward routine is such that patient traffic is

PLANNING FOR SERVICES (continued)

minimal during visiting hours and a lift installation capable of dealing satisfactorily with visiting peak traffic will cope with the patient traffic. This situation may not be valid in the future; as treatment intensifies and as the average patient stay reduces, the frequency of patient movement increases. On the other hand visiting hours are being lengthened and visiting peaks reduced.

With regard to service lifts an increased consciousness of cross infection and its implications tends towards the use of separate clean and dirty service lifts.

Insufficient vertical movement of hospital personnel comes in for universal criticism, possibly because medical staff are better placed than patients or visitors to lodge complaints. A recent analysis of personnel movement at St. Thomas's Hospital does show very intense traffic, so much so, that not withstanding the reduction of traffic anticipated by the use of pneumatic despatch and improved communications, the problem remains a very great one. It is quite impractical to consider using the visitor and patient lifts for the personnel traffic and a separate installation is necessary. The "paternoster" or repeating lift deals very competently with this type of traffic. Because of its slow speed of 80 ft. per minute, the total travel time in buildings exceeding 100 ft. may not be less than that with a good lift service, but the waiting time is virtually eradicated and so the irritation.

Because of the difficulty of anticipating traffic conditions in a tall complex building of changing function, the provision of an extra lift shaft capacity is very well worthwhile. Complaints of inadequate lift provision in tall hospitals prevail both in America and on the Continent and the installation of an additional lift after the completion of the building, where shaft space is not available is too appalling to risk.

Pneumatic Despatch.—Any service which can reduce traffic within the hospital is worthwhile examining. In this respect the application of a pneumatic despatch system to hospitals is relatively new but is already soundly established. The American manufacturers The Carrier Corporation, write of it:—

"It is considered that the tube system can be used in several ways for the conveying of:

1. Administration paper work.
2. Medical paper work, which may include (*a*) Bed cards, (*b*) confidential medical reports, (*c*) prescriptions, (*d*) instructions for special treatment, (*e*) emergency messages, *e.g.*, casualty to wards or records, (*f*) menu cards.
3. Articles of various kinds, such as (*a*) X-ray plates, (*b*) medical supplies, *e.g.*, pills, medicines and instruments, (*c*) patients' mail.

Many other items may be carried at the discretion of the hospital, the chief limitation, however, is the size of the carrier. The carriers can be padded to carry containers for dangerous or fragile goods, or liquids."

Three main points emerge from these recommendations:

1. Increased efficiency.
2. Security.
3. Economy.

With regard to the transport of drugs, the position in this country is not altogether clear as under present ruling an authorized person must always accompany dangerous drugs.

In a report on a 30-ward hospital, (number of beds not specified), Carrier estimated an annual saving of £28,000 in cost of wages and reduced losses. The capital cost is not given but is not likely to exceed £40,000. A reduction of two hours per day per nurse is claimed, which is a very major factor when nursing staff is scarce. Whether a reduction of waste nursing time would permit a larger ward unit under the control of the same staff is worth investigating.

Sources of Information

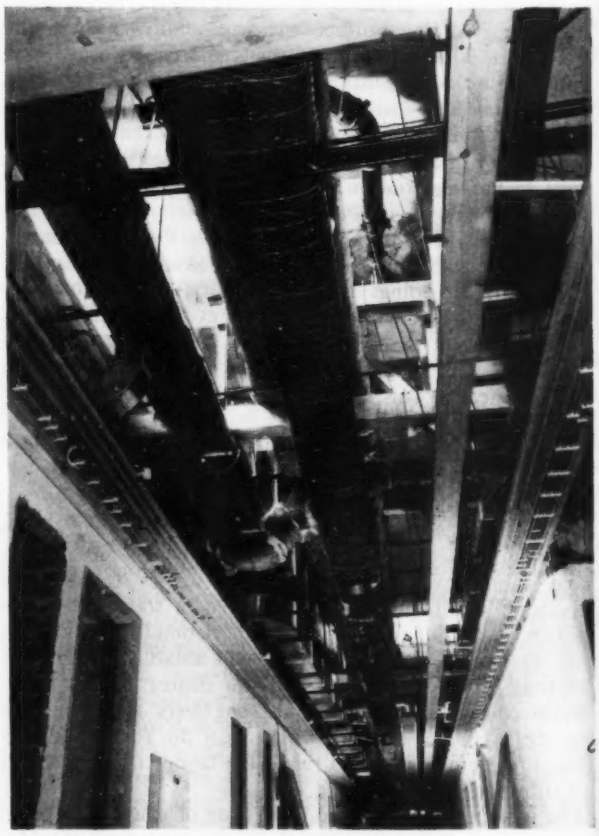
There is no shortage of references or papers dealing with the mathematics of design of services installations, but there is an acute shortage of reference to the techniques of enclosing such installations. The Nuffield Trust hospital planning investigation team worked without a services engineer and I believe greatly regretted this. The Foundation now in conjunction with Glasgow University have put two engineers to research on hospital services. It seems possible, however, that engineers without architects are even less likely than architects without engineers to integrate services structures and fabric.

Anyone who wishes to get an idea of plant spaces and services required in modern hospitals should read the account of Copenhagen County Hospital at Glostrup, published by Dansk Ingenior Forening International edition, May, 1959, written jointly by architects, structural engineers and services engineers.

Togetherness

It is imperative that the services engineer be in attendance during the briefing period. The requirements of services are too complex and far reaching to be transmitted indirectly.

Jorgen Varming in his Yerbury Foundation lecture last year spoke of the great advantages of a joint office containing architects, structural and services engineers where the size of the projects make it economical. Modern hospitals, because of their size offer this possibility and because of their complexity demand it, although in-



Corridor ceiling at Glostrup Hospital, Copenhagen.

adequate briefing may make the rate of planning uneconomically slow. On the matter of a joint office, because of the services engineers' prevailing but questionable habit of fostering within their organization specialist heating, plumbing, ventilating and electrical engineers, the rate of planning per annum must approach £500,000 in services or £1½ million in building. When services bills of quantities are taken off by the engineers—there is much to be said elsewhere in favour of this—the figures are nearer £350,000 and £1 million.

The engineers and architects can learn each others' views far better when working and living together. The engineer may realize early rather than late, whether the architect leans toward Corb, Mies or modified Nuffield (unfortunately there are as yet no Princes of services engineers, to help the architect identify his man) and can at the drawing board rather than in the finished building, hear and deal with the architect's plaintive epilogue, "that is not what I meant at all."

outpatients and visitors

DR. J. K. HUNTER

Few aspects of the hospital have undergone a greater change than that which relates to the outpatient and the visitor. This is partly due to a more considerate attitude towards the patient and the visiting public and, in the case of the outpatients department, to a redistribution of care within the National Health Service, leading to a diversion to the outpatients department of many patients who would formerly have been taken into the wards. The contributor of this article is Dr. J. K. Hunter, O.B.E., the Assistant Senior Medical Officer to the Eastern Regional Hospital Board, Dundee.

For those who have not been involved in the planning of a large out-patient department, it is important to realise from the start that such units present a pattern of considerable complexity. The volume of out-patient work undertaken at hospitals throughout the country is not fully appreciated by the general public. In Scotland, for example, some 2 million new attendances are recorded per annum; this number is approximately half the total population, and with re-attendances the total is more than trebled. While many very good and very active units exist, it is doubtful if any would be acknowledged, and few would be claimed to be incapable of improvement in design. This underlines the need for more detailed study of the functions to be discharged at these departments and the needs of those who attend for advice and treatment.

Possible Trends

Out-patient facilities form the "shop window" of hospital work and efficiency here is of vital importance to the service as a whole. Many have commented on the need for more effective liaison between the various branches of the National Health Service and in out-patient departments we have areas where links of the greatest value can be forged, particularly between the hospital and the general practitioner. With the steady improvement in diagnostic facilities there is a considerable increase in the number of patients who might be treated in their homes, with consultative advice either at the hospital or on a domiciliary basis. History may cheat the prophet but there are at present good grounds to suppose from both medical and economic angles that the flow of patients will be diverted inceasingly from expensive in-patient accommodation. Along with an expansion in consultative work for out-patients there will probably be a greater use of "day beds" which are often related to Casualty Departments as they are most frequently used for patients requiring minor operative procedures undertaken in a "Casualty" theatre.

Traffic Routes

The main entrance will be one of the busiest internal traffic areas of the hospital and while the design should be attractive, it must also assist the staff, particularly the porters and receptionists to perform their duties efficiently. The diagram on page 18 which is adapted from a preliminary study by the architect, indicates the type of traffic flow which is expected at the Ninewells Hospital, Dundee, and which will undoubtedly be similar at other large teaching hospitals. It also shows in broad outline the "administrative" and "medical zones" as discussed below.

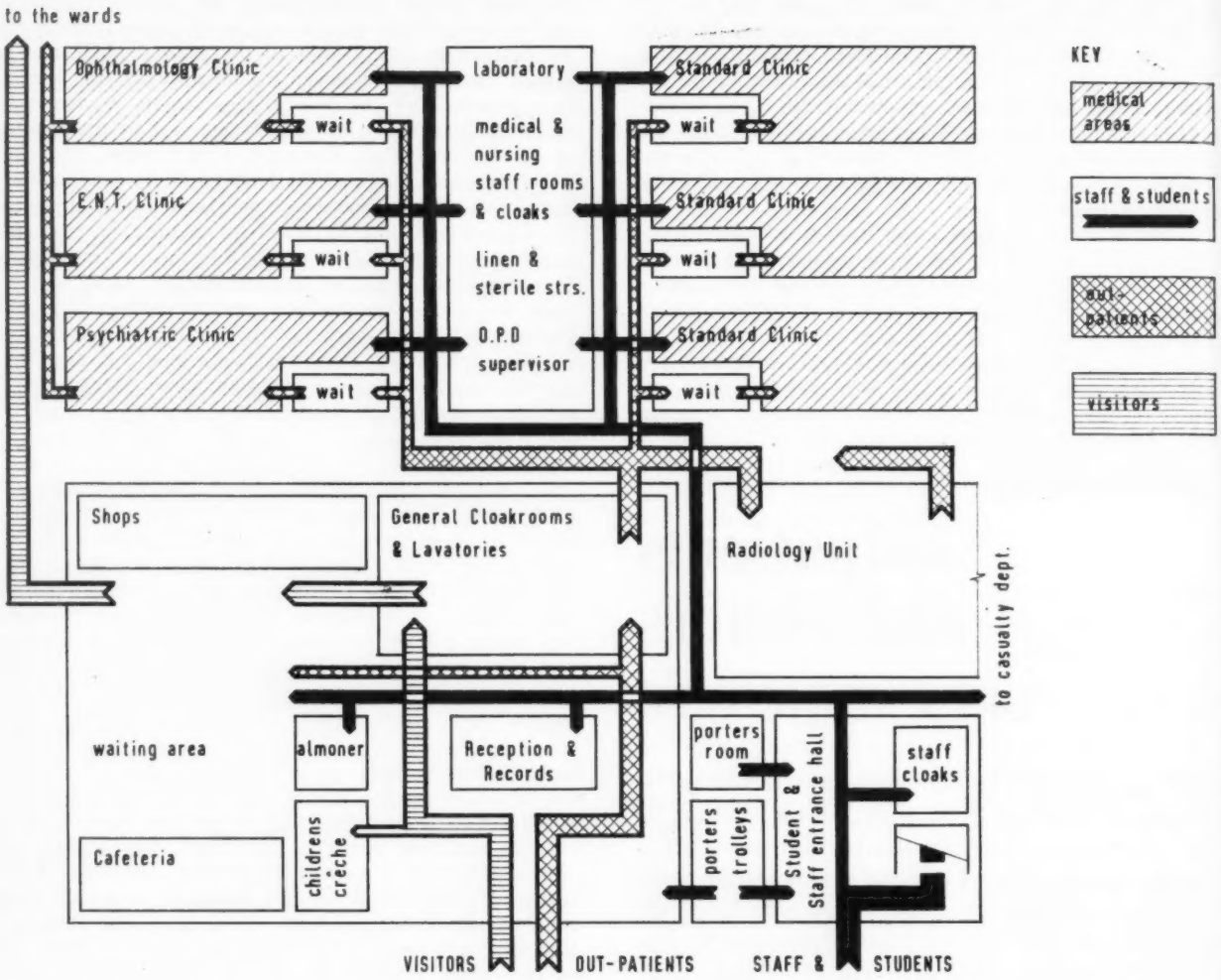
General Requirements

No firm conclusions on the complex aspects of design can be attempted in an article of this kind and, indeed, there can be no single blue-print for such units. It may be helpful, however, to look at the main requirements of the various groups involved—the patients, the staff and students, and also the visitors, and to give some examples from the preliminary work undertaken in the planning of the Ninewells Hospital.

The Patients' Needs

The first group to consider is undoubtedly the patients. There are various categories of these but they have certain requirements in common. They will arrive on foot, by private car, by ambulance and, possibly the majority, by public transport services. It is important that the entrance to the out-patient department is situated so that patients may move in comfort from public transport to the reception area. It should be realized that the vast majority are apprehensive and, while they will show their anxiety to a variable degree, their first impressions of the hospital are exceedingly important and should be as reassuring as possible. An air of calmness and efficiency is of the greatest value. The patients' objective is to be seen, investigated, advised, possibly treated, and to get out of the hospital as soon as possible. This assumes not only an efficient appointment system, but also a smooth progress from the reception area to the consulting room and a well-designed consulting suite. In addition, the patient may require some specialized examination and this can be a potent source of delay if provision has not been made for such patients to re-enter the traffic stream if this is necessary. General amenities are becoming more common. These are undoubtedly appreciated and may include, for example, a suitably staffed creche, a children's playroom, a snack counter, public telephones, and a limited range of shopping facilities.

There is little doubt that most patients dislike being



Ninewells Hospital, Dundee; out-patients and visitors circulation diagram.

" demonstrated " to large groups of students, but equally it is true that the majority of patients in teaching hospitals are most co-operative if numbers of students are small. It is probable that slightly more than half the patients attending an out-patient department such as Ninewells will be used for teaching purposes, but it is hoped that in the standard consulting suite no more than two students will accompany each consultant. There may be slightly larger numbers at some of the special clinics, but in no case do we expect more than six in any one group.

Staff and Students : Administrative and Medical Zones

It has been felt in the planning of Ninewells that distinction should be made, and have a physical expression in design, between the spheres of work of the records, receptionist and other " administrative " staff on the one hand, and those of the medical and nursing personnel engaged in clinical work, on the other. It is envisaged that the patient, on arrival at a consulting clinic, will be under the charge of " administrative " staff from the entrance to the unit up to and including the sub-waiting bays, which will be sited in direct relation to each consulting suite. Each bay of this kind will be served by a receptionist, a member of the central records staff, who will complete the registration of new patients, usher patients into the appropriate consulting room as their turn arrives, arrange for other examinations or appointments for the patients according to the consultant's instructions, and ensure that all documents and records obtained from the central records department are returned to it at the end of each clinic session, or as soon as possible thereafter. These duties will require that the reception bay will have internal and external telephone facilities and be connected directly by separate communication system with each consulting room in the suite. The reception bay will also require to have a pneumatic tube station.

The consultation suites will form the " medical " zone and in addition to the consultation and examination rooms, each standard suite will contain a treatment room with a sterile supply store, a clean linen room, a clinical laboratory for side-room testing, a dirty utility room and patients' toilets. The main requirements of the medical and nursing staff, and of the students are more firmly established and can be readily assessed. Certain points may be noted, however, on a negative basis. The consultant does not want to be overheard when talking to his patient or dictating his reports, to have to walk farther than is necessary during a consulting session, or to have to take bundles of documents away either to his ward or to his home to write or dictate the necessary letters and reports arising from the examinations performed at any individual clinic. Nursing staff do not want to undertake the duties of a receptionist or

clerkess. They do not want to run errands or to attempt to cope with patients in cramped accommodation. They are hampered by poor storage space for the linen and other materials they may use, an inadequate laboratory for side-room testing or deficient accommodation for collecting specimens. The medical student above all does not want to waste time. In a crowded curriculum he wishes to obtain the maximum advantage from the time he can spend in out-patient work. He does not, therefore, wish to see patients as one of a crowd of students. He does not want to be made to feel that he is merely tolerated or is in any way a nuisance.

With points of this kind in mind we visualize for Ninewells, that the consulting rooms will be grouped and that a standard suite will contain three consulting rooms each flanked by two examination rooms. These will be entered from a corridor leading from the sub-waiting bay and the area staffed by medical and nursing personnel will be private in character. The patients will be admitted initially to the consulting room and some who may not require to undress may be dealt with fully there. Others may be taken into an examination room by a student for further investigation, with or without undressing and the student will report his findings to the consultant for verification. For adaptability in use we envisage that adjacent examination rooms will have a communicating door so that in the case of need, one consulting room can be used in association with two, three and four examination rooms. It will be possible by this means to use any examination room by itself for both consultation and examination by one doctor, an alternative method which may be of value during non-teaching sessions, *e.g.* during vacations.

For the majority of patients, the consultant will require to write letters or reports to the general practitioner, hospital colleagues and others. For this purpose mechanical dictating facilities will be provided so that correspondence can be treated immediately after each patient has been seen, if the progress of the session permits, or at the consulant's preference, at the conclusion of each session.

The Number of Consulting Rooms

The assessment of the number of consulting rooms required in an out-patient department is a matter of the greatest importance. It must be assumed that each consulting room will be used adequately throughout the week, *e.g.*, for a three-hour session in the forenoon and afternoon of each day from Monday to Friday. This gives for any one room a potential of ten consulting sessions per week. To assess the actual number of consulting sessions required for each specialty, it is necessary to make an estimate of the number of new and return cases to be seen and of the probable duration of consultation for each type of case. For this purpose allowance must be made for the time taken in student teaching and for any foreseeable changes in the pattern of work. The work load can be estimated by an examination of the hospital and population records over a period of years. The assessment of consultation times is a somewhat arbitrary matter. Estimates for various types of clinic have been published. These are a useful guide and more detailed information should become available as soon as further surveys are being carried out by work study technique. It should be noted, of course, that the "consultation" time is only one factor affecting the time spent by the patient in the consulting suite. There is the dressing and undressing time, and a waiting period, or indeed more than one waiting period, before examination and during examination. This is overlaid to some extent by the effect of student teaching and whether consultation and examination is undertaken on a continuous or an interrupted basis. It is difficult to isolate the various elements involved, but it is important, nevertheless, to reach some assessment of the time required and to relate these to the number of consultants who may be available to work in any specialty at the same time and so to obtain the number of consulting room sessions for which provision is to be made.

It was found in our examination of the data relating to Ninewells Hospital that the number of consulting suites for the anticipated work load was smaller than might have been expected. The number brought out by calculations on the basis referred to above and covering medical and surgical clinics and allied special clinics, gynaecology, dermatology, medical paediatrics, ophthalmology, E.N.T. surgery and psychiatry, came to a total of six suites. Three of these are to be of a standard pattern and each will contain three consulting rooms. There will be three "special" suites containing a total of thirteen such rooms and these will be used for ophthalmology, E.N.T. surgery and psychiatry.

Other Features

There are many other features of an out-patient department which require examination at the planning stage: the amount of laboratory work to be undertaken during out-patient sessions with facilities for the taking and transport of specimens for study at the main laboratories; the relationship of the unit to the radiological department, the casualty department, specialized diagnostic facilities, such as E.C.G. The inclusion of a dental suite, facilities for clinical photography, the provision of staff changing rooms, the almoner's requirements and the general staff accommodation including that for a departmental sister are examples of questions which should be decided at as early a stage as possible.

Visitors

It is surprising how little work appears to have been published on the organization of general visiting, yet it seems essential to examine this question in the planning of any large hospital. In children's hospitals this matter has been the subject of examination and a more liberal attitude has emerged in recent years, but for adult patients the practice remains exceedingly restrictive in many hospitals.

The accommodation required by visitors is simple in character but very costly to provide if the traffic peaks are high. It includes waiting and cloakroom facilities and car parking space. These have a relationship to out-patient requirements and a common entrance is possible as neither group needs immediate patient care and both categories are generally mobile. In a recent count at one general hospital a total of over 1,500 visitors entered the hospital premises within an hour, a ratio of between three and four visitors per adult patient. Such peaks lead to situations which cannot be satisfactory to the visitor, to the patient, or to the hospital staff.

Experiments in less restricted or even unrestricted visiting in general wards have been recorded, particularly in the United States, and the majority appear to agree that ward routines are not as seriously affected as might have been feared. Conflicting views are expressed, however, and this is a matter which merits further study by all concerned if a generally acceptable regime is to be decided and if the necessary planning implications are to be met.

planning for growth and change

JOHN WEEKS

All concerned with the hospital programme are deeply impressed with the thought that requirements will change. Examining this aspect of hospital design, John Weeks of the Nuffield Department of Architectural Studies, points out that flexibility, if uncritically adopted, costs too much and tempts those concerned not to think out their problems in advance. He considers that, within broad limits, it is possible to gauge the nature and extent of future change and proposes that we give up our concept of planning as an exercise in finite geometry in favour of a concept based on an extendible communication pattern. In other words (to use his analogy) a duffle coat in place of a tailor made suit.

The word "flexibility" is used whenever the planning of hospitals is discussed. Everybody accepts the need for it and hospital planners endeavour to convince their clients that their plans embody such a measure of flexibility that future needs can easily be met. The word is used so much that it has become flaccid and it is worth while considering with some care its implications if it is not to be used simply to justify indecisive planning.

Flexibility has a time, as well as a space component, to its meaning. In hospitals it is necessary to provide for the absolute expansion, contraction or even disappearance of a whole department, this large scale movement taking place rarely, and as a result of a long time-scale trend. But within the large pattern it should be possible to adjust the building *immediately* so that it is susceptible to daily variations in routine without being taken apart.

One proposal is that all partitions between rooms should be demountable. Theoretically it is possible then, overnight completely to change the plan of a department by unfixing or unscrewing walls, moving them to new positions, pulling out washbasins, putting them into new positions and so on. This is not usually a viable solution. In the first place, it is amazing how adaptable work is to physical environment. Except in the case of certain specialised, almost mechanical operations, it is possible to carry on a large number of different routines in given rooms, and the call for major alteration is not therefore likely to come often. In the second place, although it is not difficult to design a partition which can be easily moved, it is remarkably difficult to design a plumbing system economically, which will enable sanitary equipment to be moved with the same ease as a light partition. Further, light demountable partitions are not notably good for sound insulation; they can be made so, but they then have to be heavy and such partitions are less easily moved.

In order to get maximum flexibility within a department it is necessary to provide rooms which fit around the activities which are to be carried on in them like a duffle coat. The duffle coat, provided by the Navy for its officers, was not a tailor-made garment. A few sizes were made and these were related to the known range of sizes of sailors so that it was usually possible to find one that would fit very reasonably, and keep the sailor quite snug. If this approach to planning is to be followed, it involves a good deal of study of the procedures which are to be housed. It is necessary to find what is the common denominator of space required for *various* routines. In an out-patient department, for example, a line of communicating rooms of the optimum size and suitably equipped, will be able to house many different clinics. Sometimes a clinic will have accommodation which is slightly too large. Sometimes a clinic may feel slightly pinched, but neither the degree of waste, nor the degree of pinch will, if the preliminary studies have been done correctly, significantly hinder the work of the department, and different clinicians will be able to work to a high level of efficiency. It would be possible on successive days for different sized clinics to be formed inside this continuous linear space, simply by opening or closing doors at various points along the line. Because the working space is continuous, it is very likely that, if there is not (and at present there is not) an absolute expansion of out-patient business, a department designed now will be able efficiently to serve its purpose for many years to come.

The principle of the continuity of space can also be applied to the design of wards. In the experimental ward plans designed by the Nuffield research teams the concept of the nurse team was used as the basic organisational element on which to build up the plans. In the Northern Ireland ward unit the number of beds nursed by one team is ten. On each floor of this ward block there are four such units under one sister. But a ward need not necessarily always consist of the same number of beds. A ward floor might accommodate a number of nursing units, physically planned in continuity and, as in the out-patient department, capable of assembly into major units of many different sizes. The basic unit is the number of patients which one team can adequately nurse. The ward floor would accommodate perhaps sixty to eighty beds, grouped in these nursing units; then if the number of patients in any speciality increases, it is not necessary to clear another whole ward, but perfectly possible to increase the number of beds by one extra nursing unit only, which may be added complete with its own sub-ancilliary rooms.

The satisfactory running of a ward floor planned on these lines is made possible by using a central supply system, resulting in a great reduction of ward inventories. Supply trolleys allocated to a sister daily, take the place of ward store cupboards, and the system is as flexible to her needs as the number of beds are to the fluctuating medical needs.

Planning for continuous adjustability has implications when the provision of services—water, electricity, drainage—in some of the hospital departments is considered. Out-patient departments, operating theatres and other areas which are intensively serviced, might be placed on top of services floors of the same area as the departments, in place of the narrow ducts usually provided. It would be possible then to make new branch connections to the main services and provide risers to equipment at any point in the

The entrance to Swindon Hospital: Architects Powell and Moya.

floor above, according to changing needs. Such changes could not be done overnight but they could be done much more easily than at present, with no interference with routine work. It is not necessary to provide in the first instance all the service points which would ever, under any circumstances, be needed, but simply to provide for the introduction of new equipment when it is seriously required, without having to dig fresh tunnels under the ground or to put pipes on the surface of the walls inside buildings.

A system such as this has been proposed by Chamberlin, Powell & Bon in their Leeds University report. Their suggestion is to build those parts of the hospital needing flexibility over a car park. Running under its ceiling are the main hospital services supplying the whole area of the building above, and instantly accessible. Until the space needs of a hospital become absolutely different rather than relatively different in adjacent departments, it is unnecessary to extend it or demolish parts of it. The "duffle coat" principle of planning can be applied where changes are necessary during the working life of a department of a fixed size, but when absolute expansion is required, the "duffle coat" will no longer serve. It is during this stage that hospitals as we know them have acquired their characteristic formlessness. Over the years there have been additions and fillings-in on hospital sites everywhere, almost always on the basis of expediency, and not according to any prearranged system. New hospitals have often been designed on an over simplified block system, bearing only a symbolic relation to the real requirements. The Bürgerspital in Basle—the prototype for much hospital planning—reveals this system very clearly. All the patients' rooms are in a long multi-storey block, as many as possible facing south. Behind this is another block, not quite so high, and in this are all the other departments of the hospital, planned with great ingenuity so that they can easily communicate horizontally to appropriate floors in the ward block. They are inflexibly corseted by each other. This method of planning is workable only so long as the accommodation has been correctly estimated and the departments do not alter in their total volume or their relationship, one to another. The pre-eminent need is for a system of planning which will allow for growth of an unforeseeable volume while still maintaining comprehensible form.

A hospital of say 500 beds is a large building and houses many people; the scale of the community is that of a small town. Small towns and villages were always visually comprehensible because they grew round a nucleus—*the* green, *the* church, *the* shopping street—which is at once recognisable even to a stranger. The first stage of the Princess Margaret Hospital at Swindon by Powell and Moya (consultant architect, Richard Llewellyn Davies) is built on either side of an entrance hall which spatially links the whole complex, horizontally and vertically. It reveals the dimensions of the building to the visitor at once; all main hospital streets start from it, and there is therefore no difficulty in directing patients to the appropriate department. Many hospitals on the other hand, are a directionless rabbit warren of corridors; blank walls give no clue to what lies beyond; lifts have their doors on upper floors on the side opposite their doors on the entrance floor; there is a lot of building buried like an iceberg out of sight of the approaching visitor: there are people working in obscure corners who reach their department by a secret route. Nobody ever sees them, except at lunch. When this is happening on a large scale, the sense of community begins to break down. A comprehensible building does not simply help to prevent distress to patients, it affects the functioning of a hospital as a social organism.

In hospitals, the added problem is that they are changing all the time. The scheme which I have outlined for continuous adjustment of various departments can lead to utter confusion unless this adjustment takes place within a fairly rigid framework of communications.

Finite geometric planning of hospitals is as irrelevent a planning method as finite geometric planning of cities; an extendable communication pattern must be the basis of the plan. In a growing, changing hospital, it is the communication pattern which can tie the whole together, maintaining its pattern, in spite of extension and shifting of the parts within the whole. The communication pattern should be designed at the outset in such a way that it can grow from a nucleus, which remains identifiable, and while the pattern grows, the whole complex retains its original direction and form, and remains understandable.

It must be known before planning begins which are going to be the important communication paths, which departments are going to do the most business together, and how this business can best be conducted; whether juxtaposition is essential, or whether the mechanical and electronic means which we have now at our disposal will serve as well.

The enormous and as yet unsolved problem of hospital design is how the architect may maintain control in a

GROWTH AND CHANGE (continued)

building which is so large that his responsibility for detailed design must be delegated through his office and where the requirements of the client are so precisely definable and paramount. The number of design decisions per square yard of building in a hospital is comparable to that in a private house. In a hospital, as in a house, the client has an intimate relationship with every space, every piece of equipment, every piece of furniture. He lives with and touches them. As in a house there is little repetition. The only department which may be repeated is the ward unit and even here precise repetition is seldom possible throughout. In the out-patient department, in one room, the consulting room for example, not only must the size and shape be right, but the consultant will be continuously inconvenienced if the wash basin and the taps are the wrong type, fixed at the wrong height or in the wrong position; if the soap dispenser clogs; if a shelf for fresh towels is not provided; if a hook for patients' coats is at the wrong height; if his patient is insecure because of the lack of privacy due to window design, if partitions are too light to give adequate sound reduction between rooms; if he is unable to get chairs for himself, his patient and a relative conveniently arranged in relation to the door so that he may see the patient coming in, and to the window so that he may see the colour in the patient's face; if there is no place where he may conveniently plug in his tape recorder; if the curtain round the patient's couch encloses an area too small for him to move freely around the couch; if there are ledges above eye level which collect dust, which, while out of sight, cannot ever be, bacteriologically speaking, out of mind.

None of these mistakes must occur. Hospital planning is not a joke, nor is it to be solved by narrow aesthetic decision. Every room in the hospital needs correct decisive planning. Given the chance, those who work in individual departments will guide the architect into taking correct decisions in details, though the overall planning considerations may be beyond them as they are too enmeshed in local circumstances. Yet if all decisions at the level of the outstretched arm are taken on an *ad hoc* basis, no system will be apparent and the prime purpose of the architect's control, which is to reveal order and render calm, will have been sabotaged. The architect must produce a system of space development relevent to the planning needs and correct in the scale of building; devise a method for ordered small scale decision-making within an overall design system, and refrain from the arrogant denial of function through private delight in form.

the organisation of central sterile supply departments

BRIG. J. D. WELCH

The case for the Central Sterile Supply Department (C.S.S.D.) is two-fold: to save the nurses from having to sterilize in the wards and to reduce the risk of cross infection. The Department represents a revolution in hospital practice, but, thanks to the work of the Nuffield Provincial Hospitals Trust, it is a revolution about which a fair amount is known. The author of this article, Brigadier J. D. Welch of the Nuffield Provincial Hospitals Trust's operational research team, was himself concerned in the C.S.S.D. which the Trust helped to design at Addenbrook's Hospital, Cambridge (architects : Easton, Robertson, Cusdin, Preston and Smith), and which was recently completed. He is able, therefore, to give firm information about how such a Department should be planned.

Except in the London teaching hospitals or in a few favoured localities, difficulties are daily being experienced in finding enough nursing staff for hospitals. Even in those hospitals which have enough nurses, much would be gained if some of their work could be done by others less highly skilled. The nurses would then have more time to devote to their patients. This problem has for long been acute in the USA where they have explored every avenue to take work off the nursing staff, one hospital consultant recently estimating that some 30 per cent. of the work had been removed from American nursing staff in one way or another. One of the principal means of lightening the work load has been to undertake all ward sterilization centrally. By this system all surgical instruments, bowls, catheters, rubber tubing, syringes and needles, instead of being cleaned and boiled on the wards, are returned to a central department (C.S.S.D.) which has been specially designed, equipped and staffed to undertake such a task.

But, more recently, and in Great Britain, further arguments have added weight to the demand for a change in the present system of sterilization. In 1958 the Nuffield Provincial Hospitals Trust published a booklet giving an account of present sterilizing methods.* The Foreword of this booklet states:

"The results of the investigation of the operational research team have, however, been so revealing, especially when considered in the light of the present high incidence of hospital infection, that the advisory panel have recommended to the trustees of the Nuffield Provincial Hospitals Trust that they should publish this report for the information of hospital authorities at once.

The report shows that the standards of sterilizing practice in the six hospitals investigated are open to criticism. It is reasonable to assume that standards throughout hospitals in England may be similar. . . . The imperfections of sterilizing technique may be a major contributing factor to the present high incidence of infection in hospitals."

There are thus two main arguments for a change in the system of sterilization in hospitals. Firstly there is the need to provide a better quality of service and secondly the need to take work off the nursing staff. So insistent have these arguments become that every new hospital now being built contains provision for a central sterile supply department (C.S.S.D.) whilst many old hospitals also are planning to open such departments as money becomes available. It is hoped that the paper that follows may be of assistance in crystallizing thought on the matter.

* Present Sterilizing Practice in Six Hospitals—Nuffield Provincial Hospitals—1958.

The Aims and Principles of Central Sterile Supply Departments (C.S.S.D.)

The aims: At the outset it is important to state the aims of C.S.S.Ds.

1. To conduct hospital sterilizing practice so that it can be properly controlled and supervised thereby contributing to a reduction in the incidence of hospital cross-infection.
2. To take a measure of work off the nursing staff thereby giving them more time to devote to their patients.

First let us glance at American practice since it was here that the original conception of central sterilizing arose. In the USA it is usual to provide the doctor or the nurse with everything that they may need for a particular procedure. But all the equipment provided is seldom used. As a result quantities of equipment go backwards and forwards. Again in the USA there is little attempt to organize a work flow. They do not seem to realize that a C.S.S.D. should be run like an industrial production line rather than a hospital. In some instances the methods of washing and cleaning are ill organized. The reason is not far to seek. The costs of the central supply department, as is the case with most US hospital practice, can always be passed on to the patient and there is thus little incentive to keep costs down and to employ efficient methods. It is difficult to defend American methods under a National Health Service where proper economy and efficiency must be practised. Let us consider how to improve on American practice.

The types of equipment to be processed. If we are to achieve the aims stated above the more that can be sterilized centrally the better. It is accordingly suggested that everything should be done centrally except:

Pharmaceuticals—because they must be produced under the supervision of a pharmacist.

Bedpans and Urinals—because they are used too frequently and are too bulky to be transported round hospitals.

Theatre surgical instruments—because so many are used and the turnover is so fast that it would require a huge stock to "fill the pipe line" between the theatres and the C.S.S.D.

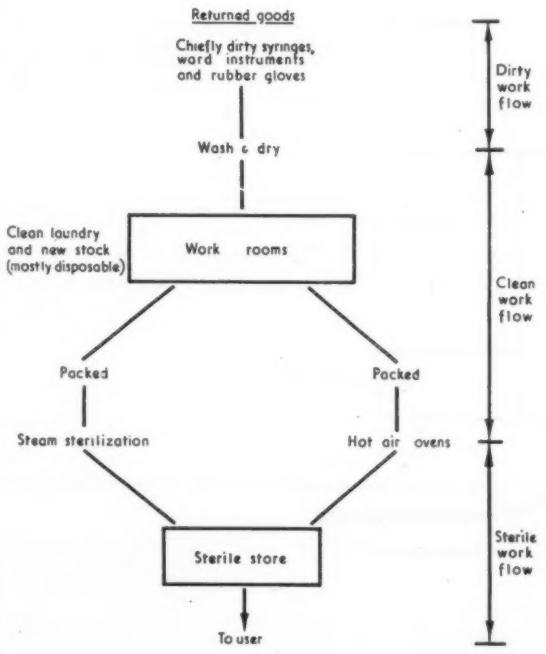
As a general rule pharmaceuticals must be produced in the pharmacy, bedpans and urinals in the wards and theatre instruments in the theatre suite. This will leave syringes, ward instruments, soft dressings, rubber gloves and tubing, linen and, possibly, topical solutions to be done in the C.S.S.D. Two methods of sterilization may be employed, high vacuum steam sterilizers and dry heat. The former should be used for all soft goods which should be treated separately from the syringes and ward instruments. The modern high vacuum equipments are so much faster in operation than the earlier downward displacement types that their size can be reduced. Eight cubic feet steam sterilizers are large enough for most hospital purposes. Two such sterilizers should be sufficient for a 1,000 bedded hospital.

Syringes and ward instruments should be packed in aluminium containers and sterilized by dry heat, preferably in an infra-red moving-belt machine. Such machines reach the temperature needed more quickly than ordinary hot-air ovens and ensure that all syringes receive the same heat treatment. Details are given in the Nuffield Provincial Hospitals Trust booklet on syringe services.*

If all the articles mentioned above are to be provided packed and sterile for use in all departments, it follows that there is no need for the wards also to be provided with their own means of sterilization. Indeed it would be a mistake to do so since sterilization there cannot be controlled and supervised, and only encourages inefficient processing.

The Work Flow. It is essential to organize a proper work flow which separates the contaminated from the sterile. This is not necessary simply because of the danger that used articles might contaminate sterile packs—the packaging should be good enough to prevent this. It is necessary because of the danger that used articles, particularly syringes and ward instruments, may get mixed up with sterile articles. Every C.S.S.D. should collect all contaminated equipment for re-processing and should deliver sterilized equipment to the user. Upon arrival all used articles should be washed in a wash room. No article should leave this room until it is clean and dry. It can then be moved in a clean and dry state to its own particular room for further processing, gloves to the glove room and instruments and syringes to the instrument and syringe room. After sterilization all packed and sterilized goods should be stored in a sterile store. The work flow required can be shown diagrammatically as here.

DIAGRAM OF WORK FLOW



The Principles. Having thus considered the aims, equipment to be sterilized and the need for a work flow, it may be appropriate to summarize the principles to be borne in mind in organizing a suitable department:

1. The C.S.S.D. should, in general, be responsible for producing all sterile requirements other than pharmaceuticals, bedpans, urinals and theatre surgical instruments.
2. The C.S.S.D. should be organized and planned to provide proper work flow and economy of labour.
3. The C.S.S.D. should deliver sterile packs to users and undertake the collection of used and contaminated packs.
4. Contaminated articles and sterile packs should be kept separate.
5. Sterilization should not be attempted in hospital wards and departments (other than of instruments in the operating theatres).

The Application of the Principles

Having considered the principles on which the work should be organized it becomes necessary to discuss how these principles might be applied. Whatever building is

* The Planning and Organisation of Syringe Services. *Nuffield Provincial Hospitals Trust.* 1957.

C.S.S.Ds. (continued)

put up a lot of expensive equipment will be required. High-pressure steam sterilizers cost £3,000 each, washing machines about £1,750, glove processing equipment about £700 and infra-red sterilizers a similar sum. All this expensive equipment, even in the smaller sizes, has a capacity greatly in excess of that required for any small C.S.S.D. Calculations indicate that a single department to serve 1,600 beds costs about £40,000 to build and equip. But four small departments to serve the same number of beds would cost about £70,000. Running costs would also be lower for the single large department. Only one supervisor and a lower level of staffing would be needed to cover holidays, sickness and leave. It has been estimated that one large department would cost about half as much to run as four smaller departments to cover the same number of beds. It follows that it is, in general, extravagant for hospitals each to run their own C.S.S.D. Rather the department should be run by one hospital for the group; or, provided distances are not too great, by one hospital for several groups. This means that the C.S.S.D. should not be tucked away on the top floor of a building but should have good road access for distribution purposes for which a large van will certainly be required.

It will next be necessary to decide how large a building is wanted. This is essentially a matter which can only be answered in the light of experience and that experience is not yet available. The American Sterilizer Company, who have done a lot of work on these departments, quote a formula which few American architects seem in practice to follow. As a result of much discussion and from the limited experience available it seems as if some 3 or 4 sq. ft. per bed should be enough in which to provide all sterile requirements assuming that single shift working is used. A large department should certainly be able to do with less but a small one may require a little more space. This space should be divided as in the following proportions:

	Per cent.
Work room	20
Sterile store	17
Bulk store	12
Wash room	11
Syringe and instrument room	10
Autoclaves, glove room, office, rest room, lavatories, etc., cleaners' cupboard and passages	30
Total	100

It is also desirable that each department should have four entrances. One each for contaminated and clean goods entering the department; one for sterile goods going out; one for staff and visitors. It may sometimes be possible for staff and visitors to use the "clean" entrance but they should, in general, be kept to a separate entrance.

If possible the work room should be a long and narrow room with a work bench running its full length and ending just short of the autoclaves, and with store cupboards round its walls. Space will also be wanted in the work room all round a linen folding table, which should measure about 6 ft. by 4 ft. and should be lit from below so that

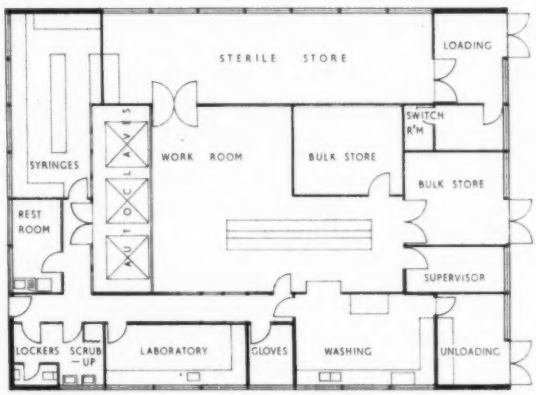
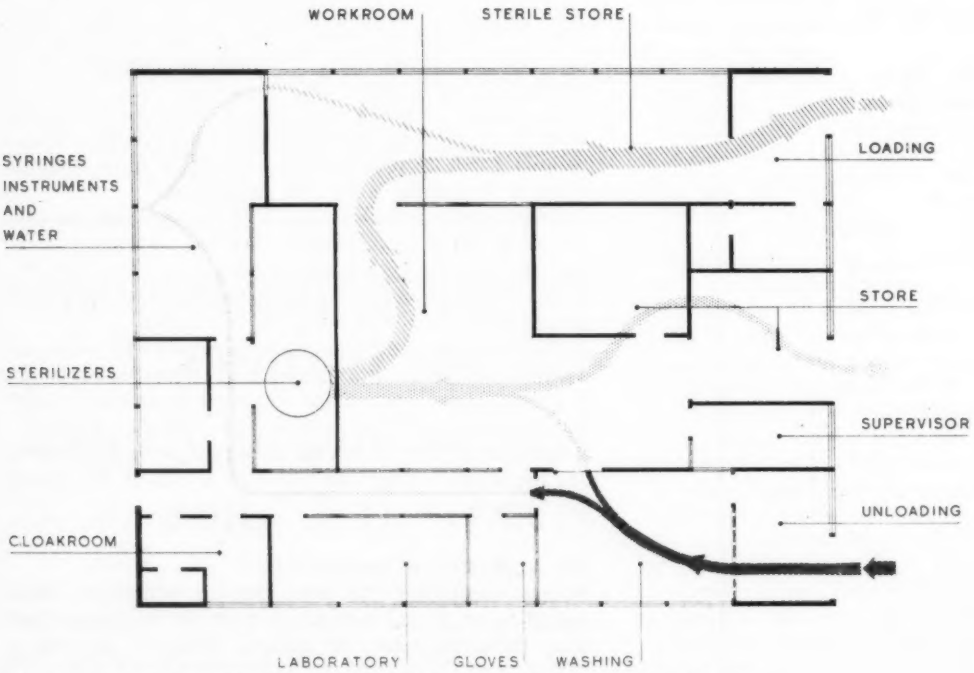


Fig. 20. C.S.S.D. at Addenbrooke's Hospital, Cambridge.



The darker dotted stream is dirty equipment; the lighter dotted stream is clean but not sterile; and the hatched stream is sterile.

Fig. 3. C.S.S.D. at Addenbrooke's Hospital, Cambridge: work flow diagram

C.S.S.D.s (continued)

any holes in the linen are apparent when it is being folded. The sterile store should contain storage cupboards with doors whilst room should be left for delivery trolleys. Open shelving is adequate for bulk stores. The wash room should be equipped with sinks and draining boards whilst space in it is also required for a modern syringe and instrument washing machine. The syringe and instrument room requires a good daylight for needle cleaning. It is also advantageous if a moving-belt sterilizer at one end of this room can be sited to deliver its load into the sterile store. Space must be left in front of the autoclaves for loading and round them for servicing. In view of the heat generated by autoclaves, washing machines and hot air sterilizers, ventilation in the department is of considerable importance. Like theatres, C.S.S.Ds. are usually too hot. If a positive air pressure can be arranged to flow from the sterile store, through the syringe and instrument room and work room and thence out from the wash room it will help to maintain proper aseptic conditions. In any case, the wash room requires to be generously equipped with extract fans. Ceiling height should not be less than 10 ft. and, in view of the need to keep the whole department clean, standards of finishing should be high. A suggested list of equipment required is given in Appendix A.

A department embodying these points has recently been constructed at Addenbrooke's Hospital, Cambridge. It has, however, not yet been working long enough for any faults to appear. It is regretted that it is not yet open for inspection. This will, however, be done as soon as the first experimental periods are over. Fig. 2 shows a plan of the department and Fig. 3 indicates how the work flow has been organized.

Appendix A: Equipment Required for C.S.S.Ds.

For the collection of returnable equipments:

1. Plastic bucket with a securely fitting lid for used forceps, syringes etc.
2. "Dirty" trolley for collecting filled buckets.

In the Wash Room:

3. Automatic washing machine employing either the ultrasonic or high pressure water jet principle.
4. Glove washing and drying machines.
5. Needle washer. Small ultrasonic tank.
6. Needle rinsers to hold about 40 needles at a time.
7. Drying cabinet.

In the glove room:

8. Glove powderer.
9. Glove packing bench.

In the Syringe and Instrument room:

10. Equipment for sharpening and packaging of syringes and needles.
11. Still for bottled water for topical use.
12. Infra-red hot-air sterilizer.

In the Work Room:

13. Pack preparation bench.
14. Linen inspection table.
15. Automatic pack tying machine.
16. High vacuum, high speed steam sterilizers.
17. Perforated aluminium trays for the bulk handling of small packs. Trays should be standardised so that they fit into autoclaves, store cupboards and delivery trolleys.

In the Bulk Store:

18. Adjustable shelving for clean supplies.

In the Sterile Store:

19. Cupboards with adjustable shelving and well-fitting doors. Cupboards should be adequately ventilated.
20. Closed trolleys with adjustable shelving.

maintenance

W. FOWLER HOWITT

We spend £14m. a year maintaining our hospitals. There is no doubt that this is a more significant titem with hospitals than with other buildings, needing exceptional care. This aspect is considered by W. Fowler Howitt, architect to St. Thomas's Hospital, London, who gives his own practical conclusions in respect of the most critical surfaces. He concludes with an appeal for some equivalent to CLASP among hospital authorities enabling them to buy the high quality materials and fittings they need at more advantageous prices.

Another contributor to this issue has suggested that the annual cost of maintaining and staffing a hospital may be one-sixth of the initial cost. Most of this sixth is accountable to staffing, but it is certain that hospitals are more costly to maintain than any other building type. There are many reasons for this: the need for exceptional cleanliness, the high standard of maintenance of service installations to ensure that they do not break down, the proneness to damage by wheeled trolleys and the fact that maintenance, when done, must be carried out in awkward conditions and at awkward hours to keep the hospital working. The architect, therefore, has certain very specific requirements to meet. What these are can best be explained by considering concrete instances, beginning with those which relate to the building fabric.

In order to cover a large subject in a short article it may be permissible to state a few general principles to be observed in the design of hospitals:

(a) The building fabric must be designed to lend itself to simple adaptation. It should be detailed to facilitate cleaning, and in certain areas the materials chosen should resist hard wear and frequent cleaning.

(*b*) The services must be accessible for regular maintenance and for adaptation and must be specified in the best quality materials.

(*c*) The mechanical equipment must be accessible or made available for regular maintenance and key plant duplicated for standby use.

(*d*) The equipment and fittings must be designed to withstand the hardest wear, mobile equipment designed to avoid damage to the building fabric, and the materials used must be chosen with a view to eliminating or reducing future maintenance.

(*e*) The acceptance of standard units and some system of modular co-ordination will not only reduce initial cost but also maintenance in future alterations.

(*f*) Attention to the siting of workplaces and stores for maintenance staff and equipment will reduce future maintenance cost.

To illustrate these principles by reference to some of the more important items:

1. The Building Fabric

(i) *Floors*

Bacteria in dust and fluff will naturally tend to accumulate

MAINTENANCE (continued)

on the floors of the hospital. To guard against cross infection in patient areas the cleaning of floors should be done with as little disturbance of the room air as possible. The traditional method in such areas has been damp mopping and, more recently, a combination of damp mopping and suction cleaning. If suction cleaners are used the container for the dust should preferably be outside the patient area or, of this is impossible, should be well protected to ensure that bacteria do not escape into the room air. In a new building a central vacuum cleaning plant is the most efficient and safe method.

Floor finishes for hospital building should generally be quiet, hardwearing, easy to clean and should not be slippery, readily combustible, liable to cracking or lifting. It is an advantage if they are also pleasant in appearance and not expensive. To a certain extent these are conflicting requirements and no finish has yet been found to be equally suited to all parts of the hospital. This tends to reduce adaptability.

Certain areas require flooring with additional qualities. Operating theatres, treatment rooms, sterilizing areas and sluices require to be very frequently washed and operating theatres will, in addition, require anti-static qualities. For this type of floor no equal has yet been found to the terrazzo floor. Properly laid in small areas, with jointing strips, protected from contact with hot pipes or heat-producing equipment to avoid cracking, it can be readily flooded and mopped or machine scrubbed with no change in appearance over many years.

Lavatories, showers, bathrooms and other areas liable to receive considerable wetting are also frequently floored in terrazzo, but as a personal preference it is considered that ceramic and vitreous tiles may provide better non-slip qualities and the possibility of trouble from joints and cracking is improbable in these areas.

Kitchens are a similar type and main kitchens will require washing with strong solutions to remove grease. Tiles with a carborundum content will provide the least slippery floor in these areas and a very few can be obtained which retain a pleasant appearance.

For all other areas the choice of floor finish and cleaning method has been radically altered by the introduction of floor sealers. Previously the most popular floors, timber and linoleum, have been wax polished. This has been a time-consuming process, the smell and noise disagreeable to patients and an over liberal application of wax would cause slipperiness both on that floor and on terrazzo or stone floors to which it was carried on the shoes of the staff. Periodically the wax had to be stripped and the process restarted.

The sealers, generally urea formaldehyde, phenolic drying oil or epoxy resin, provide either a penetrative and covering skin or a purely surface skin, and it is the sealer which must then be judged for its maintenance in terms of cleaning, wearing and non-slip quality. The floor finish, e.g., wood, cork, lino, plastic or P.V.C., has only to provide the qualities of quiet, stability, and appearance.

Experimental installations at St. Thomas's and other hospitals, and a large experiment being conducted by the Division of Hospital Facilities of the King Edward Hospital Fund for London, while not conclusive, seem to indicate that in regard to cleaning and non-slip qualities, the sealers have simplified the problem. The hard-wearing properties are more in doubt and manufacturers are constantly improving their products, this will only be established in time.

Generally, in areas not subject to intense traffic or to water, the sealer should require renewal annually, the epoxy resin type having a longer life but being more difficult to renew. The preparation of the surface and the sealing process must be very carefully carried out but the resulting finish requires only suction cleaning if spilt liquids are mopped up reasonably soon.

Briefly considering the floors commonly sealed: hardwood block or strip floors tend to move and, when sealed, will tend to produce fewer but larger open joints. It is suggested that these floors should only be used in areas such as dining-rooms, common rooms and offices, where their qualities of appearance are not outweighed by the opportunity they present to bacteria, and their relative noisiness. Cork is known as a very quiet floor, but is liable to indentations unless precautions are taken in the fittings and mobile equipment. It should not be used, even when sealed, in areas of heavy pedestrian traffic.

Linoleum is less liable to indentation, is available in a much wider range of colour and can generally be recommended.

Thermoplastic floors have not been entirely suited to hospital heavy wear and the P.V.C. type, either in sheet or tile form, is now regarded as the best flooring finish for general hospital use, although it may be more noisy than linoleum. P.V.C. sheets may be welded to form a watertight surface, bacteria proof, and allowing those authorities who follow the ward cleaning routine advocated by Dr. Carl Walter to swill out the floor regularly.

(ii) *Walls and partitions*

In the interest of adaptability it is recommended that wherever possible walls and partitions should be designed to allow rearrangement without major structural change. It follows logically, if not in practice, that where a choice exists permanent fittings and fixtures should be attached to the permanent walls. Flexible partitioning is infinitely varied and requires no assessment here but its use in hospitals poses certain problems. It is important in certain areas, notably examination and treatment areas, that privacy is maintained, that speech should not travel from one cubicle or room to another. This may conflict with the general maintenance consideration that the surfaces should be free from ledges or inaccessible areas which will harbour dust, spores and bacteria. These areas receive hard wear and a panel material which cannot be repaired must be replaced. This is particularly obvious at door openings and can be very expensive if overlooked.

Hospital walls, and subsequently partitions, have traditionally been either tiled or plastered and painted. Tiles have joints and joints need attention and, with the exception of decorative areas in tile or mosaic, have no place on the walls of a modern hospital. Plaster and paint, oil or emulsion are invariably used and no doubt will continue though they are not very satisfactory from the maintenance point of view. Plaster will continue to crack and be broken on impact. Paint will continue to require expensive skilled labour to wash it down and periodically renew it. Startling effects on paintwork may be observed over improperly ventilated sterilizers and other steam-producing equipment.

Timber is suspect on jointing, as are the more rigid plastic products which are also expensive and impossible to repair. The cement glaze type of material and a similar appearing plastic sprayed application have very definite possibilities in areas where the very slight ripple effect is not considered unsuitable.

Protection to walls, particularly corridors, has been achieved by the application of lino and, more recently, by

the thin sheet P.V.C. The latter, while still expensive and not giving as much protection to the wall surface behind, does seem to have almost infinite possibilities in hospitals as its cleaning and maintenance are so simple.

(iii) *Ceilings*

The traditional lofty ceiling height in hospitals has now generally given way to a ceiling height of about 10 ft. This relates directly to the subdivision of large areas into smaller, more private areas in the planning of the patient accommodation. In the attempt to provide flexibility in planning, the services have tended to be housed in or below the floor slab and suspended ceilings are normal. Access must be allowed to these services. Having chosen floors to reduce noise, walls and partitions to reduce noise-transmission, the ceiling is the best area for the reduction of local noise which is unavoidable. This is complicated by the fact that the best sound-absorbent materials will also harbour bacteria. While the present-day systems of demountable ceilings are very suitable for corridors, offices and general outpatient areas, some variation must be made in wards, treatment rooms and operating theatre suites. In wards a good deal of the disturbing noise can be eliminated by good planning and by choice of materials for the fittings and equipment. The remaining noise should be reduced by limited areas of ceiling absorbent, preferably of the grooved as opposed to the perforated variety. In theatre and treatment rooms the joints must be sealed in some way, preferably access to services should be made available from outside the clean area. The use of thin plastic sheeting in these areas as a ceiling finish offers promise of simple maintenance.

Condensation has been a difficult problem in old hospitals, particularly in steam-producing areas and certain paints will greatly assist. The proper answer to this is to insulate the external walls and to provide adequate ventilation in these areas, including kitchens. If this is done these ceilings may be treated as any other hospital ceiling.

(iv) *Windows*

The design of hospital windows varies enormously and even the most interesting developments, e.g., the Nuffield experimental units at Larkfield and Musgrove Park, are not entirely satisfactory in performance. From the maintenance point of view window hinges or control gear should be capable of adjustment. The vertical centre pivot type are least satisfactory in this respect. Hardwood frame windows, with the exception above, can be planed to accommodate the effect of movement, but neither oiling nor a plastic seal is a very satisfactory finish as both require regular renewal.

The cost of painting metal windows can be surprisingly high and the rival claim of aluminium must be seriously considered, and preferred in areas free from high atmospheric pollution. Even in these areas if a routine washing of the frames is carried out at the same time as the glazing, their appearance is acceptable.

Window cleaning must be accepted as one of the larger recurring maintenance items, and the designer's aim is to make it as simple a process as possible. Contrary to a widely held opinion, it is suggested here that the outside surfaces of hospital windows should be cleaned from the outside. This is preferred for two reasons. Firstly, the difficulty of access to all areas at certain times and, secondly, the quantity of dirt from outside which inevitably is transferred to the internal surrounds and walls when all cleaning is carried out from inside.

Venetian blinds provide very good control of sunlight which is appreciated by patients but they are not a simple maintenance task. If contained within a double glazed frame they will collect less dust but may be less efficient blinds unless other ventilation openings are provided.

(v) *Doors*

Bearing in mind the volume of mobile vehicles, hospital doors should be wide and high enough to allow good clearance from the largest equipment. Single leaf doors are preferred to double leaf for ease of operation by one individual. It follows that the doors must be of a substantial nature to withstand distortion and be provided with strong hinges in turn securely fixed to solid frames. Doors not only may give a great deal of maintenance work but may also be one of the worst offenders in regard to noise. British manufacturers of door furniture still have a good deal to learn from the American industry in regard to door closers, and to the German industry in regard to door furniture suited to hospital building.

However wide the door opening, impact will still be made on the frame and reveal. Protection is often afforded by a stainless steel cover plate and recent trials of rubber and plastic show promising if not conclusive results.

2. Services and Mechanical Equipment

These have been very well covered elsewhere in this issue and the maintenance considerations, if good practice is followed, are largely a matter of access. In planning the access it must be arranged so that the engineer is not obstructing a vital doorway or corridor and the contents of any duct should be as carefully arranged as any room if all services are to be accessible. It is also important to ensure that the services really go in as planned, as there is a tendency for the first contractor in to occupy the best place with consequent disastrous results; this means the production of one drawing showing all services.

3. *Equipment and Fittings*

It has been noted that all equipment must be robustly constructed to withstand heavy wear and that mobile equipment must be designed to avoid damage to the building fabric. It is suggested that a series of stainless steel frames mounted on rubber wheels—these last designed to assist cleaning and not less than 4 in. diameter—with a series of detachable containers of aluminium or fibre will most efficiently carry all hospital supplies and will give the maximum adaptability in use. It is common to have rubber or plastic-covered guard rails fitted to stores trolleys to protect walls. An interesting pattern has been seen in Germany where wheels are mounted on the corner uprights proving very efficient in use. It is perhaps worth noting that certain wheeled vehicles require a brake mechanism—its absence may be annoying to staff or prove serious to the patient.

A cove skirting will not only assist in floor cleaning but will also, to some extent, protect walls from wheeled vehicles. Guard rails are fitted on lift walls and on some corridor walls, but it is suggested that a more efficient and less expensive method of dealing with the problem is to ensure properly designed vehicles.

Fittings in hospital most often require rearrangement and alterations and this work and their cleaning and repair constitute a large part of the day-to-day hospital maintenance activity. Having noted that fittings generally must be robust, only the patient areas require special consideration. Hospital laboratories do not differ greatly from other laboratories and passing mention may be made of the advantages of benching having a fixed top and adjustable storage units below.

MAINTENANCE (continued)

In the patient areas the emphasis is again on ease of cleaning and, to assist in this, the avoidance of dust-catching ledges or inaccessible areas. From the maintenance viewpoint the only satisfactory construction is in stainless steel, glass and hardwood, with a very limited use of plastic sheet. This may appear to be an impossible, all-embracing generalization, which indeed it is, but it is only outside these materials that the major difficulties appear. The difficulty of any plastic sheeting or veneer is the edge finish which with constant use tends to break or leave crevices which are impossible to clean. Painted softwood will stand neither constant cleaning nor hard wear without regular renewal. Furniture sealing compounds appear attractive as an alternative to polish but in fact, to date, have not proved to be very suitable, particularly in respect of scratches and the difficulties of resealing.

In conclusion, the general recommendations made in these examples have all shown that from the maintenance viewpoint only the best materials should be chosen for hospital work and the greatest care must be taken in the design and assembly to reduce future work, whether it be cleaning, alterations or repair occasioned by misuse. The acceptance of these high standards will certainly increase initial capital cost, but it cannot be over-emphasized that maintenance is a recurring cost and it is in the long term interest of everyone, if only as taxpayers, to see that future maintenance costs are as small as possible.

Great advances have been made in certain groups of hospitals in recent years in co-ordinating their standards and requirements so that bulk orders or central purchasing schemes may be adopted. This has had the effect of considerably raising the quality of the goods and at the same time lowering their cost. With active support and direction from the Ministry of Health for minimum standards of hospital planning, to be followed by some general indication of cost standards, it is not unreasonable to assume a possibility of some general minimum standards of materials and finishes. The hospital building programme seems to be taking the school building programme as a guide. School authorities have successfully combined their ordering of certain building materials to agreed standards, to the benefit of all, both in cost and quality, and it is suggested that it is in this direction that the architects and authorities responsible for hospital building should be looking today if they are to provide efficient and economic hospitals which will still be pleasant to look at and efficient to operate in twenty or fifty years' time.

THE DEPARTMENTS

the wards

ALAN WIGHTMAN

The policy of making patients move about as soon as possible (" early ambulation "), the reduction of movement by the nurses to a minimum to cut down cross infection and many other factors besides, have contributed to make the ward very different from what it used to be. In this article, Alan Wightman of the firm of Robert Matthew and Johnson Marshall, the architects for Ninewells Hospital, Dundee, describes the present state of ward planning theory, putting forward, as he does so, the bold proposal which is being entertained for Ninewells of a double ward unit with a total of 48 beds, half for women, half for men.

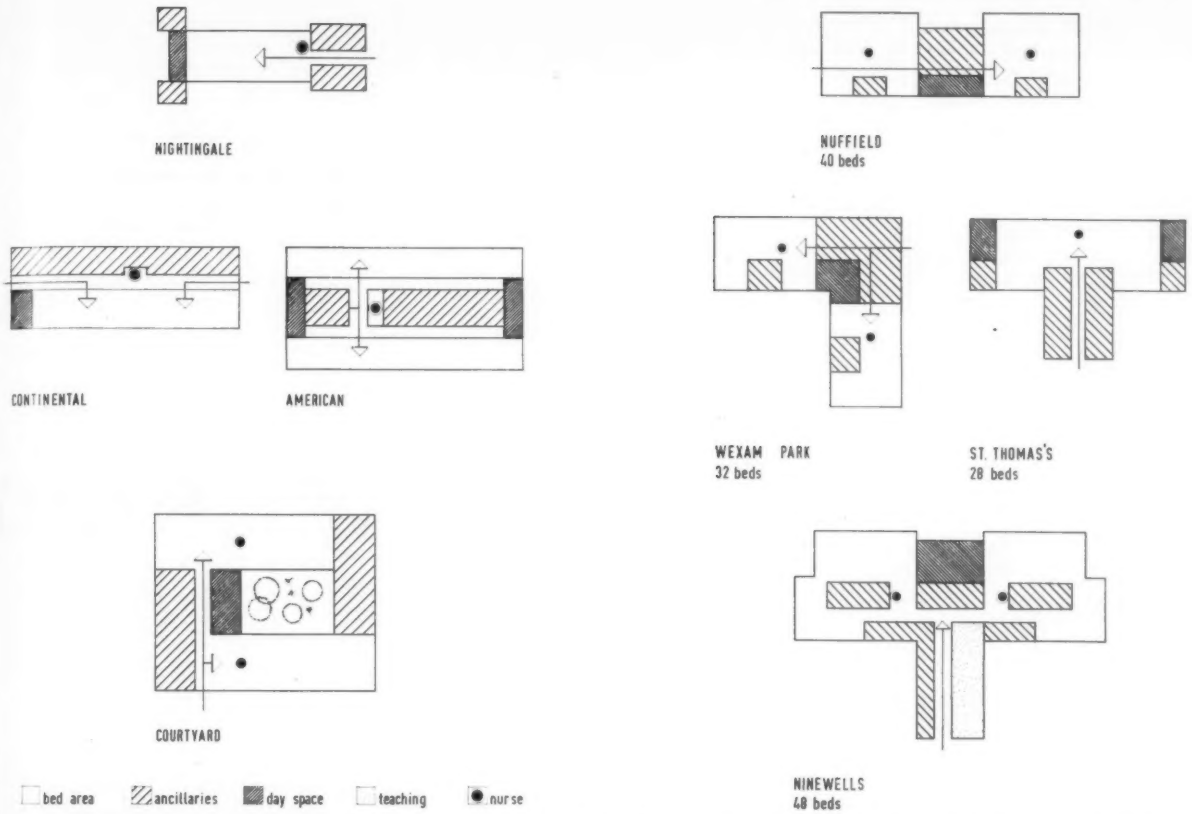
The old military tradition of ward design is now stone dead (but one occasionally sees its ghost around even now). In its place is a new attitude to the patient and a better understanding of the function of the hospital ward. There is, however, a long road of investigation and experiment ahead before our understanding of ward functions, organization and layout has reached a point where a new tradition in ward design has established itself. These few notes draw together some of the threads of current thinking and reflect not so much new ideas as a sharpening of view of the trends in ward design now evident for example in Scotland. The selected threads have been gathered together under their different heads:

(1) Medical Policy

Essentially the ward is a place where the patient, the nurse and the clinician are brought together in a sustained effort to restore the patient to health. Part, but only part, of the process necessitates the patient being in bed, and it is the reassessment of the process of recovery, both physical and emotional, that is changing our attitude to ward design. There are two aspects of medical policy involved in this new attitude, *viz.*, early ambulation and cross infection.

(*a*) *Early Ambulation.*—The medical policy of " early ambulation " has grown rather haphazardly over the last half-century and its development has depended mainly on a handful of surgeons. As a theory it was formulated around the turn of this century by Emil Ries.*That was 60 years ago so that as a method of patient treatment it is hardly new; but for many years it received very little support. It took the impact of the last war for the theory to be practised on any scale. War-time expediency forced doctors to adopt a policy of early rising, and early discharge in various forms. For example, the London blitz prompted a policy of allowing as many patients as possible to get up on the third day; in general no ill-effects resulted from such treatment, less nursing care was re-

* Emil Ries (1899), *J. Amer. med. Ass.*, 33, 454.



These diagrams indicate comparisons, to scale, of various types of ward layout, showing the disposition of the main elements. The arrows indicate the means of access. Of the British types which retain the open plan, the Nuffield ward exemplifies the first major advance over the Nightingale ward in that the ancillary services are brought into the middle; however it still retains the end access. Subsequent development, e.g., Wexham Park, by Powell and Moya, avoids this latter defect. The last example represents a study by Robert Matthew and Johnson-Marshall for the typical ward unit of the new teaching hospital at Ninewells, Dundee; the compactness of the plan is achieved by providing some of the ancillary accommodation in a central core.

quired for the early risers and they had a more rapid and comfortable convalescence.* In the post-war years the findings of D. J. Leithauser† prompted further experiments in early movement, early rising and early discharge which helped to clarify the needs of post-operative care in relation to the process of healing and the avoidance of strain on the injured part of the body. It became clear, for example, that the worst strains to which a recently repaired surgical wound can be subjected are those of coughing and the use of the bedpan.

The growing recognition in the post-war years of the benefits and indeed the necessity for early ambulation, can be summed up in the remark of D. M. Dunlop in an address to Edinburgh postgraduates in 1949,‡ " . . . complete rest in bed should be prescribed like a potentially dangerous drug, and not instituted as a matter of course for all hospital patients until the contrary has been ordered." Yet in 1951 Dr. J. W. D. Goodall's survey of hospital practice§ showed how surprisingly little was the policy applied at that time. Dr. Goodall's findings are now well known but are so important as to be worth recalling here. In his assessment Dr. Goodall placed the patients in three categories each corresponding with a distinct phase in the cycle of recovery, viz., bedfast, semi-ambulant and ambulant. From a sample of 522 patients drawn from 21 wards the assessment showed that the potential figures (expressed as an approximate percentage for each ward) for each category under a policy of early ambulation were as follows:

Ward	*Bedfast* *Per cent.*	*Semi-Ambulant* *Per cent.*	*Fully Ambulant* *Per cent.*
Surgery	16	35	49
Medicine	26	28	46
Gynaecology	16	46	38
Obstetrics (ante-natal)	22	28	50
Obstetrics (puerperal)	12	38	50

These are average figures and there would obviously be day-to-day variations, depending on the size and composition of the ward.

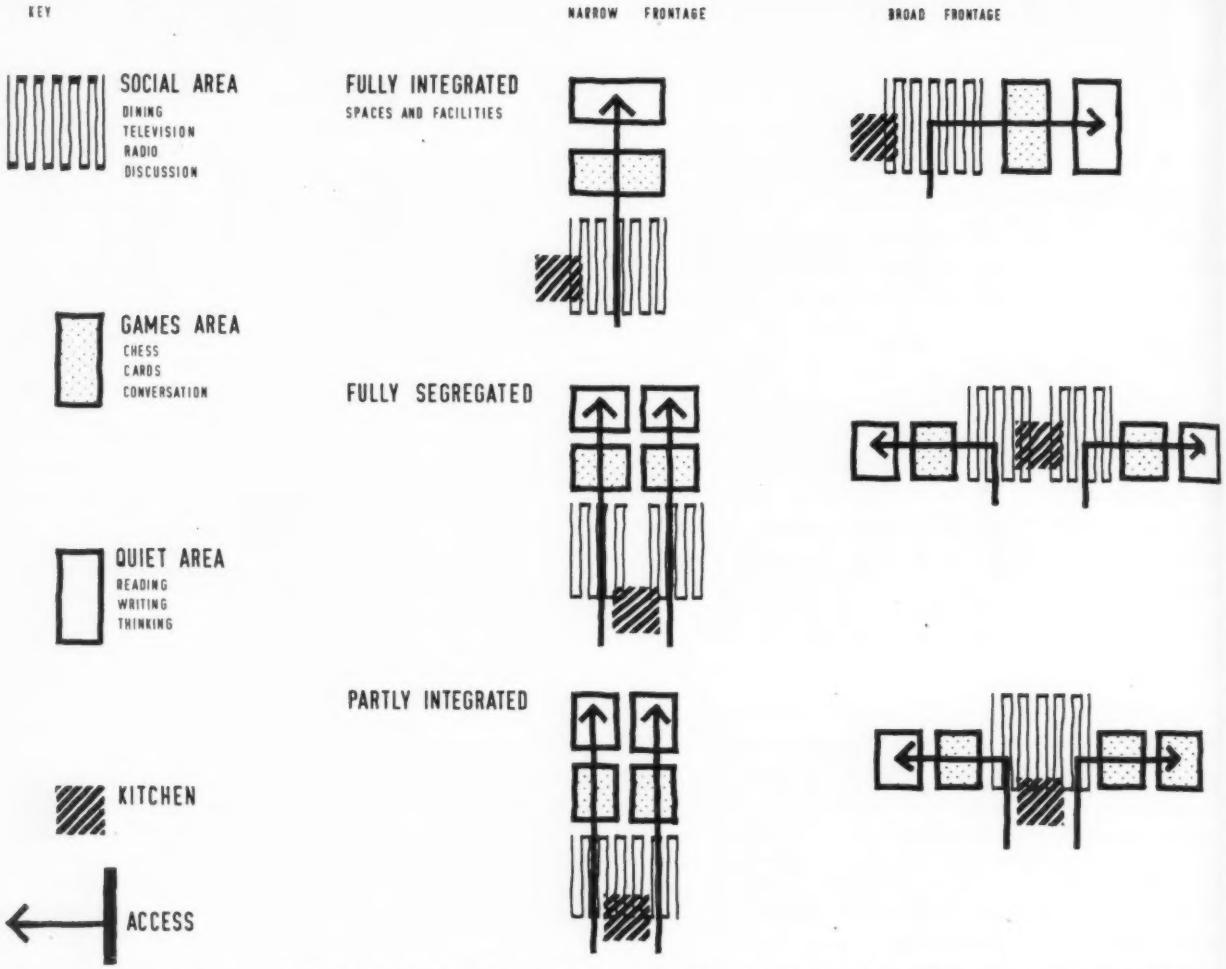
(*b*) *Cross Infection*—About 15 years ago the proportion of antibiotic resistant strains of staphylococcus amounted to some 10 per cent. of the total variety of the organisms. Now they amount to about 90 per cent. which indicates the measure of the problem. In tackling this problem the bacteriologist is seeking to raise the standard of techniques in medical care and to reduce the extent of aerial contamination. To this end certain principles affecting ward design are now generally recognized:

(1) Dressings and other procedures involving open wounds shall be done in a ward treatment room.

(2) There shall be no counting or sluicing of linen on the ward.

* Bryant E. Cullen (1947), *J. Canad. med. Ass.*, 57, 257.
† D. J. Leithauser (1946), " Early Ambulation and Related Procedures in Surgical Management," Springfield, Illinois.
‡ D. M. Dunlop (1949), " Changing Concepts in Therapeutics," *Edin. med. J.*, 56 146.
§ J. W. D. Goodall (1951), *The Lancet*, 1, 43.

THE WARDS (continued)



These diagrams represent a study by the architect for the Ninewells Hospital in the provision of a combined day space for a ward unit, i.e., a pair of wards, one male, one female. They show six different ways of arranging the constituent parts of the total space available, according to function, and the use, integrated or segregated, by both sexes.

(3) The ward floors should be cleaned by a central vacuum system.
(4) Treatment rooms shall be placed away from the busy traffic area of the wards.
(5) Beds shall be spaced at a minimum distance of 8 feet centre to centre.*

(2) Accommodation

(*a*) *Bed Area*—It is now established practice in Britain to arrange the beds of a ward in small groups on the Rig's lay-out,† partly in open bays but with a small proportion of single rooms. Single rooms are needed for the dying, the gravely ill and the noisy or obstreperous patient and Dr. Goodall has indicated that for these purposes the number need not exceed 25 per cent. of the total in any ward.‡ The policy in other countries of providing nearly all beds in single rooms is based partly on their concept of a hospital as a hotel with medical services attached, and partly on the belief that single rooms are the answer to the cross infection problem. In this latter respect the bacteriologist, in this country at least, regards the single room as of limited value; whilst it can help to reduce aerial contamination it does not overcome the real problem—the nurse; it is her nose, hand and uniform that are the prevalent sources of cross infection on the ward.

The concept of progressive self help is an integral part of the policy of early ambulation and has become an important influence on ward design. Although no hard boundaries can be defined, the bed area of the ward can be envisaged as being in three zones; quiet, semi-quiet, and active. The single rooms would be in the first zone for the acutely ill patient, and as his recovery progresses he moves into the open bays. This is the general theory and it is of value providing that the quiet zone is adequately screened from the active zone, and providing that the patient remains under the same nursing team, *i.e.*, that the progression is within the familiar surroundings of the one ward.

The grouping of beds in the open bays is still a subject of considerable debate. There are those who say " every man with his own corner," in other words are in favour of four-bed bays. But there are also those who believe that a six-bed bay gives a better social unit, *i.e.*, a better choice of neighbour. The issue is probably of lessening importance when policies of early ambulation can be fully implemented.

* Central Health Services Council, the *Cohen Report* (1959), " Staphylococcal Infections in Hospitals."

† Named after the Rigs Hospital, Copenhagen (1910). Wards are divided into bays by partitions at right angles to corridor wall. Bed heads are against partitions.

‡ J. W. D. Goodall (1951), *The Lancet*, 1, 1063.

The active zone should of course be immediately adjacent to the day rooms and the ward kitchen which are at the focus of ward activity. Needless to say this area should be accessible without going through the quiet zone where traffic must be kept to a minimum.

(*b*) *Ancillaries*—It is with the ancillary accommodation that we see the major implication of the medical policies previously referred to. For a policy of early ambulation to succeed the first and obvious requirement is to provide an adequate number of W.C.'s, wash-basins and bathing facilities. Whilst these should be within easy reach of the patients a reasonable standard of noise insulation must be achieved; a single door by itself is not an adequate barrier to sound. A sound standard of provision is probably one W.C. and basin for every four patients; some now advocate, in addition, an enema room for each ward. Apart from its obvious lack of privacy the use of the bedpan is a source of danger to the patient, to other patients and to the nurse. The time has come when this primitive practice ought to be discarded; the fact that the problem concerns only 25 per cent. or so of the patients in the ward, and the provision of an enema room should help us to find the answer.

In general, medical opinion recognizes the superiority of the shower over the bath; but there are several types of case (*e.g.*, the orthopaedic) who could not use the shower, so that the conventional bath will still be needed. A reasonable standard of provision for bathing facilities is one shower for every 12 patients and one bath for every 24 patients.

The treatment unit, comprising a sterile supply store, treatment room, and dirty utility room is now an established feature of ward planning.* Procedures can be carried out in it under controlled conditions with privacy for the patient and with less disturbance to other patients in the ward. It is important however that it is located outwith the area of heavy traffic, and if it is really to fulfil its function a high standard of aseptic technique should be possible in the use of it; essentially it is a minor operating room.

(*c*) *Day Space*—With some 50 per cent. of the patients able to get up for several hours of the day adequate accommodation is required for their differing needs and interests. The space so provided, *viz.*, the "Day-Space," is so often thought of as a single room in which meals can also be taken; the inadequacy of such a room can be seen if one tabulates the varying interests as follows:

Patient	*Recreation*	*Environment*	
Elderly male	Dining Radio and television	Active and reactive	Smoking and non-smoking
Elderly female	Conversation Card games	Social	
Young male			
Young female	Reading and writing Chess and crosswords Serious music	Quiet and meditative	

Various types of patient can thus have a wide variety of interests, the satisfaction of which could play an important part in their recovery. These should at least be recognized before implementing a policy of early ambulation however difficult it may prove to meet the needs simultaneously in a limited amount of space.

The extent to and the manner in which these needs can be met however will be governed by social, technical and economic factors. SOCIAL—It is difficult to predict the trend in social behaviour and recreational needs but in planning the day-space accommodation the needs of the third group for quietness should be met. There is a growing body of opinion in favour of men and women being able to share the day-space; it points to the psychological benefit of hastening the patient's awareness of normal patterns of behaviour and the recovery of confidence and self respect. The Matron of a well know Scottish teaching hospital expressed the view recently that she sees no difficulty in the sexes sharing the day space; her one proviso is that there should be a separate smoking room.

TECHNICAL—In meeting the varying recreational needs of the patients perhaps the biggest single difficulty is the TV and radio which should be provided in such a way that it does not become a disruptive force. It is not only that the sound is thrown out into the whole room but there is the potential conflict over the choice of programme. If the sound can be conveyed to the individual by means of a small earpiece receiver then the problem would be largely solved; there could even be two TV screens in the same room, with conversation as well.

ECONOMICS—There is probably some optimum number of patients, on the basis of which a sufficient amount of day space can be justified. Above the optimum there would probably be difficulty in supervision; below it the space available would become unduly restrictive. For example, if the space available for each of two wards of say 24 beds were combined something very near the optimum could be achieved. Two such wards, one male and one female, make up the typical "ward unit" for the new teaching hospital at Ninewells, Dundee, and reasonable provision could be made by grouping the total day-space available with the ward unit kitchen. From preliminary studies by the Architect reasonable provision for about 50 patients amounts to about 850 sq. ft. which could be allocated as three rooms, *viz.*, one male Quiet Room and one female Quiet Room each of 210 sq. ft. and one mixed Social Room of about 420 sq. ft. There is thus partial segregation (a non-smoking rule could be applied in the two Quiet Rooms). The Social Room in this instance would serve as the dining space as well as the place for the TV and radio. This layout does not represent the ideal arrangement but is an example of a workable compromise between patients' interests, nursing supervision, and building economics.

(*d*) *Staff Accommodation*—One of the lessons to be learnt from the Nuffield experiments at Larkfield and Musgrave Park relates to the position of the sister's room. If this is to function as the working base for the sister it should be strategically sited within the ward, adjacent to the nurses' station and the day space. It is less important that she should be next to the interview room which is better placed next to the clerkess at the entrance to the ward unit.

The location of the nurses' station must obviously be as near the centre of the bed area as possible and there is a growing opinion that it should not be split (for reasons of visual observation) into two separated bases. Consultations between the staff are made easier if there is one station where all the ward records are readily available to doctors, nurses, students, dieticians, physiotherapists, etc.

(*e*) *Teaching Facilities*—In a teaching hospital the old routine of bringing groups of students round the ward is being replaced by the use of a demonstration room to which the patient is brought in his bed. Clearly this room must be sited within the ward unit (*i.e.*, a pair of wards, Male and Female, comprising a medical charge) if the patients are to travel the shortest possible distance. A room of such size (about 400 sq. ft.) in the heart of the ward unit is a major factor in the ward design; it is usually associated with a tutorial room where small numbers of

*Nuffield Provincial Hospitals Trust (1955), "Studies in the Functions and Design of Hospitals." O.U.P.

THE WARDS (continued)

students can write their notes, study case records, etc. Both these rooms should be accessible without entering the actual patient area.

(3) Layout and Form

(*a*) *Principles*—Three general principles governing ward design may be noted here:

(i) Traffic: The first and most important is that of the cul-de-sac—a ward should not be a traffic highway. This is not only important from the point of view of cross infection but also from the patients' viewpoint; the frequent intrusion of strangers into or through the ward area could be disturbing to the patient's sense of individuality in *his* or *her* ward.

(ii) Sunlight: The recovery part, *i.e.*, the semi-quiet and active zones of the ward should have a southerly aspect. In our variable climate the psychological benefit of sunlight is of immense value, providing its penetration can be controlled. Solar heat gain cannot be ignored merely because we live in a temperate climate.

(iii) Prospect: In all weathers the short view through the windows can be more stimulating than the long open view; it can give more interest and stimulation by being able to see the colour and developing form of growing plants, the changing texture of a tree. Assuming the therapeutic value of such views to the patient (and also the nurse) nearness to the ground can give the most benefit. This amounts to a plea against the towering cliffs of ward blocks.

(*b*) *Economics*—The economics of ward design concerns both efficient organization and layout. Nursing patterns and the means of providing ancillary services are still evolving so that comparisons between one scheme and another must take account of the nature (size, extent, grouping, etc.) of these two factors in relation to the number of beds. Efficient layout is largely a matter of the degree of compactness, which is not only a question of square feet, but of frontage and depth.

Ward design is still influenced by Nightingale principles of natural cross ventilation and this in a climate so variable that the necessary degree of control over the air flow in a ward cannot be ensured. It is not uncommon for the prevailing wind to prevent the use of the conventional window to give adequate ventilation; apart from the discomfort, the bacteriological risk is obvious.

The obvious consequence of this at least, is thus towards deeper planning of the ward block with the use of mechanical ventilation. This enables much of the ancillary facilities of the ward to be grouped in an internal core, with resultant shortening of walking distances for the nurse, and a shorter frontage. The extra cost of mechanical plant is to some extent offset by a reduction in external walling and in length of main corridors; but convenience and user efficiency cannot be omitted from the balance sheet.

There is still a wide variation in space standards for wards. In the open bays one must first determine the minimum distance for the bed centres, and between the ends of beds; these are governed by such items of equipment as dressing trolleys, Balkan frames, bed curtains, etc., and also the principles laid down in the Cohen Report. More investigation is needed before space standards can be established with confidence; it is apparent however that a 20-feet frontage for the typical bay is too small, and recent studies indicate that an increase of 10-12 inches in needed.

(*c*) *Adaptability*—A reasonable degree of adaptability should be built into most parts of a hospital; to ask for anything more, *i.e.* for " flexibility," is to increase the cost very substantially as it means extensive demountable construction, and a multiplicity of service points. Bed accommodation will be relatively static compared with other parts of a hospital, and there is the added factor of the control of admissions within the hospital group as a whole. Even so, some degree of adaptability is needed in the ward layout to meet the emergency, changes in clinical demand and in sex distribution. In theory the size of a ward could be varied by oragnization on the basis of the smallest possible unit, *e.g.*, the bathroom; in practice the ward organization is tied to bigger units based for example on the treatment room (in charge of the sister) and the demonstration room (in charge of the medical chief).

But adaptability is not just a matter of organizational units; it is at least a matter of planning techniques. For example, a high degree of standardization of accommodation and components, plus the modular design of space and its related services would go a very long way to meet the need.

Conclusion

These discursive notes have not touched on many other aspects of ward design (*e.g.* nursing patterns, central supplies, call systems, food service, etc.), and if they indicate how far we have come in the understanding of the needs of the sick, the convalescent, and their nurses, they also indicate how far we have to go in providing them with a sympathetic environment.

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the theatre

PROF. DONALD DOUGLAS

The technical requirements of a hospital reach a point of complexity in the operating theatre. This all important speciality is discussed by Donald Douglas, Professor of Surgery at St. Andrew's University. Professor Douglas describes in turn the requirements of the surgeon, of the patient and of bacteriological control; and outlines the effect of these on planning and equipment.

The Operating Theatre Suite from the Surgeon's Viewpoint

A surgeon looks upon the theatres as his workshop in much the same way as a scientist his laboratory, a business

man his office or a craftsman his bench. His requirements may not be the same as those of other members of the staff or of the patient but it is important that his viewpoint should be appreciated by the architect.

In the section which follows the writer has attempted to lay down, in functional terms, the desiderata of a good operating environment.

(a) Team Work

A properly executed surgical operation is the result of the concerted efforts of many people and each has a vital part to play in bringing the procedure to a satisfactory conclusion. The surgeon's chief prop and stay is the theatre sister and it is upon her knowledge and training that the smoothness of the procedure chiefly depends. Since the surgeon is preoccupied with a narrow visual area and is constantly thinking ahead under conditions of great tension, it is difficult for him to give detailed instructions to the theatre sister without breaking his concentration. Hence a theatre sister who is capable of following the progress of a complicated procedure and of preparing the right instruments in the right order without instruction is a critical member of the team. It is a sign of a good team and of a properly trained sister if the surgeon has to say very little and if instruments flow from the theatre sister's hand to the surgeon's without orders. It is self evident that the sister must equally have an efficient staff nurse who can deputise for her and who knows the surgeon's techniques almost as well as she does herself.

Next in the team comes the chief assistant, usually a senior registrar. His role is that of an apprentice learning first by assisting and later by doing. A well trained chief assistant is an expert in displaying the essential tissues of the operation to the surgeon's view. He does this by placing and handling retractors effectively, by the judicious use of packs which hold tissues aside and by other technical wrinkles. He also becomes well versed in the stages of technical procedures.

Finally, the anaesthetist, in the past simply a man who rendered and kept the patient unconscious, is now a much more active part of the team, concerning himself with monitoring the patient's condition, with replacing his blood volume as necessary and with pre- and post-operative care.

The essential members of the team therefore are surgeon, theatre sister, staff nurse, chief assistant and anaesthetist and any design of a theatre suite must, in the writer's view, enable this vital group to work together from day to day. In current theatre suite design this aspect has not been sufficiently stressed.

(b) Environmental Conditions

Since many modern operations last for long periods up to five hours or more without a break, it is important that the staff should have comfortable working conditions. In the writer's view a temperature of 65–70° F with a relative humidity of 50 per cent. is ideal. There must be good ventilation, perhaps 8 to 12 air changes per hour. The theatre should be shielded from extraneous noise since this, if of a high intensity, can be most distracting during a worrying procedure. There should be comfortable ancillary accommodation so that the surgeon can dictate his operation notes immediately after the procedure. Comfortable shower baths and changing rooms are essential.

(c) Lighting

The problem of effectively illuminating deep cavities has not been really effectively solved in any theatre with which the writer is familiar.

The problem is a complex one since at least three different functional areas have to be considered, the operation field, the anaesthetist's field and the general theatre lighting. In addition total "blackout" may be needed for such endoscopies as cystoscopy, gastroscopy and sigmoidoscopy.

(i) THE OPERATION FIELD. The principal difficulty here is that the operation field is often at the bottom of a cavity with an oblique axis and six to twelve inches deep. The head of the surgeon and his assistants continually intervene between the light source and the objective. Finally, the field may change continually as the operation proceeds.

If there is to be good illumination, therefore, a highly flexible illumination system is necessary capable of being re-directed at a moment's notice.

It is highly desirable that the control of the direction and, if possible, intensity of the light beam should be by the surgeon himself since only he can say precisely when the illumination is ideal. The usual practice is that the surgeon gives orders to a nurse or orderly to tilt the operating light or move it as necessary. But this leads to two undesirable effects. First, the orderly moves into the operating area and raises the risk of bacterial contamination and second the lamp itself is tilted and moved directly over the sterile area and contaminated dust may fall on instruments, towels or the wound.

A great advance in theatre lighting would be a system whereby the surgeon could control multiple light beams with a foot switch by the side of the operating table whose source is outside the theatre. Multiple light beams are necessary to overcome the problem of shadows from the surgeon's head and shoulders. Light sources outside the theatre would overcome completely the problem of overhead movement of lamps. Remote control of light beams of this type would be a profitable field for research by lighting engineers.

(ii) THE ANAESTHETIST'S FIELD. Important indications of the general condition of a patient under anaesthesia is obtained by an examination of the face, lips and eyes. Pallor indicates blood loss, blueness inadequate oxygen uptake, sweating a low blood volume and fixed dilatation of the pupils extreme depth of anaesthesia or cerebral anoxia. The anaesthetist must therefore be able to inspect in good light the face and eyes of his patient. The lighting should approximate as nearly as possible to daylight. Too much red light will give him an unduly favourable impression, too much blue the reverse.

The anaesthetist must also be able in comfort to carry out such fine manoeuvres as intravenous injections and to read dials of monitoring equipment such as electro-cardiographs, temperature scales and so on.

(iii) GENERAL THEATRE LIGHTING. The intensity of general theatre lighting must be such that the theatre sister and her staff can select and manipulate instruments, some of them quite small with accuracy and comfort. The threading of fine needles with fine sutures is a typical task which must be allowed for. There are arguments for having a large element of daylight in general theatre lighting. Daylight is bactericidal, it makes for pleasant working conditions for the staff who feel "cooped up" without any windows to the outside world.

(d) Teaching

Like all technical skills, postgraduate surgery is taught by the apprentice system. The surgical trainee learns by watching, assisting, doing under supervision and finally doing on his own.

But the undergraduate training is quite different. Here we wish to show the student the general stages in an operation so that he can have an informed insight into the problems of surgery when called upon to discuss them

THE THEATRE (continued)

with patients and their relatives. This can best be taught by television techniques with a two way conversation between the viewing room and the operating theatre. A built-in television camera above the operating table but outside the theatre itself appears to be the best way of accomplishing this. If cost permits each theatre should have its television camera.

If viewing galleries are to be used in a theatre they must be outside the theatre itself. They must be overhead so that using a pair of opera glasses, a detailed view of the operation can be obtained. Laterally placed galleries are largely a waste of money.

(*e*) *Ancillary Accommodation*

All theatre staff should change into freshly laundered theatre clothing in changing rooms before entering the theatres. Hence comfortable changing rooms with showers and lockers are essential. In addition, there should be dictating room with dictaphones or with a special theatre secretary, to allow of dictating of operation notes immediately after the procedure.

Since modern operations often last for many hours and a break is often necessary, facilities for simple refreshment should be available in the theatre suite. This could be provided from the main refectory and served in a small theatre pantry.

difficult.

The Theatre Suite from the Patient's Viewpoint

The person who matters most in the theatre is the patient and it is important to think about his viewpoint. In general, though there are notable exceptions, the less experience the patient has of the theatre suite the better. The ideal would be for him to fall asleep in his hospital bed and wake up in the same place some hours later after the operation is all over.

There are serious technical objections to this, however. Chief among these is the danger of transporting unconscious patients from nursing units to and from the theatre suite. Inhalation of vomited material into the larynx causes deaths each year which could be avoided if immediate tracheotomy or bronchoscopy had been carried out. Since these are techniques quite outside the competence of the nurses and porters who accompany patients to and from wards, it follows that during the period of unconsciousness the patient should be under continuous observation by the anaesthetist. The latter certainly cannot be continually walking between theatre suite and ward unit. The inescapable conclusion therefore is that patients must be transported to and from wards conscious or sufficiently so to expel vomitus by coughing. If we accept this, and accept it we must, the patient is entitled to a peaceful unhurried transit to the theatre suite and a reception in a quiet atmosphere without having to lie on a trolley in a theatre corridor with people hurrying to and fro. There is much to be said for a reception ward in the theatre suite to which patients can be taken in good time and without hurry and in which they will be under the control of the anaesthetist who can carry out pre-operative treatment such as aspiration of the stomach and the setting up of intravenous infusions. Pre-operative sedation could also be administered there at the discretion of the anaesthetist.

From the reception ward, the patient can be moved to the appropriate anaesthetic room with the minimum of fuss and at exactly the right time.

The patient is equally entitled to a peaceful recovery of consciousness in good surroundings, usually the recovery ward in the theatre suite. It is a sound principle that no patient should be returned to the ward unit until he has recovered consciousness.

Bacteriological Control

Dr. Somerville has already discussed bacteriological control in another part of this issue; but, since the main object of a theatre suite is freedom from micro-organisms, something further must be said of the detailed problems this poses.

(1) *Theatre atmosphere*

The main source of dangerous organisms in the theatre atmosphere is believed to be material brought from the ward units in the form of sheets, blankets, clothing and so on. In addition talking and coughing may propel organisms from the mouth and nose of the staff. Very few if any dangerous organisms come from the open air. It can be shown by using plenum ventilation bacterial counts and can be reduced almost to zero as long as no movement of staff takes place. Whenever this occurs there is a rapid rise followed by a gradual fall.

It would be good architectural practice therefore to design the theatre in such a way that minimum movement of personnel was necessary and that unsterile material of any kind was excluded from the theatre. Woollen blankets and outdoor clothing in particular should never be permitted. To achieve minimum movement more use might be made of automation in the delivery of instruments and so on from sterilizing room to theatre and from theatre to sink room. To exclude outdoor clothing a definite psychological and physical barrier should be placed between the hospital proper and the theatre across which no clothing can pass which is not clean and freshly laundered. It is perhaps worth noting here that the practice of planning twin theatres with common facilities and which was so common after the war has now been virtually abandoned because they make bacteriological control more difficult.

(2) *Infection from Personnel*

The anterior part of the nostrils seems to have a special attraction for the pathogenic staphylococci which are among the most troublesome of the micro-organisms.

The theatre area must be regarded as a place where mouth and nose must be covered in such a way that pollution does not occur through talking and coughing.

(3) *Instruments and Dressings.* (M.R.C. Report, *Lancet*, 1959, *i*, 425)

The sterilization of instruments and dressings has been the subject of a recent detailed study by a sub-committee of the M.R.C. After a wholesale condemnation of most hospital sterilizers the committee makes the following recommendations.

(*a*) Replacement of old sterilizers with high pre-vacuum steam sterilizers with automatic control. In this way the human error in the process may be largely eliminated. The sterilizers should be of rectangular shape for ease of packing and should be tested from time to time with test spore preparations. Bacillus stearothermophilus is a suitable non-pathogenic organism.

(*b*) Replacement of metal drums by packs, two layers of fabric being used. The risk of aspiration of contaminated air on cooling is thereby diminished since here is no rigid container.

(*c*) All instruments, dressings and lotions should be sterilized in this way; sterilizing by boiling should be abolished. These are the M.R.C.'s conclusions, but we should not lose sight of the possibility of sterilizing by high energy gamma irradiation. For example, this is used already as a means of sterilizing blood vessel grafts. The grafts are freeze-dried, sealed *in vacuo* and

irradiated at Harwell with doses of about 3 × 10^6r. The grafts retain their physical characteristics and even microscopically appear normal or nearly so.

If animal tissue can be sterilized in this way without physical change, it seems likely that vegetable tissue such as cotton, linen, wool and metals such as steel would be unaffected. Perhaps a cobalt cource might be practical. If it proved to be so there are theoretical advantages, since the heat used in conventional sterilization has a very deleterious effect on rubber and to a lesser extent on fabrics and metal. Since a cobalt source is continually giving off high energy rays night and day, a 24-hour largely automatic sterilizing source might be provided without any increased cost. A corollary of this is that it might be possible to provide cheaply so many duplicate sets of sterile packs to the theatres that sterilizing in the theatre suite itself could be reduced to facilities for emergency sterilization of single instruments wanted in a hurry or dropped on the floor.

(4) *Equipment*

The problem of keeping bulky equipment bacteriologically clean is a difficult one. Such apparatus includes anaesthetic machines, pulmoflators, instrument and operating tables, recording and perfusion equipment. These are usually swabbed over with an antiseptic solution before and after the day's operating. Dettol and ethereal soap is commonly used. This by no means sterilizes them but simply removes gross particles and leaves a layer of antiseptic. The walls to a height of 7 feet are similarly dealt with.

This problem of sterilizing bulky equipment might merit further study. Perhaps antiseptic vapour might save a great deal of time and labour. A fumigating chamber in the theatre suite might be worth looking into.

The Sterile Zone

How much of the theatre suite should be regarded as within the sterile zone? It is obviously impossible to include the whole suite since there must be an area into which staff and patients enter from the hospital proper. It seems sensible to have three zones in the suite, (1) the *sterile zone* including the theatres, sterilizing rooms and anaesthetic rooms, (2) a *clean zone* including the reception and recovery wards, the office and dressing accommodation, instrument rooms, (3) *Disposal zone*, including the sink rooms and special corridors serving them.

There should be no communication whatever between the first two zones and the disposal zone. The disposal zone serves entirely as a route of discharge of dirty, infected and waste material from the theatre suite. Ventilation should be so organized that air flows from the sterile zone into the other zones and never in the reverse direction. In a complex area like a theatre suite, this poses a difficult problem for the engineer.

The points of ingress to the sterile zone from the clean zone must be clearly marked and recognizable by everyone including untrained persons such as nursing probationers. Entrance must be prohibited unless outdoor clothing has been discarded and theatre wear worn. Beds coming from the reception ward to the anaesthetic room must be cleaned down with antiseptic and all ward blankets and linen discarded.

(1) *Position.*—In view of the foregoing bacteriological considerations, it will be seen that there is a great deal to be said for siting the theatre suite in a cul-de-sac of some kind or at all events away from main hospital traffic. It should be regarded, functionally, by the architect as a sterile zone in which no traffic other than that specific to the theatre can be permitted. Casual visitors should be discouraged. Against this must be placed the need for reasonable proximity to the surgical wards.

(2) *General arrangement of rooms* (Fig. 1).—From the hospital area there are two entrances and exits to the theatre suite for patients and staff respectively. The normal mode of entry for patients is into the reception ward. There, ward linen and blankets are removed and fresh theatre linen substituted. The beds are cleaned down with antiseptic solution. Similarly the patient's exit would normally be from the recovery ward. Staff would enter and leave the suite through the changing rooms and anaesthetic department.

From the reception ward, the patient is taken in bed through an air-lock, to the appropriate anaesthetic room and transferred to an operating table. The bed is removed to the exit room in the theatre. After anaesthesia is induced, the patient is taken to the theatre and back to the exit room after the completion of the operation. From there he is transferred to the bed and back through the air-lock to the recovery room. After recovery of consciousness he returns to the ward.

The staff enter the suite through the changing rooms where outdoor clothing is discarded and enter the sterile area proper through an air-lock. Sink room staff enter through the disposal corridor and do not enter the theatre sterile area at all.

The recovery and reception wards are served by common ancillary rooms of standard type.

(3) *Details of an individual theatre* (Fig. 2).—The essential elements are the anaesthetic and exit rooms, the scrub-up room, the sterilizing and sink rooms and the theatre proper.

The anaesthetic room should be big enough to accommodate bulky anaesthetic equipment and to allow of easy movement of a bed and an operating table. About 50-180 sq. ft. would be adequate. The exit room has no equipment and serves only for transference of the patient from table to bed; 100 sq. ft. is sufficient. The scrub-up room should be big enough to accommodate 4 people scrubbing at once and for the laying out of sterile packages of caps, masks, gowns and gloves, perhaps 150 sq. ft. In the sterilizing room trolleys are prepared with sterile linen and instruments to serve for a complete operation. At least two and sometimes three sterile trolleys will be laid for each case. It should be about 180 sq. ft. The sink room can be smaller since only the washing of instruments and the placing of them in the autoclave occurs there; 120 sq. ft. should be adequate. Between the sink room and the sterilizing room is a pre-vacuum automatic autoclave through which all instruments pass. This is the only communication between sink room and sterilizing room.

The operating theatre itself should be not less than 400 sq. ft. The trend to small theatres was, in the writer's view a mistake since it increased the risk of overcrowding and contamination of sterile by unsterile personnel. Modern techniques in anaesthesia and resuscitation require bulky equipment which takes up much floor space. It is true that some monitoring equipment could be accommodated in special galleries but a good deal must still remain near the patient. One or two theatres in the suite should be larger, say 500 sq. ft., to accommodate specially bulky equipment.

The shape of the theatre should be as nearly square as is convenient but all corners should be rounded off for ease of cleaning. Wall heights should not be higher than 10 ft. for the same reason.

THE THEATRE (continued)

Influence of the Nature of the Operative Work on Theatre Design

It is obvious that when only simple operations are undertaken, for example in cottage hospitals, complex theatre arrangements are unnecessary and something much simpler than the foregoing will suffice.

But even in large hospitals there are degrees of complexity of operations. Thus in neurosurgery, urology and orthopaedics, complex and bulky equipment is often necessary —radiographic, stereo-tactic and so on. This is bound to lead to a greater demand in floor space both because of the size of the equipment and because of the number of people controlling it. In cardiovascular surgery the use of heart-lung machines with monitoring equipment to give information about the patient's condition is a specially complex matter. The equipment may be measuring simultaneously pressures in (1) the arterial blood, (2) central venous blood, (3) in the various heart chambers, (4) recording the activity of the heart by electro-cardiography, (5) the activity of the brain by electro-encephalography and finally (6) oxygen saturation of peripheral blood. Thus six different variables may be measured at once on a multi-channel oscilloscope. In addition to this bulky equipment, the heart-lung machine together with its attendants takes up much space and the anaesthetic apparatus is also bulky.

Recently in the United States attempts have been made to remove much of this equipment from the theatre floor by building, adjacent to the theatre, a special equipment laboratory in which the technicians could work. This is a most desirable development but is limited by the fact that the leads from the patient and the manometer leads must be in the theatres and the oscilloscope must be completely visible to the surgeon, anaesthetist and cardiologist.

There is room for a good deal of work by engineers on the problem of spatial dissociation of monitoring equipment from the patient and the visible oscilloscopic screen.

At all events it is clear that at least two theatres in the theatre suite should be materially bigger than the others or alternatively should be fitted with special equipment galleries or laboratories.

Number of Theatres

A period of cleansing and ventilation is important between each case to allow the bacterial count to fall to low figures. If too many cases are put down for operation in one theatre, there is a strong temptation to hurry between cases so that the staff can finish work at a reasonable hour. Hence the last case at the end of a long list is likely to have a greater chance of infection than the first case. There is evidence from the writer's own unit that this is so. Thus the overall infection of clean cases is about 2 per cent whereas in cardiovascular cases which are always first on the list the rate is 0·25 per cent.

In order to avoid overloading the theatres, there should be one theatre for 30 surgical beds. Thus in a hospital with 180 surgical beds six theatres should be provided. Not more than three major cases should be operated on in any theatre per day if theatre contamination is to be kept at the lowest possible figure.

Size of Reception and Recovery Wards

One bed per 20 surgical beds for each of the reception and recovery wards seems adequate. Thus for 200 surgical beds 10 reception and 10 recovery beds should be provided. This gives a 20-bed charge for a ward sister and her staff. As mentioned, the usual ward ancillary accommodation should be provided common to both units.

If four operating teams were in action, rather more than two cases for each theatre could be brought down to the reception ward early in the day. Once there, they should be under the professional care of the anaesthetist.

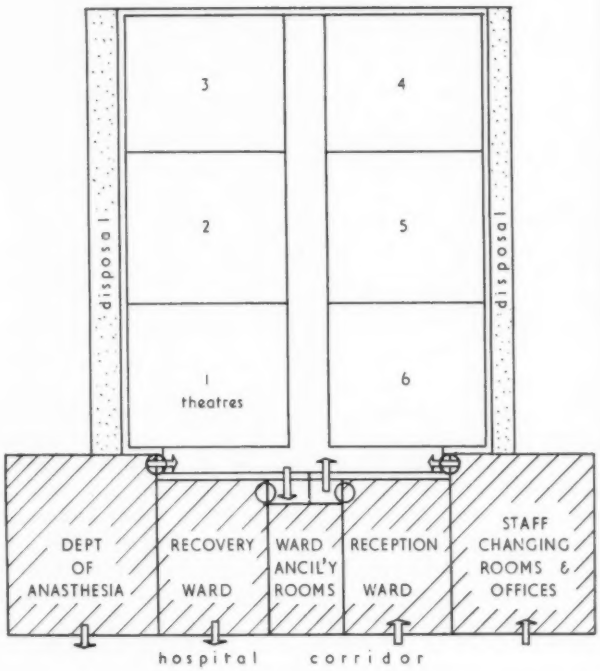


Fig. 1. General layout of theatre suite (not to scale). The "clean" area is hatched, the "sterile" area enclosed in double lines, the "disposal" area stippled. Air locks are situated at the four points of ingress and egress.

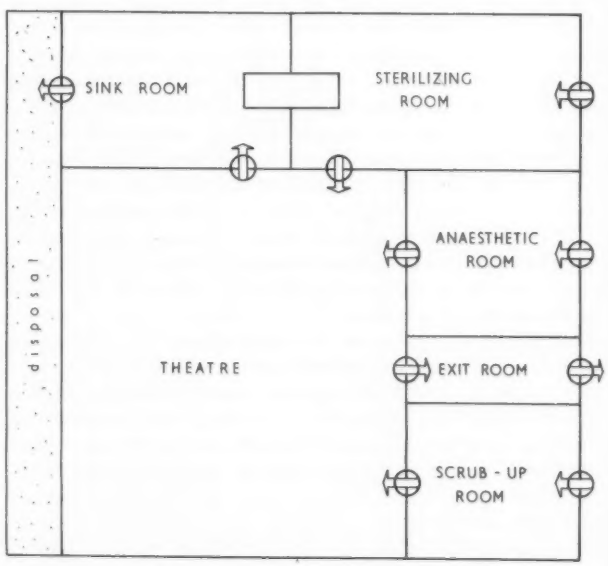


Fig. 2. General layout of individual theatre complex (not to scale). The sterilizing room is sited to receive instruments and dressings from the "sterile" corridor.

the laboratories

JOHN MUSGROVE

Of recent years the Nuffield Foundation Division for Architectural Studies has done much work on Laboratory Design. A member of the Division, John Musgrove, here discusses the types of laboratory wanted in hospitals. After raising the problems of how far you can " embed " the research facilities in the patient areas (raised in an earlier paper by Professor Hunter), he proposes that some of the more expensive facilities should be shared between adjacent laboratories. He also puts forward the concept of a " unit of laboratory space " which will be so designed that it can accommodate different disciplines as requirements change.

There is an increasing emphasis on laboratory accommodation in the hospital complex, partly as a result of developing diagnostic techniques, and partly because of a growing interest in on-the-spot clinical investigation. In non-teaching hospitals, the laboratory function has usually been largely diagnostic, and indeed, the tendency is still to think in terms of the " path-lab." Nevertheless, the clinical pathology department may now embrace half a dozen or more disciplines, practising specialized techniques. The laboratory element in hospital planning, must be regarded as an expanding one; clinical research, as well as investigation in the diagnostic sense, is receiving more attention in non-teaching hospitals, and the demand for research accommodation in the teaching hospitals is greater than ever before. The architect may be called upon to provide for routine work and research work in pathology, bacteriology, biochemistry, pharmacology, and the related disciplines such as haematology, histology, cytology, etc., as well as various combinations of some or all of these disciplines in clinical departments as widely different as surgery and psychiatry.

General Planning

The relationship of diagnostic laboratories to patient areas remains broadly the same in all hospitals. Samples and specimens are brought to the laboratory either by courier or by a pneumatic tube system, but the occasional need for consultation between the laboratory worker and his clinical colleague remains a very real one and argues for a not-too-remote plan position. In teaching hospitals, the relationship is further complicated by the teaching laboratory element, and by the desirable close association of the clinical laboratory with patient accommodation, teaching areas, and with the paraclinical diagnostic and research laboratories.

The paraclinical departments must cater for diagnosis, research, and teaching; all three functions may be (and usually are) carried on by the same staff. In addition, to encourage clinical research and investigation, there is a tendency to seek a close clinical/paraclinical link, so that the clinician may conveniently seek the help and advice of the university worker in the paraclinical departments. The circulation requirements may, therefore, be grouped, as follows: the need to provide for each relationship will, of course, depend upon the type of hospital, whether teaching or non-teaching, and upon local circumstances such as whether or not any given department has the opportunity or the wish to carry out research.

1. *Patient areas* (wards and outpatient department, operating theatre suite)/*diagnostic laboratory*. This has been mentioned above. Circulation may be by pneumatic tube, to and from a collecting point (probably called a reception area at the laboratory end). The need for consultation between clinical and laboratory worker is of importance. Most outpatient departments will be equipped with local laboratories to deal with simple procedures: only more complex work from this source will be taken to the diagnostic laboratory, and when this is necessary, the patient may be transferred to a ward for observation. The diagnostic laboratory function is similar in both the teaching and non-teaching hospitals, except that in the former the laboratory accommodation for the clinical departments will have a prior claim to close association with patient areas. (Clinical investigation and research are dealt with separately below in item No. 4.)

2. *Clinical and paraclinical departments/teaching areas.* The ideal arrangement for undergraduate teaching is one in which the students can reach the teaching laboratories from a medical school entrance or concourse, from the canteen, etc., without going through patient areas or laboratory areas. If the library, museum, etc., can be associated with this traffic route in the same way, it is desirable to do so.

3. *Routine diagnostic laboratory/research laboratory/special accommodation.* The desirability of a close link between diagnosis and research within and between departments has been mentioned above. In addition, in teaching hospitals (and possibly in non-teaching hospitals in the near future), there must be easy access to special areas such as the animal house (from pathology, biochemistry, pharmacology, experimental surgery, for example) and possibly to a department of physics (isotope preparation and dispensing) from biochemistry, for example.

4. *Clinical investigation and research/patient areas.* Apart from the laboratory areas which are planned as part of the ward, clinical investigation is demanding specialized accommodation closely related to wards where patient investigation can be carried out in close association with the more conventional routine work. It is obviously necessary for this accommodation to be as near to wards as possible, and indeed, it is an important question at present as to how far such areas can be " embedded " in the patient areas, when the relationship with other departments, common staffing, etc., are taken into account.

5. *Other relationships.* In addition, there may be other minor relationships to consider. For example, in teaching hospitals, surgery with pathology, medicine with therapeutics, etc. Over-all relationships between the departments and central storage facilities, workshops, etc., must also be borne in mind. Little attention has been given in the past to the possible economies which can be effected by grouping facilities which may be needed in a number of related departments. Expensive facilities (cold storage animal accommodation, etc.) are often provided on a small scale in a number of areas, widely separated and individually controlled by the immediate users. Such facilities may be economically grouped and shared, pro-

THE LABORATORIES (continued)

vided that the necessary arrangements for staffing and shared use are made between the people concerned. Such arrangements may involve a new outlook on hospital laboratory organisation which the writer believes is well worth exploring when new laboratory buildings are being planned.

A complex servicing system must be carried to all laboratory areas, and the arguments for keeping the service routes simple and direct are overwhelming: it reduces installation costs and simplifies maintenance and modification to meet demand. Servicing economy is a major consideration in laboratory building costs (see below) and should play a large part in determining the layout of rooms; and in hospital laboratories may also influence the relationships between the laboratory group and the other major elements.

The approach to laboratory design described here has been evolved during a study of laboratories carried out by the Nuffield Foundation Division for Architectural Studies, and is aimed at providing a high density (in terms of serviced working area per unit of total floor area) building which combines the advantages of limited adaptability and thus of convenience, with reasonable economy in initial and running costs.

Assessment of Space Requirements

The principal demand in hospital laboratories is for serviced bench space (the latter term should be taken to include serviced wall space); i.e., for space for carrying out work of the scale usually associated with conventional bench-type laboratories.

Room or bay size for such buildings is determined by the depth of benches (or built-up rigs), the space required for service lines to the benches, the distance between the benches, and the length of serviced bench (or wall) to meet the demands of workers in a given discipline. From these fundamental dimensions, the sizes of rooms are built up. Each is dealt with briefly below.

Bench Depth and Service Rooms. Recent anthropometric studies suggest that arm reach across a work bench prohibits the use of a working surface (for actual manipulation) of more than about 2 ft. 0 in.; the back part of many laboratory benches of 2 ft. 6 in. or more in depth are used for local storage, and there can rarely, if ever, be a valid argument for making benches deeper than 2 ft. 3 in. The latter depth may be needed in positions where large items of equipment (ovens, incubators, etc.) are carried on benches.

Movable benches in comparatively short lengths are essential to ease and economy of internal adaptability, and are made possible by the use of semi-permanent service spines, which, of course, also occupy floor space. The thickness of the service spine will depend on the range and complexity of the services carried in it; 5 in. to 6 in. may be adequate in some cases, but up to 8 in. is common, particularly if cup-sinks are provided in the spine in order to maintain complete mobility in the bench units.

Bench Spacing. Many factors—safety, ease of working and communication, as well as anthropometrics—determine bench spacing. The clear space in front of a working bench should never be less than 4 ft. 0 in., and this is not sufficient if back-to-back working is envisaged. 4 ft. 0 in. may, therefore, be regarded as a minimum, and suitable for single depth working. The spacing for back-to-back work should not be less than 5 ft. 0 in. and may be up to 6 ft. 0 in. where there is trolley traffic or where the inter-bench space also serves as circulation space for other workers.

Bench Length. A great deal of work, on survey lines, has been carried out by the Nuffield Foundation on bench lengths to meet demand, but in the compass of this article it is sufficient to say that by far the most adaptable method of providing working length (taking account of the most common sizes of working team, as well as the needs of individuals) is in comparatively long, straight runs. A serviced bench or wall of the order of 24 to 25 feet in length, placed at right angles to the window wall on either side of a deep room or bay shows many advantages in flexibility of use. It allows items such as fume-cupboards, wash-up sinks, etc., to be placed along the service runs without cutting down working space to an unacceptable size, it provides working areas which are suitable to individuals in a large range of disciplines, and compact, economical accommodation for teams of 2, 3 or 4 workers in various disciplines.

In the hospital context such a bay would provide accommodation for 3 or 4 workers in a medium-use discipline such as pathology or bacteriology or for 2 or 3 workers in a high-use discipline such as biochemistry (the actual number housed would depend upon factors such as whether separate office accommodation was also provided, and the serviced length taken up by standing equipment such as refrigerators).

Standardization and Adaptability

It is suggested that *a unit of laboratory space* is used, and that such a unit can be dimensioned in such a way as to cater for all the bench-scale disciplines. In designing such a unit, no restriction is placed on staffing methods, and greater attention can be paid to economy of servicing and furnishing, as well as to economy of over-all building shape and density of usable space. The range of dimensions for such a unit is shown in Fig. 1. Taking account of partition widths, the range for a service grid width is approximately 10 ft. 0 in. to 12 ft. 0 in. Experience has shown that from the point of view of interchangeability between the disciplines, a width of 11 ft. 0 in. to 11 ft. 6 in. places the least restriction on use.

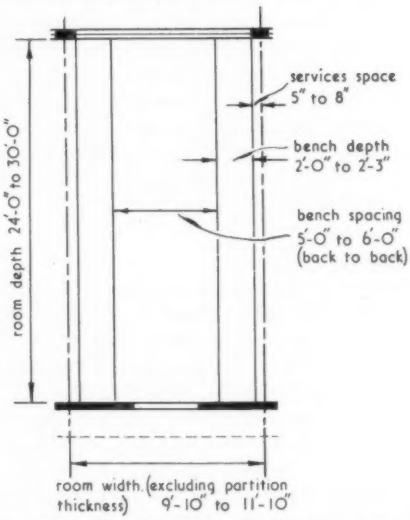


Fig 1. A proposed unit of laboratory space.

It will also be seen from Fig. 1 that a short length of horizontal sub-main* caters for long runs of serviced

* For buildings up to five or six storeys, central horizontal sub-mains are more economical in first cost than either vertical sub-mains placed at grid points or perimeter sub-mains. Vertical sub-mains have great advantages in accessibility for maintenance and modification, and may be justified on these grounds in multi-storey buildings.

bench or wall, and, arranged in this way, leaves the outside walls free to accommodate the heating and/or ventilation system.

Special attention must be paid to lighting in rooms of this depth, but recent work on permanent supplementary artificial lighting now enables the designer to combine natural and artificial sources in such a way as to permit full use to be made of the advantages accruing from deep rooms. Articles on this subject in relation to laboratories and other buildings have been previously published in this journal and it is not proposed to enlarge upon it here.

Partial artificial ventilation may be needed in rooms of great depth, especially in chemical or biochemical laboratories. It should be remembered, however, that make-up air for fume extraction may be essential in such laboratories in any case, and the extra cost involved in extending such systems to deal with room ventilation where no fume cupboards are in use, may be marginal. A further consideration here is the desirability of some form of artificial ventilation in rooms where radioactive or other toxic or dangerous substances are used. The number of such rooms is ever-growing and suggests that artificial ventilation of laboratory areas generally should be considered seriously.

the casualty department

M. J. BLANCO-WHITE AND P. C. RENDLE

The problems involved in the design of casualty departments is being studied by a team comprising a doctor, an architect, a nurse and a work study officer. In this article M. J. Blanco-White and P. C. Rendle describe the work of the team. They have proceeded to examine the problem in four aspects: to find out what the casualty load comprises, to determine how much work this involves, how many staff must be accommodated and, finally, what facilities are needed. The aim is to evolve, thereby, firm principles upon which the design of the casualty department may be based.

An attempt is being made to evolve some principles for the design of casualty departments by means of a rather more detailed approach than has hitherto been customary. The work of casualty departments is being studied and quantified to provide a basis for designing or redesigning these departments so that they will be closely fitted for the work to be performed in them. The team carrying out the study comprises a doctor, an architect, a nurse and a work study officer. All have had some work study training and the team provides what seems to be the minimum range of skills needed for the exercise.

The method has been to find out what the casualty load comprises, how much work it entails and, consequently, how many staff must be accommodated at the same time and what facilities they need. Thus, if an item of treatment takes half as long again in one hospital as in another, there is a corresponding effect on the accommodation required. It is, moreover, possible to estimate the likelihood of waiting at various stages in the department and to aim, in the provision of facilities, at a definite rate of progress for patients.

Load

The load of a casualty department may be made up, broadly speaking, of all those persons requiring, or thinking they require, the services provided by hospitals, other than:

(*a*) out-patients attending specified clinics; and
(*b*) arranged admissions.

It is important to note that the casualty department is not dealing solely with traumatic injuries more or less immediately after the event. The casualty service is concerned with the whole range of casual attenders at hospitals.

An analysis was first made of 4,000 first attendances at the casualty department of a hospital in a Scottish city in order to establish three main facts, the range of casualties, the range of treatments given and the distribution of arrival times. While each casualty department will have its own pattern for these factors, a relatively small survey would establish for any department to be rebuilt any significant deviations from published figures.

The distribution of broad categories of injuries was found to be as follows:

Lacerations	*Bruises or sprains*	*Fractures*	*Infections*	*Multiple injuries*	*Foreign bodies*	*Pain*	*Other*
25%	25%	12%	12%	7%	6%	6%	7%

These injuries led to the processes set out in Diagram 1. While the percentages of injuries following each path are for this particular hospital, the several paths are typical of any department. The essential stages are: reception, examination, diagnosis, treatment, and disposal. Examination and diagnosis are always done by a doctor and a quarter of the treatments are also carried out by him and, in practice, the medical staffing is the key to the possible rate of flow of patients through the department. In this sample, the diagnosis of 38 per cent. of injuries was assisted or confirmed by X-ray. Of the treatments carried out in the casualty department itself, three times as many were done by nurses as by doctors.

Nearly 30 per cent. of injuries were referred elsewhere for treatment. This proportion depends, of course, on the organization of the hospital and of the casualty service in the district; but its size indicates the importance of organizing the service in depth—in the main hospital building and elsewhere. This category, moreover, includes the more serious casualties. The diagram also shows how many patients need to use the various facilities (e.g., the theatre) over a period.

The arrival times of the patients in the sample are in course of analysis. Casualty departments all suffer from peak loads from time to time, whether daily, weekly or seasonal peaks. These peaks must be analysed and if possible ironed out. The casualty load in the commonly accepted sense—the accident load, the case requiring immediate attention, is the most random element; but other important elements in the load are patients returning for further treatment or dressings and patients referred by their general practitioner. It needs to be seen whether an attempt

THE CASUALTY DEPARTMENT (continued)

should be made to spread the return cases, for example, or concentrate them at quiet times or when staff is available. General practitioners might be encouraged to ask non-urgent cases to attend at specific times. If the return load is concentrated at a time when new arrivals are also frequent—as is often the case—the accommodation has to be greater, but much of it will only be in use for casualty work for limited periods. The surplus accommodation may, however, be designed so as to serve a dual use, for example, as an out-patients' clinic in the afternoons.

The aim should be that any regular peaks (which cannot be planned away) should be within the capacity of the department and that only infrequent peaks cause any appreciable delays to patients.

Work

While the load determines what range of facilities is required in a casualty department, the extent to which each facility must be provided cannot be decided until the time needed to do the work is known.

The times taken to carry out various aspects of casualty work have been studied in some detail. Table 1 (facing page) gives the mean times taken by doctors in examining and treating patients at various casualty departments. The range of times in each department has also been studied and the greater the mean time, the greater is the range. In this connection it must be pointed out that, ultimately, broad units are being dealt with, *e.g.*, there will be one or two doctors at work perhaps; or the choice may be, say, between four, six or eight treatment cubicles; between one or two minor theatres; or between a separate X-ray unit or one shared with another department. Extreme accuracy of times is not material; but it is of value to determine the order of times of the various processes, with the reservation that the sequence of long, medium and short cases cannot be predetermined.

Table 1 shows the results of a survey of doctors' work in eight hospitals. In each of Hospitals 1 to 4 about 150 first attendances were recorded, while in each of the others, about 30 first attendances were surveyed as a rough indication of the difference between hospitals. The times recorded include all doctors' activities in dealing with one patient —examination, diagnosis, writing of records, discussion of, or telephoning in connection with, the case, and time spent in treatment. Six main influences on the time spent by the doctor were noticed. High pressure of work on the casualty doctor naturally influences the time which can be spent, but in a well-run department without much pressure of work the time may be short notwithstanding. The seniority of the doctor always affects the rate of working, more experienced doctors being quicker, as might be expected. The nature of the work to be done—whether treating relatively serious or trivial injuries—affects the time required; some indication of this factor in the hospitals surveyed is given by the percentage of patients who were given treatment by a doctor; about twice as much time is required when a doctor's treatment is given. A further factor affecting the doctor's time is the support he receives from the nursing staff, orderlies and clerical staff so that time need not be spent in writing particulars of patients for the records, ushering and so on. Junior doctors and especially students often receive less support and this again lengthens time required for their work. An important part of the doctor's work is the time spent in recording his diagnosis and specifying treatment; this may take over a quarter of his time per patient but it can be reduced by, for example, pre-planned records. Another factor which affects the times is the degree of specialization among doctors: in Hospital 7 the patients were divided into two streams, orthopaedic injuries and others, and thus in each section the work was fairly specialized.

Similar studies have been made of times taken by nurses and by the staff in the plaster room to treat patients. Further surveys have covered the time spent by patients requiring to be X-rayed.

The work actually performed by the staff may be broken down into necessary and unnecessary work. This latter may be: (*a*) Waiting (*e.g.*, for telephone contact or for the use of equipment).

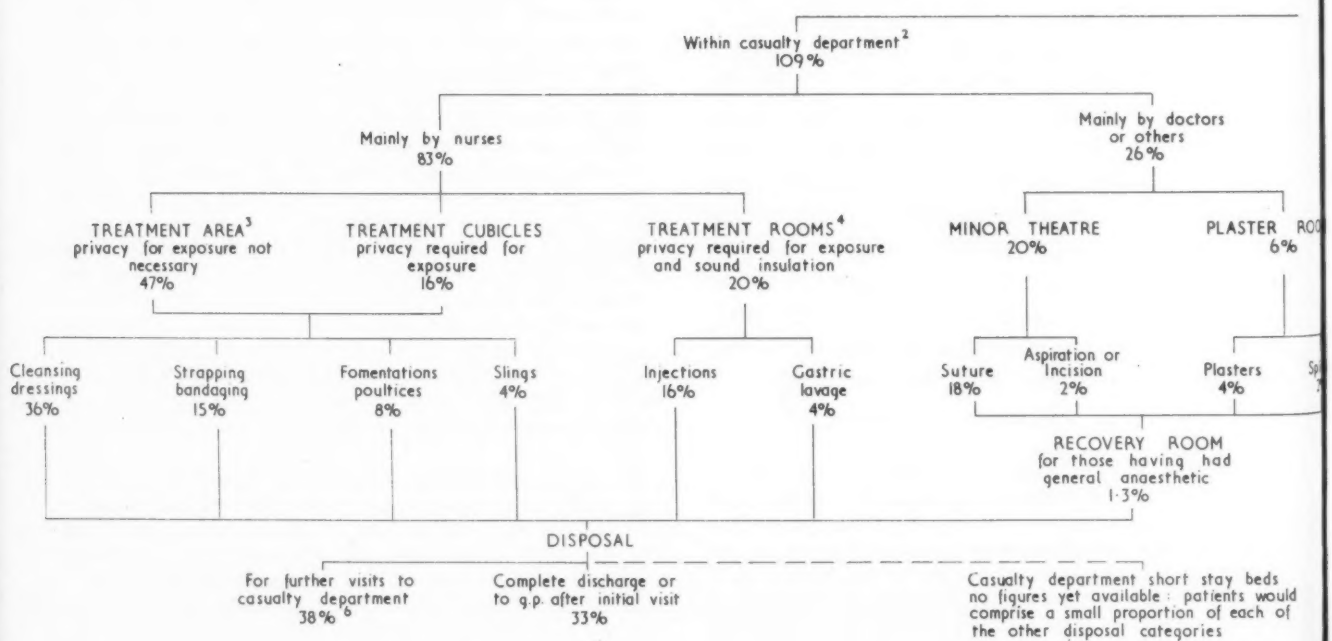
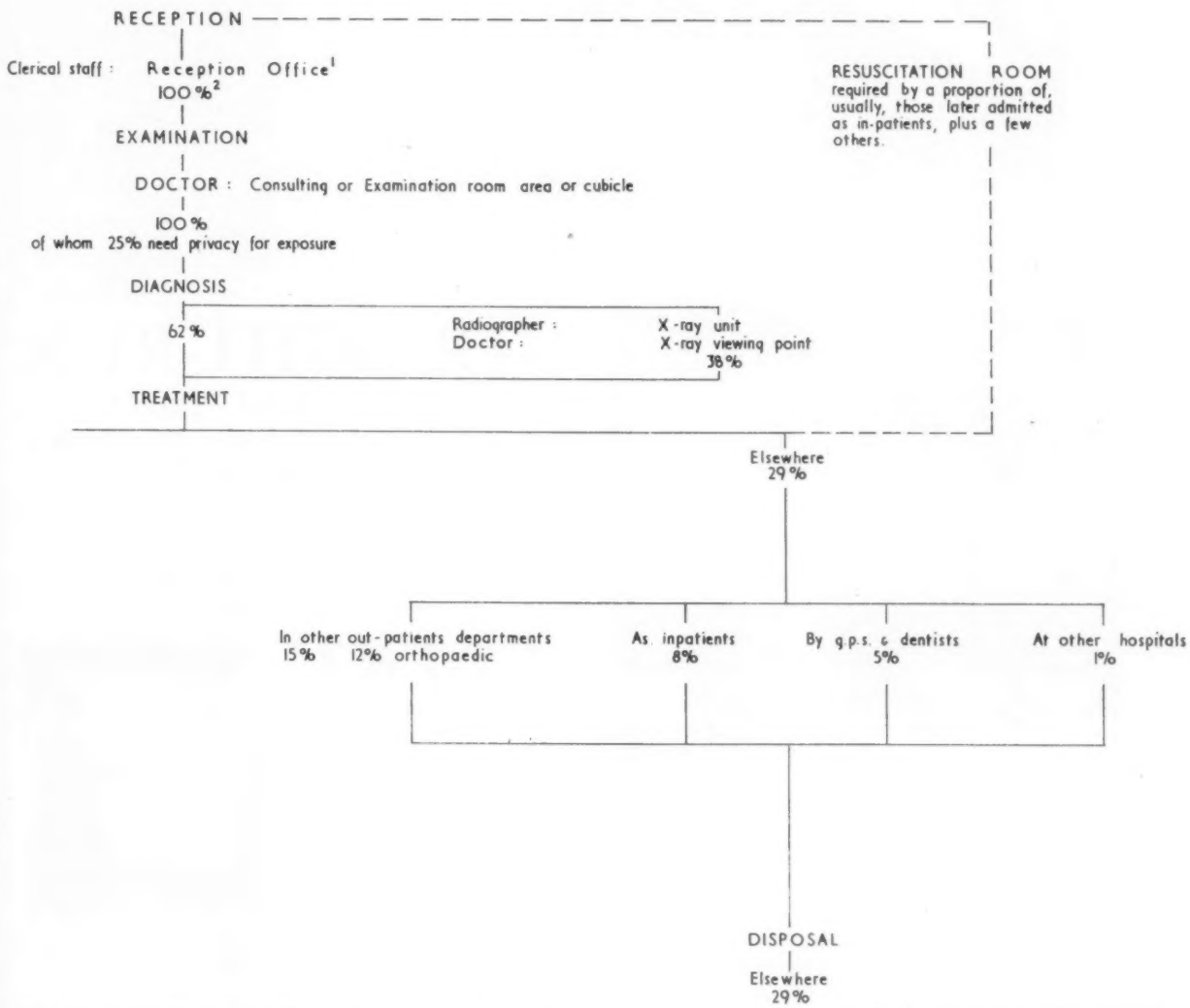


Table 1. Mean Doctors' Time per Patient in Minutes

		Junior House Officer, House Resident, or Student	*Senior House Officer or above*	*Patients* TREATED *by:*		*Patients* NOT TREATED *by:*		*% of patients treated by doctor*	*% of doctor's time spent writing*	*No. of new patients per day per doctor†*
				J.H.O. or student	*S.H.O. or above*	*J.H.O. or student*	*S.H.O. or above*			
Hospital 1:	new patients	12·6	—	19·6	—	7·7	—	41	23	—
	return patients	3·2								
Hospital 2:	new patients	12·6	8·3	20·8	18·5	8·0	5·3	28	20	22
	return patients	2·6*								
Hospital 3:	new patients	7·2*		12·0	—	5·5	—	28	27	75
	return patients	2·5*								
Hospital 4:	new patients	13·8	—	18·6	—	10·8	—	39	—	13
	return patients	—	—							
Hospital 5:	new patients	7·5*						28	—	14
	return patients	2·2*								
Hospital 6:	new patients	—	8·3					33	25	16
	return patients	—	1·6							
Hospital 7:	new patients	—	4·7					16	23	25
	return patients	—	1·8							
Hospital 8:	new patients	7·0*						39	18	26
	return patients	—	1·6							

* Doctors of different seniority worked together. † Includes doctors working day or night in the department.

Diagram 1. Processing of Casualties on Initial Visits. (Percentages based on an analysis of casualty records of a Scottish city hospital.)



1. All arrivals are registered: some 80 or 90 per cent. register at the office personally or through relatives, etc. Otherwise, office staff may attend on a patient in an examination or resuscitation room to take particulars or failing that, seek information from police or ambulance attendants.

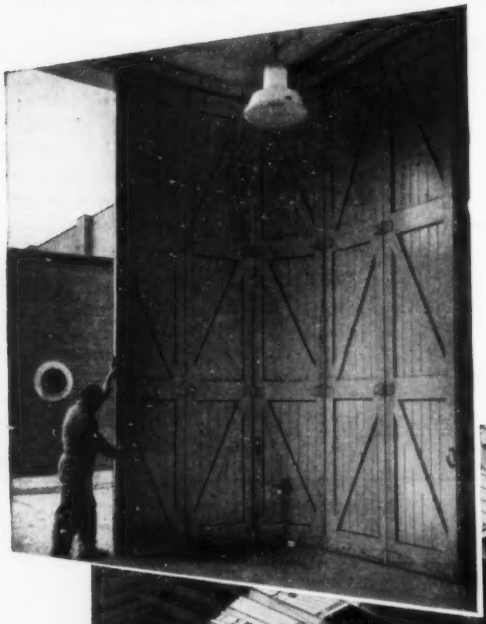
2. Percentages are of the total number of injuries. There are rather more injuries than patients and appreciably more treatments than injuries. (Treatments within the department are 109 per cent. of the injuries arriving there and 154 per cent. of the injuries treated there: e.g., many patients have an injection and a dressing.)

3. It is taken that privacy on grounds of exposure is not necessary (though it may be provided) for treatment on throat, face and head, elbow and below, and lower leg and below.

4. A room (rather than a cubicle) is required for injections for children: but it is a matter of opinion whether or not a cubicle would normally suffice for adults.

5. In the hospital concerned, fractures when diagnosed are sent to the orthopaedic out-patient department when it is functioning.

6. The 38 per cent. of injuries necessitating return visits involve three return visits on average. The ratio of total initial visits to total return visits is about 1 : 1·2



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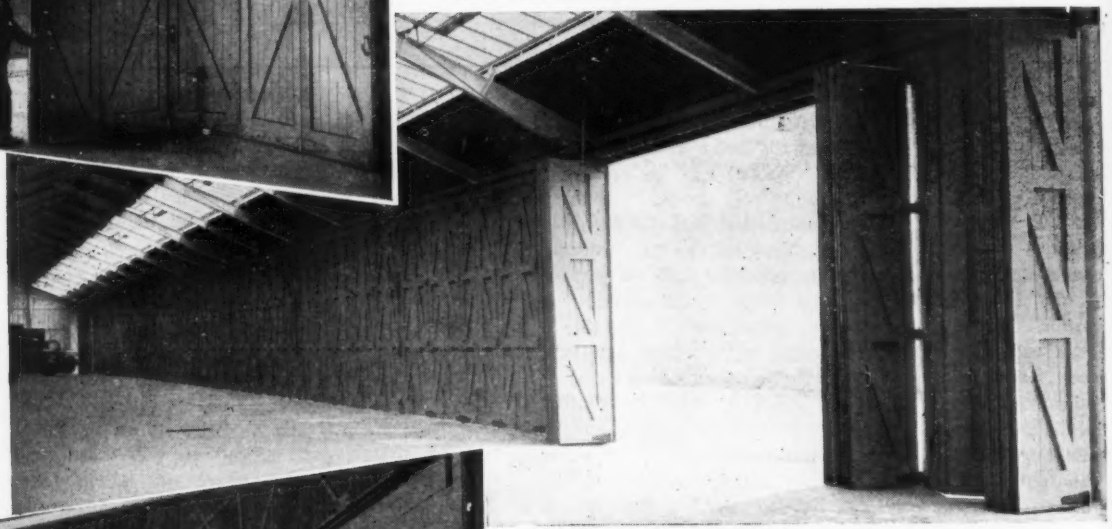

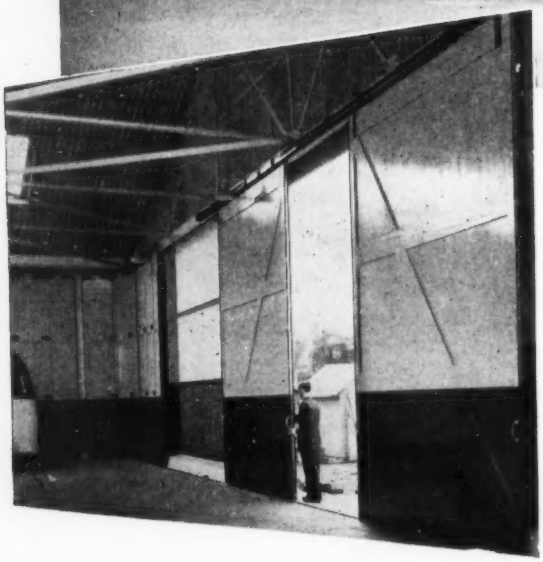

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THE CASUALTY DEPARTMENT (continued)

(*b*) Walking (this may be due to inappropriate design or unsuitable placing of storage space and equipment).
(*c*) Local sterilizing instead of central sterilizing.
(*d*) Writing (some casualty records are devised to minimize writing by being in a "yes/no" form).
(*e*) Inappropriate work (doctors acting as porters, nurses ordering ambulances).

The work of the staff may be hampered and lengthened by the inadequacies of accommodation—rooms being too small, corridors and doors too narrow for the easy manoeuvring of wheelchairs and trolleys, etc. The design data should exclude unnecessary work so far as possible, since this should be at a minimum with an efficient design and organization. But it should be noted that the actual physical arrangements are only one factor contributing to the efficient casualty department. Others are the general organization, the staffing, the skill of the staff, the records system, the efficiency of the paper work and so on.

For a new casualty department the main procedures to be used should first be critically examined and then defined in some detail. While medical efficiency is paramount, working efficiency frees doctors and nurses to attend thoroughly to their particular tasks and results in a better service and less waiting for patients. For example, in the department illustrated in Figure 3, the treatment procedures required had been worked out in accordance with a definite medical policy, and had been translated into a clear pattern of work for staff and a smooth progression of patients stage by stage. This allowed the architects to assemble the design around an efficient procedure.

Figures 1 and 2 are a record of the work of two nurses, and their purpose is to show what work has been done and so to allow consideration to be given to different ways of doing it and to different layouts of rooms in a new or altered building.

Figure 1 shows one nurse's work during one hour in an old building. During this time the nurse has collected and prepared equipment; fetched casualty cards from a fixed point and ushered the patient with the card to the doctor; assisted the doctor; filled in casualty, X-ray, and ambulance cards; carried cards to the X-ray department; treated patients; cleared away equipment; washed her own hands and visited the cloakroom.

Figure 2 shows one day's work of a sister in charge of a joint casualty and out-patients department. The sister's activities comprise the following: receiving reports from the nurses; speaking to her deputy about the off-duty list and disposing the nursing staff for the day; checking stocks; looking through the lists for the day's clinics; looking over all rooms before and after the day's work, checking equipment, and airing the rooms; inspecting equipment said to be faulty and reporting this; adjusting equipment; speaking to painters at work in the department; inspecting casualty patients on arrival, ushering very ill patients, seeing that patients are not overlooked in their progress through all sections of the department, and helping with the X-ray of serious cases; supervising patients in the recovery room; supervising the nursing staff, fetching an orderly and speaking to ambulance drivers; giving personal attention to a patient belonging to the hospital staff; looking after the parents of a seriously ill patient: requesting another doctor when essential; and seeing that patients' cards are correctly filled in and handled.

Figure 3 shows a model of a small department re-constructed with great attention to efficient procedure. Patients with all types of injury, except fractures or multiple injuries, are dealt with here. This design is based on three principles. There is no separation of new and return cases, but a separation of "clean" cases requiring few attendances from infected cases requiring repeated attendances. Further, there is no separate accommodation for the sexes but cubicles are used where required. The final principle is that the doctor and nursing staff stay in fixed positions with their equipment, while patients move from one to the other. Stretcher cases are an exception: they do not pass into the main stream of the department but are taken to a resuscitation room by the entrance where the

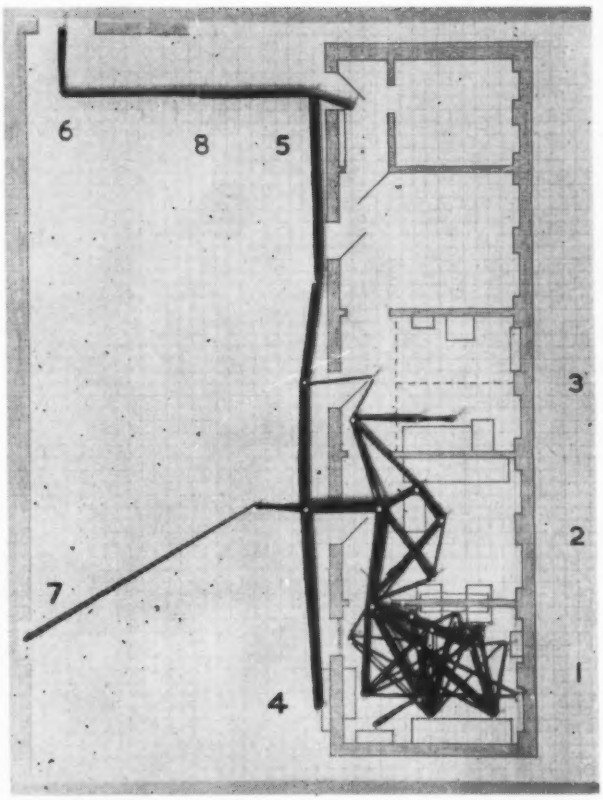

Fig. 1. One hour's work of a nurse in an old building.

1 *and* 2 *Treatment rooms*
3 *Examination cubicles*
4 *Shelf for casualty cards*
5 *Entrance to X-ray and wet viewing rooms*
6 *Entrance to theatre*
7 *Registration Office*
8 *Stairs to nurses' cloaks in basement.*

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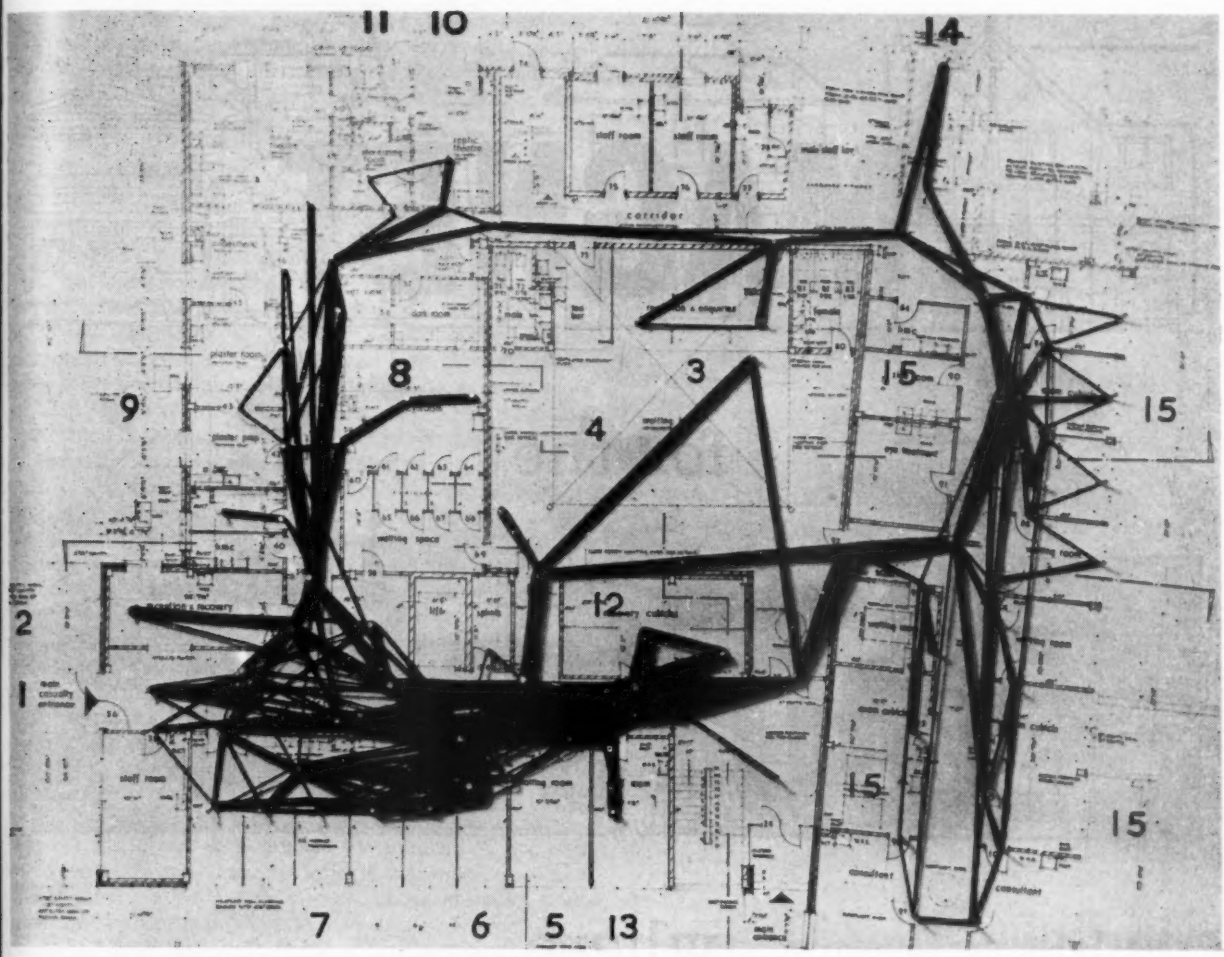

Fig. 2. One day's work of a sister in charge of a joint casualty and outpatients' department.

1 *Ambulance entrance*
2 *Resuscitation rooms*
3 *Reception*
4 *Waiting*
5 *Special waiting for doctor*
6 *Doctor's cubicle*
7 *Dressings cubicles*
8 *X-ray room*
9 *Plaster rooms*
10 *Casualty theatre*
11 *Utility rooms*
12 *Recovery room*
13 *Sister's room*
14 *Corridor to main hospital and main X-ray department.*
15 *Outpatients' clinics*

doctor attends them. This room is equipped for treatment of shocked, collapsed, or very ill patients, equipment being kept in glass-fronted cupboards.

Ambulant patients move in a loop with separate circulation on the ways in and out. They enter a waiting room with registration counter and canteen, and wait until called in order of arrival into the doctor's consulting room. This has a cubicle with examination couch for patients requiring privacy, but the majority of patients see the doctor at his table and then pass through to the adjoining dressings room. They take with them a coloured tally indicating the treatment to be given. (There is a loudspeaker intercommunication between the two rooms if additional instructions are necessary.) The dressings room also has cubicles for injections or treatment requiring privacy. Patients requiring an X-ray pass through the dressings room and along the corridor to this department. Patients requiring treatment other than dressings are filtered out of the main flow and wait until the return cases have been dealt with; they are then treated either in the stitch room or the theatre.

The theatre is used for all operations under anaesthesia, the septic cases being treated after the others and the theatre then cleaned down. Adjoining the theatre is a recovery room where patients lie with heads to the aisle, their heads never being screened. They are constantly supervised and visited by the anaesthetist between each

THE CASUALTY DEPARTMENT (continued)

case on the list. Septic cases requiring longer treatment than other return cases come by appointment to a special dressings room where all dressings are carried out with full surgical asepsis and there is a separate set of sterilizers.

Patients' Waiting Time

The time for staff to carry out their work can be translated roughly into occupancy of the various rooms—the examination rooms, treatment cubicles, operating theatres, etc., but this does not give the complete picture. The patient's time also affects the design. His time in the rooms in which treatment, etc., is being carried out on him is accounted for by staff time, but apart from this his waiting time has a considerable affect on design. As with the work of staff, the patient's waiting time may be divided into that which is necessary and unnecessary. Necessary waiting is the time, for example, which must elapse between an A.T.S. test injection and the full dose, waiting prior to and after a general anaesthetic, waiting for the development of an X-ray film, or waiting for a plaster to set. Unnecessary waiting may occur before any process and includes any waiting in a queue at successive stages for previous patients to be dealt with, waiting for a facility to become free, waiting for attention in any way (for example, for acceptance and treatment as an in-patient), or waiting for an ambulance. The first object is to ensure that no particular facility or service forms a serious bottleneck, though the method of doing this may not necessarily be to increase the facility or service but to spread the load or to arrange for the sharing of additional facilities or staff with another department.

The second object is to reduce the number of points at which patients may have to wait. If one member of staff can deal with a patient for two successive stages of treatment, the patient is unlikely to have to wait between them; while if two separate members of staff are dealing with these two stages, intermediate waiting by patients is very likely. But this solution may have limited possibilities in a casualty department.

Waiting patients occupy either facilities (cubicles, etc.), waiting space or circulation space. The aim should be to forecast all the points at which patients may have to wait and to provide waiting spaces for them which are big enough, near enough to where they are wanted, and pleasant. These can, of course, be provided at every successive stage where patients are likely to have to wait but this would be uneconomical of waiting space since the total amount provided in this way will normally be very much more than the amount of waiting space occupied at any one time. The bulges only occur in one or two places at once. On the other hand it is inefficient and inconvenient to return patients at every stage to a single large central common-use waiting space. For one thing, staff time is consumed in sorting and marshalling patients and seeing they are not overlooked. Some combination is required, however, and the problem is to group into as few convenient spaces as possible the places (*i.e.*, not necessarily the stages) where patients may wait.

Another lesson to be learned from a detailed study of work is the value of an efficient system of communication among casualty department staff and between them and the staff of other departments. The mechanization of communication is a question affecting the whole hospital but is also important in the casualty department. In any reorganization of procedures, the mechanization of communications will play an increasing part.

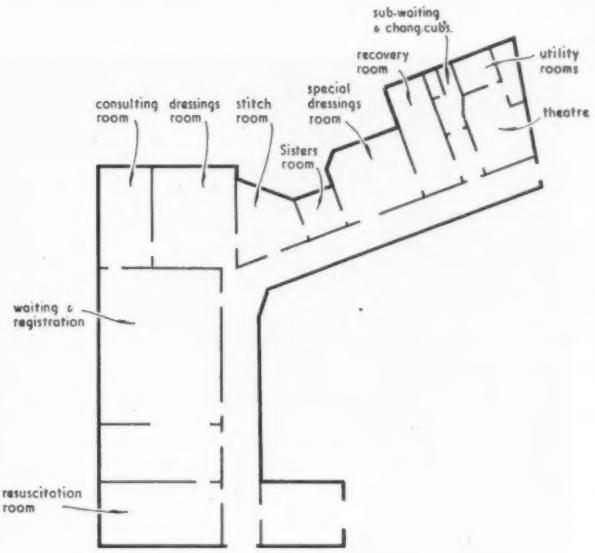

Fig. 3. Design for a small casualty department.

The research group to which the authors of the above article belong was set up by the Department of Health for Scotland.

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the laundry

A. I. T. LUSK

The discovery of the extent of cross infection has caused a complete change in the method of handling washing in the hospital, involving the transference of work from the ward to the laundry and the creation of a clear cut division between clean and dirty within the laundry. At the same time the need for greater efficiency has led to the adoption of production flow methods and the setting up of a central laundry to serve the needs of a group of hospitals. All of these matters are considered and presented with much practical detail by A. I. T. Lusk, the Group Laundry Manager of the Glasgow Royal Infirmary and Associated Hospitals.

The hospital laundry is so often thought of as a large washhouse requiring little, if any, skill to run and a big

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THE LAUNDRY (continued)

simple shed-like building to house the washing machines. The scientific approach is changing this primitive concept and the bacteriologist is in the forefront demanding radical improvements in techniques.

Past Practice

Basically, the main function of a hospital laundry is to receive all soiled work, including staff work, from the hospital or hospitals serviced. To cleanse and finish that work adequately, at an economic cost, and to return it to the sender as quickly as possible via the central linen room or direct.

Hospital soiling is graded into one of the following categories: (*a*) normal soiling, (*b*) foul (excreta, blood, etc.), (*c*) foul and infected, and (*d*) infected.

In the past (*b*) and (*c*) were usually sluiced in the ward annexes, where the heavy soiling was removed, then (*c*) and (*d*) were soaked in a suitable disinfectant for a requisite period. After this period of soaking the heavy moisture was wrung out by hand and all work classified on the annexe floor where it was listed in duplicate, packed into a wicker hamper and forwarded to the laundry. On arrival at the laundry it was again classified and checked against the laundry list, where the numbers very rarely, if ever, agreed. Finally the work was weighed and processed. One copy of the laundry list, together with the wicker hamper, was then sent to the central linen room or despatch area at the laundry to await the freshly laundered linen, where it was checked against the laundry list and, together with the duplicate copy, packed into the wicker hamper and returned to the sender.

This then, generally speaking, was normal routine.

Bacteriological Control

Increasing knowledge of the causes and prevention of cross infection in hospitals is the biggest single factor in the rapid advances in laundry design and practice in recent years. Very little research or knowledge, however, was available until the early 1950's. It was discovered then that in laundries where the reception, classifying and washing areas were not physically separated from the remainder of the plant, pathogenic organisms could be cultured from the atmosphere in the despatch area—previously accepted as clean. Where these conditions existed, it was quite possible for freshly laundered linen to be re-infected by air pollution in the despatch area, or, indeed, anywhere within the plant, as air movement distributed the bacteria from the reception, sometimes quite evenly, throughout the factory.

The possible spread of infection, however, is not confined to the laundry alone, as it is reasonable to assume that infected linen can, if handled excessively or carelessly, cause cross infection anywhere within the hospital. This led to a complete examination of the route of soiled linen, including the ward, ward annexes, porterage, method of conveyance, containers and laundry lists, and the laundry itself.

Blankets, all woollen articles, and indeed all fabrics requiring low temperature wash processes were also a very vexatious problem. These articles are usually processed at a temperature not exceeding 100° F.—ideal, one might feel, for the growth of bacteria, or at least for the even distribution of the bacteria over the remainder of the work in the machine.

As a result of investigations, the bacteriologist has stated certain clear principles which can be summarized as follows:

(*a*) There should be no counting, sorting and sluicing of linen on the wards.

(*b*) There should be the minimum handling of linen to, from and in the laundry.

(*c*) There should be complete separation of the sorting and washing area from the extraction, drying and despatch area; a complete physical barrier is necessary which means separate staff with their own welfare and toilet accommodation.

(*d*) Mechanical ventilation should be designed to give negative pressure in the sorting and washing areas, but positive pressure in the drying and packing areas. Special precautions are needed in the extraction area when large volumes of air are pulled through the hydro-extractors.

(*e*) The actual washing process should be scientifically formulated and automatically controlled.

(*f*) There should be highly skilled supervision of the laundry and regular bacteriological checks in all its departments.

Foul and Infected Work

These categories are two of the most potent sources producing harmful bacteria in the hospital unless they are properly controlled. Material of this type should be removed direct from the bed by a nurse or orderly dressed in a special overall, rolled up and packed into a container with the least possible disturbance. When the container is full the protective clothing of the nurse or orderly should be added and the bag closed, sealed off, and sent to the laundry or central sluicing area. There should be no treatment of the linen on the ward floor.

Containers should be washable and disposable and must be designed both to take soiled linen to the laundry and packed clean linen back from the laundry. Soiled linen should be packed in bags, fouled infected linen in containers which are proofed against seepage and can be sterilized or disposed. Trolleys should be washed down with bacteriacide after each main soiled linen collection.

Although it is possible to have vans for foul and infected linen, it is expensive as this represents so small a proportion of the whole. If vans are used for all classes of items, they must have a sealed off compartment for foul and infected linen. This compartment must have a separate door, washable surfaces, drainage and ventilation. A frequent despatch cuts down the need for storage in the despatch area and the risk that linen will be re-infected there, reduces the stocks that must be kept in the wards and ensures a liberal supply of fresh linen to the wards and departments.

On arrival in the laundry the material is not classified but is fed to a washing machine which is designed to deal with this work. However, it should be noted that this only forms approximately 10 per cent. of material for laundering. If there are any woollen articles in the container, these should be removed before the remainder can be boiled. If a central sluicing area is in use, the foul container, if of the rigid type, can be washed and sterilized there and returned to the ward. The sluiced work can be taken to the laundry in the normal washable container.

The Laundry Process

The laundry must be divided into two distinct areas which can be referred to as CLEAN and DIRTY.

The DIRTY area comprises

(1) Reception of soiled linen.

(2) Classification or sorting of soiled linen into suitable quantities for processing.

(3) Washing area.

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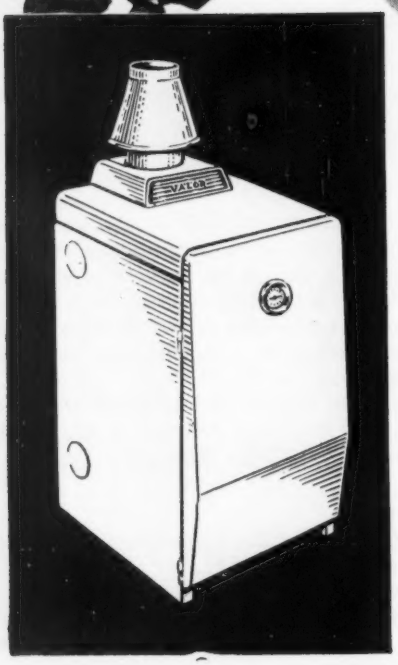

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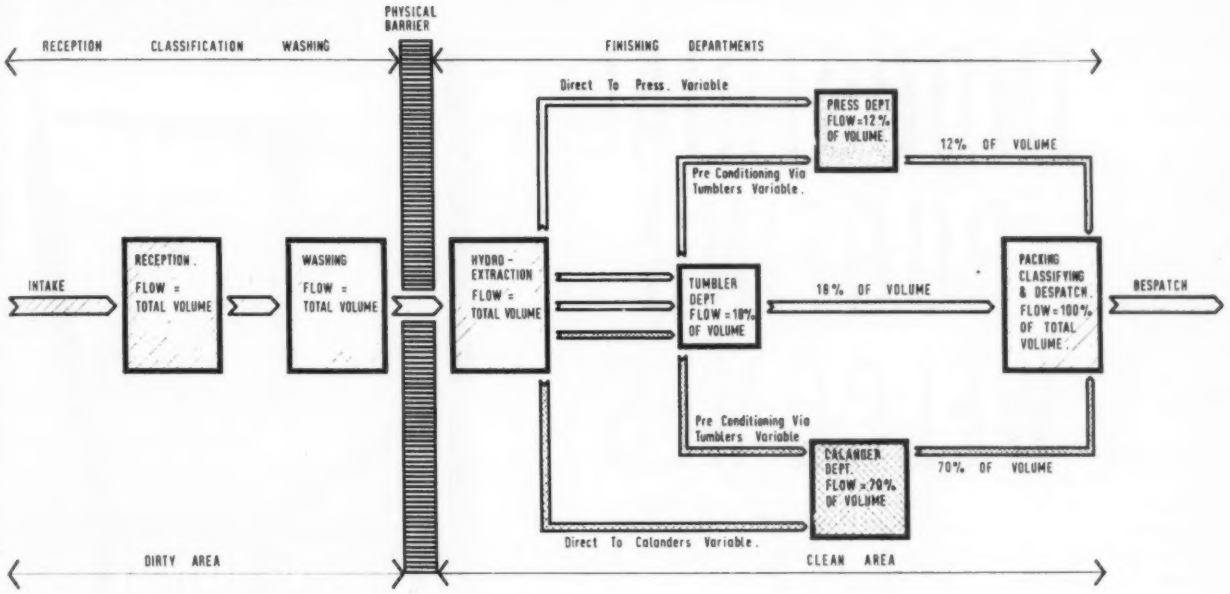


Diagram of departmental work flow in the laundry.

The CLEAN area comprises:
(1) Drying.
(2) Finishing.
(3) Despatch.

Each area should have separate changing and canteen facilities for clean and dirty staff. Workers in each area should wear a different coloured overall. The building should permit a " straight through " production. All dirty linen is delivered to the reception area. Normal soiled linen is classified according to the processes it must undergo and sorted before being delivered to the machines and it is fed into the machines in a sequence which will ensure that the finishing plant is working to full capacity. Foul and infected work must be fed straight from the bag to the washing machine so that the contents do not come into contact with the atmosphere of the laundry.

The washing machines can be fed from trolleys used only for soiled linen. The machines sluice, wash, boil, rinse and bleach and, to cut out human error, should be fitted with automatic controls incorporating technically formulated processes. Processed work should never be allowed to pile up in the washing area as it would be exposed to a dirty atmosphere.

After passing through the machines, linen passes the barrier between the " clean " and " dirty " areas. A better arrangement is to use " double ended " washing machines which themselves form the barrier. The best method of transporting clothes away from the washing area is by mechanical conveyor. The partition between " clean " and " dirty " halves may be fitted with sprung rubber doors through which trolleys or a conveyor belt can pass and the ventilation system should ensure that air passes always from the " clean " to the " dirty " side.

Hydro extractors, drying tumblers, garment presses, calenders, collar blocking and polishing machines and hand irons all comprise the finishing department. This equipment can be suitably balanced providing the wash house flow rate per hour is known. Hydro extractors remove approximately 50 per cent. of the moisture from the wet wash. Drying tumblers using hot air dry or partially dry damp linen. Garment presses are used to finish items such as overalls and uniforms. Calenders are used for ironing large articles such as sheets. The remainder are self-explanatory.

Mechanical conveyance should be installed wherever possible to reduce handling of the finished article. Storage in the despatch department should be reduced to the absolute minimum. Clean linen on arrival should be classified, put in racks and then packed, in relation to the general laundry flow. Batches should never be held over because of a small number of " shorts " and storage, if necessary, should be outwith the plant. Freshly laundered containers should be for common use and marked for their destination when they have been packed. The only counting undertaken will be on packing the containers which should then be sealed before despatch. All linen is subject to damage and steps must be taken to remove damaged linen from the laundry process and to send it to the sewing room for repair. Containers for torn work should be placed at major finishing departments where torn linen can be collected prior to finish, tumbler dried and sent to the sewing room for repair. When repaired, it should be sent to laundry reception for processing. Samples of all new fabrics should undergo tests in the laundry prior to purchase. Receipt, issue and marking of new linen is part of the laundry service and all new issues should be date stamped.

Work Floor and Sequence Control

Every endeavour should be made to ensure a uniform flow of work through the laundry from delivery to despatch to a timed schedule. If this can be achieved not only will there be a high level of production but it will also make known the " flow rate per hour " which will in turn permit maximum use of plant and labour.

Several factors can contribute towards maintaining this even pattern of work.

(*a*) Automatic operation of the various machines in the department will obviate human error.

(*b*) Classification of batches of work passing through the process will ensure maximum use of all the equipment.

(*c*) Scientific formulation of the washing process will ensure that linen will receive the most effective cleansing treatment possible.

THE LAUNDRY (continued)

(*d*) Sequence control of the machines to ensure a timed production flow.

(*e*) Weighing of linen to be processed will ensure that the machines are not overloaded and give maximum performance.

Thus in order to control the flow of work, sorting and handling in the reception department cannot be avoided. Full control over each sequence or cycle of the process will lead to considerable economy in services and should also help to produce a pattern of work in which there are no peaks (e.g. steam production in certain circumstances can be halved). It will facilitate correctly balanced finishing plant and obviate departmental "bottlenecks." It is advisable to allow 15 per cent. excess capacity in all departments for peak periods and fluctuation in bed occupancy. Alternatively, the laundry process can be calculated on 100 per cent. bed occupancy.

The Central Linen Room

Under the regime which has been described, each ward receives all its own linen back again. An alternative is to operate the laundry on the pool system and to house this pool in a central linen room. This system appears to give a greater control over linen, but leads to difficulties in practice. One of these (which could, indeed, be eliminated in time) is that the naming of laundry items is not standardized. This means that laundries operating the pool must hold much larger stocks than would otherwise be necessary. Again, even when the pool system is operated, separate departments always retain a proportion of articles which are not in common use. These must be handled separately, requiring a two-fold system for pool and non-pool items. Lastly, the pool system does not make checking and listing unnecessary, since you must always check what comes from a ward in order to know what must go back. Further, when a batch is delivered to the wrong department (as happens quite often), the mistake is not discovered until the sender complains. By this time investigation is very difficult.

Economic Aspect

Two main aspects are to be considered in the economic running of hospital laundries.

(1) Centralization.

(2) Automation.

Centralization can be introduced to give a high-powered service in areas where there are a number of small laundries of uneconomic size or, where because they are remote, they cannot give the best possible service. By centralizing, better equipment may possibly be provided, supervision and efficiency can be of a higher standard and overall the best possible service from the laundry should be achieved.

Automation combined with centralization leads to further economies in the running of the laundry. Fully automatic control will save on steam and water supplies and on labour and production costs.

Two major factors in economic design are:

(*a*) the volume of work to be processed per hour.

(*b*) the finish required.

When these are defined the plant can be machined up to provide the best service. The production area of the laundry should be capable of processing 5 lb. dry weight of work per sq. ft. per week.

Production costs illustrated below cover labour, washhouse materials, calender, press and collar machine, clothing, fuel, water, power, gas, light, maintenance, repairs, rents, rates, management and transport. They do not cover capital expenditure, depreciation or administrative costs. In fairness it must be pointed out that so many factors influence cost that comparisons can be most misleading if not based on an exact assessment of circumstances.

Steam	*Water*	*Production in lb. dry weight/ 42 hour operator week*	*Production cost per lb.*
MANUAL OPERATION			
4 lb.	5 gal.	900	2·9d.
AUTOMATIC OPERATION			
2·2 lb.	2·8 gal.		2·5d.

Fire Risk

Fire risk is high in a laundry because of the danger from spontaneous combustion. A fire may start when clothes from a drying tumbler are piled in a trolley and left undisturbed for several hours. Surface fibre from articles which pass through the finishing department and which collects on the floor is a highly inflammable material. Because of this, the floors should be kept free of this material, possibly by vacuum cleaning. Laundries are subject to the Factory Act and, therefore, must conform to the conditions relating to safety, working conditions and fire.

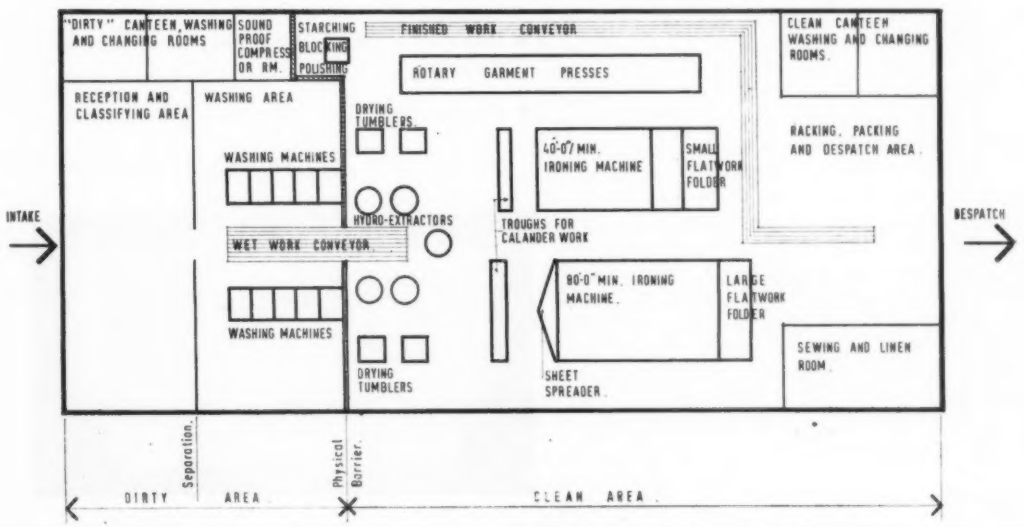


Diagram of laundry processing 60,000 *lbs. dry weight per* 42*-hr. week.*

the kitchen

PROF. B. S. PLATT

Most of the departments of the hospital are in a state of radical change, but in most of them the need for this change is accepted and the technical solution is well in sight. Catering is not in this position. The author of this article, Professor B. S. Platt of the National Institute for Medical Research, proposes that the greater part of hospital cooking should be done not in the hospital as at present but in the food factory. In making this proposal (as he points out) he is only claiming for cooking a development analogous to what has already taken place in the pharmacy. If his proposal is accepted, it will mean a saving in space and in staff, a reduction in food waste and, above all, food which tastes better and is more nutritious than that which is usually supplied by communal cooking on the spot.

The Need and the Techniques

Good catering for patients in hospitals means the provision of good food, well-cooked and attractively served. Hospital catering can properly be regarded as a branch of applied nutrition and, like applied nutrition in general, involves a wide range of knowledge and skills. I shall outline in this article a number of recent developments which may be of interest in making plans for feeding patients in hospital in the immediate future, in the hope that they may be useful to architects who in many ways are interested in " the shape of things to come." I do this with hesitation because many of the ideas presented have been tried out only on a comparatively small scale. However, the results so far obtained are sufficiently encouraging to warrant at least the setting up of a well-planned experiment on a pilot scale.

There are special problems associated with feeding the sick, but the meals served, at least in large hospitals, like those served by many large-scale catering organizations, especially those run at low cost, are monotonous and unappetizing and much of them is often wasted. These are particularly undesirable features; but it is difficult to see how they can be avoided under the conditions so often found in hospitals in this country. The outstanding problem, as emphasized by the Chairman of the Hospital Catering & Dietetic Committee* recently, is the " structural inadequacy of kitchens in many hospitals which are not only poorly equipped but also badly designed." Hospitals, he writes, are also understaffed and it is felt that under present conditions the hospital service will not attract its " proper proportion of talent."

Moreover, there is considerable and widespread indifference on the part of the medical profession towards nutrition and hospital catering. Support for this statement can readily be produced. It has been constantly confirmed in discussions at international level and on several occasions the attention of Member Governments of United Nations Organization has been drawn to the need for including adequate instruction on the principles and practice of nutrition in the teaching of medical students and in the training of public-health officers. An interesting illustration is to be found in a paper in a recent number of the British Medical Journal by a doctor who writes proudly claiming as his own discovery that " inadequate feeding impedes convalescence." Yet Hippocrates (ca. 460-377 BC), writing about different methods of processing foods, stated that " each of these differences produces in a human being an effect and a change of one sort or another, and upon these differences is based all the dieting of a man, whether he be in health, recovering from an illness, or suffering from one. Accordingly there could surely be nothing more useful or more necessary to know than these things."

One feels sympathy for the architect as a potential contributor to the ideal of good catering in hospitals. In a recent compilation of information on the subject* a comment is reiterated by several contributors. One writes: " In no functional unit of the hospital is there less concrete information on planning available than in the dietary department. Practical basic standards are not available and the type of food service which will best serve the patients in specific institutions causes considerable concern. The inefficiency in kitchens now in use and in many being planned today reflects the lack of basic information and the pressure upon the administrator from all departments for space. Often, space for the dietary department is allocated with no preliminary study of the needs or functions to be performed. The dietician is consulted too late." Another contributor complains: " The plan which the architect will show you will be little more than a rough sketch of the building, showing the shape of the area available for the kitchen and food service facilities. He will have marked the entrance for supplies and, perhaps, will have blocked out groups of equipment for the various departments. The architect will talk over with you his ideas on the locations and trend of service and, finally, leave the blueprint with you for study. You are then left alone with several yards of nice blue paper with white lines on it and a real problem." Whereas, for example, the design of operating theatres in different hospitals may have many features in common, this does not seem to be true of hospital kitchens. The situation appears to be analogous to that in therapeutics when there are many different remedies for a complaint like the common cold; none of them effective. Not so long ago, the lay-out and organization of the hospital pharmacy resembled in many ways the present-day catering department. The jobs requiring tincture presses, mills for grinding, pill-making machines, etc., are now performed by the manufacturing chemist who supplies the pharmacist with standardized drugs in convenient containers ready for administration.

Hospital catering just grew. As the number of patients fed in hospitals increased, so, for example, the size of the cooking containers increased from that of domestic saucepans to huge containers designed at a time when food science and technology were in their infancy. The results achieved bear all the marks of poor design in relation to function. I have seen in canteen kitchens containers in which liver was being stewed and found the material next to the steam jacket over-cooked and chunks of liver in the middle of the mass still containing ice crystals. The effects of poor design of the equipment are often accentuated by lack of enough skilled kitchen staff.†

* King Edward's Hospital Fund for London. Third Memorandum on Hospital Diet (1959).

* Readings in Hospital Dietary Administration. American Hospital Association, Chicago (1952).

† For an appreciation of hospital feeding in 1945-7, see *Lancet*, 248, 19, 61, 94 123 (1945); also ibid. 253, 884 (1947).

THE KITCHEN (continued)

The methods in use in the hospital dietary service have evolved from those used in the domestic kitchen and the time has come to decide whether this evolution should continue or whether we should take a completely new look at hospital feeding in the light of the recent advances in food science and technology.

A system along the following lines seems to be feasible:

(*a*) the bulk of the preparation of the food to be done in food factories.

(*b*) appropriate storage and ultimately proper transport to hospital stores;

(*c*) suitable storage on hospital premises, possibly only for short periods of time;

(*d*) distribution within the hospital on the day of issue;

(*e*) assembly of meal components and, where required, rapid heating immediately before serving to groups (eating units) of about 50 patients.

The amount of preparation and type of storage will depend partly on the nature of the product; when a product is served cooked, the extent of pre-cooking will depend on the heating device used at the final stage. Some items would clearly be issued to the eating unit fresh, *e.g.*, fruit and some components of salads; others may be items preserved in familiar ways, *e.g.*, by canning. There are a number of products now on the market, with which the housewife is becoming increasingly familiar, which are deep-frozen without cooking, or which are cooked and then deep-frozen. A new range of products is being investigated, obtained by accelerated freeze-drying.* Over 5,000 food items are said to be available in the modern supermarket today. The layman can read about many of these developments in processing food in *The Times* Supplement on "Britain's Food" of March, 1959, or in The Yearbook of Agriculture, 1959,† especially in the chapters on Modern Food Processing and The Development of New Foods. The keys to the production of most of these products are (*a*) preservation from the effects of micro-organisms, (*b*) the slowing-down of chemical changes, which might affect quality, by freezing, drying, packaging, with or without the use of additives to assist in these objectives. Only the simplest skills are necessary in the final stages of preparation for serving to the patient. In the factory, however, the highest skills could be applied in obtaining products of acceptable appearance, flavour, texture and nutritional value. The problems of control of hygiene in preparation, especially in regard to bacterial contamination, can be better taken care of in a factory than in a hospital environment.

It has recently been stated that "research thus far has given only a glimpse into the vast science of food constituents, their identity, their interactions under all conditions, and their effects on human nutrition," yet the food technologist has a considerable background of fact against which to develop new products. "The search for new knowledge of foods and their constituents goes on at an ever-increasing rate in university, government, and industrial laboratories. As it accumulates, improvement in commercial food products will follow. So will the development of new ones."

The food industry is already familiar with the special problems of storage, including refrigerated storage, and with the design and use of appropriate storage for the prepared and other food products in the hospital. Some experiments have been in progress for many years on the application of techniques used in air-liners for distribution within the hospital.‡

There are at least two possibilities for rapid heating equipment, one combining electrical heat with air circulation, the other the microwave oven, employing an electronic device which heats up food extremely rapidly. The latter device has been used with success for heating pre-cooked food in the Kaiser Foundation Hospitals in California, U.S.A.; it is not satisfactory for cooking food from the raw state.*

Park and Ibata report that five "dietary employees," plus two relief employees to cover off days, are expected to take care of a complete food service operation for 100 patients—a 30 per cent. reduction of staff compared to one of their other hospitals where conventional equipment is used. One feature of their service is the use of "one-service" plastic-coated paper utensils, thus eliminating washing-up almost entirely, except for silverware and trays. Immediately a suggestion of introducing into hospital catering a system of the type outlined above is made, objections are raised on the grounds of cost and the acceptability of the food thus provided. The objection on the ground of expense is usually based on individual personal experience of the cost of packaged products available on the open market. I know of no comparative data for institutions on costs of "home" prepared or "ready-to-serve" food. The results of an American study of feeding different type meals for two-day periods to a family of four, including two teenage children, are, however, of some interest. In one period the foods were all home-prepared except the bread, and the time taken was 5.5 hours and the cost 4.50 dollars per day. When the meals were made from partly-prepared foods, which included such things as apple pie made from canned apple and "bakery mix," the preparation time was about 3.1 hours, and the cost 5.80 dollars per day. When "ready-to-serve" meals were used, including frozen apple and meat pies, but not a complete "frozen" dinner, the time taken was 1.6 hours and the cost 6.70 dollars per day. The cook was a trained home economist in each case; the home-prepared meals were liked best; those from partly-prepared products were considered nearly as acceptable and the meals from ready-prepared food were least acceptable. Foods in each group differed in acceptability. This study shows that the meal which was cheapest in terms of money took longest to prepare, and that roughly the extra time involved in preparing the cheapest, as compared with the most expensive, came out at about 50 cents an hour. Extrapolation from these figures to large-scale feeding is unjustifiable, but they give some idea of the differences in the cost of pre-prepared foods. It has to be admitted that the latter were less well-received than the home-cooked food, but in hospital feeding, of course, the patient, except perhaps in the smallest of hospitals, would not be provided with home-cooked food. Several economies should result from this centralization of food preparation. For example, raw materials can usually be purchased direct from the producer at contract prices; all of the raw material can be used, *e.g.* the various cuts of an animal carcass, and "preparation-waste" can be processed for animal feed or for fertiliser; all grades of raw materials fit for human consumption can be included; the weight and bulk of material for transport to the stores is generally reduced and losses in storage should also be reduced as the stability of the processed as compared with the raw material is increased.

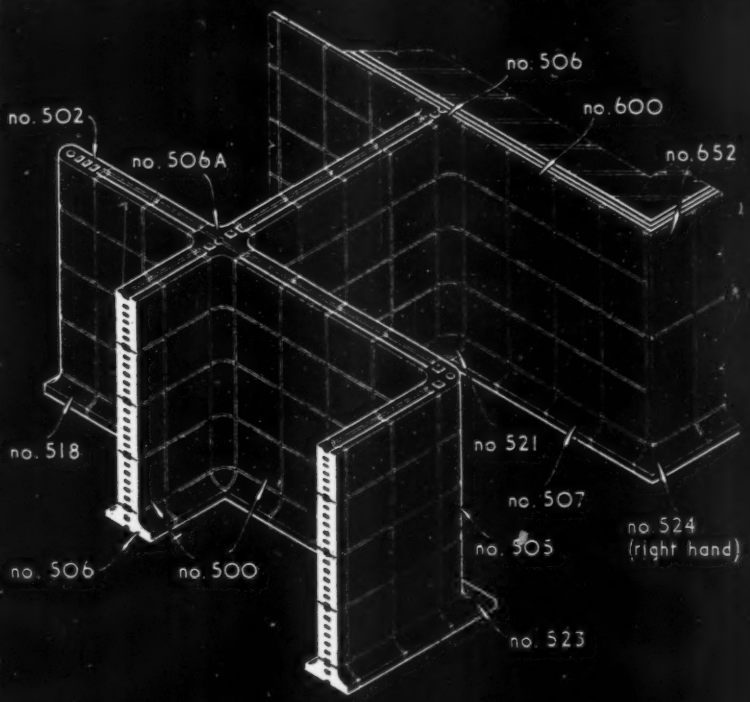
In the system proposed, it would be possible to employ highly qualified staff more efficiently. Idle time for equipment, which is wasted time, would be reduced. Such equip-

* S. W. F. Hanson, "Accelerated Freeze-drying of Food," *Food* (1959), July.
† J. C. Forrest, "Large-scale Freeze-Drying Equipment for Foodstuffs," *British Chemical Engineering* (1959), July.
‡ Joseph T. Greco and Henrietta Becker, "Six Years' Experience with Airline Food Service in the Hospital," *J. Amer Diet. Ass.* (1955), 31, 1243.

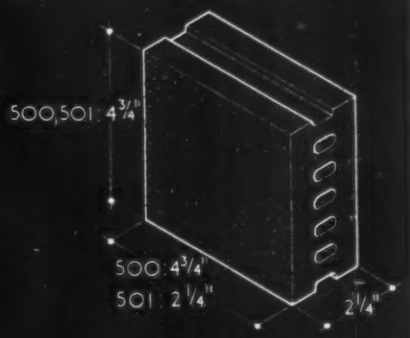
* E. R. Park and E. D. Ibata, "The Kitchen was Built for Microwave Cooking," *Modern Hospital* (1957), 89, 108.
E. R. Park, "We Cook with Microwaves," *Hospitals* (1957) 31 (17).
V. G. Hart, "Use of Microwave Ovens with Raw Foods," *Hospitals* (1957), 31 (17), 78-80.

BUILDING BLOCKS | CLAY | GENERAL DATA

The Architects' Journal Library of Information Sheets 773. Editor: Cotterell Butler, A.R.I.B.A.



TYPICAL APPLICATIONS OF BLOCKS, TILES AND FITTINGS



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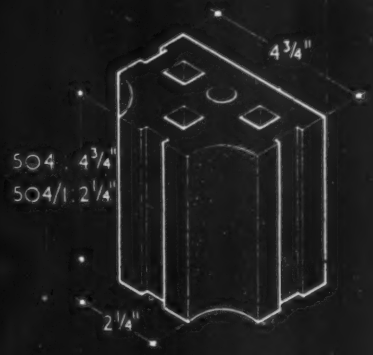

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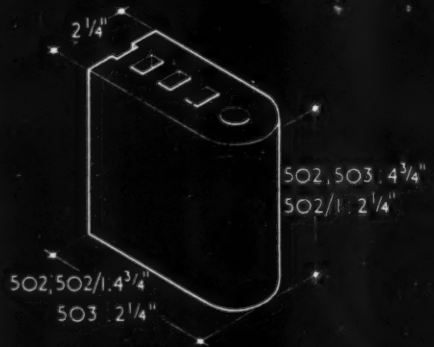

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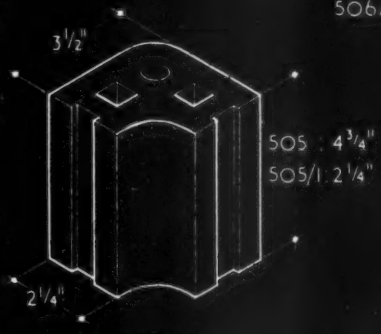

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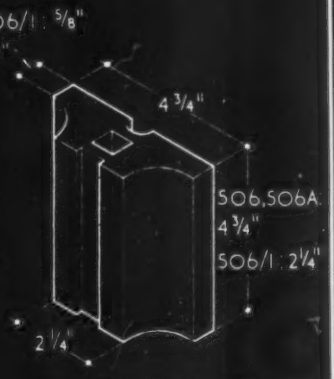

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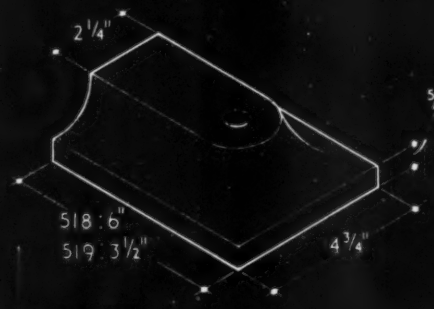

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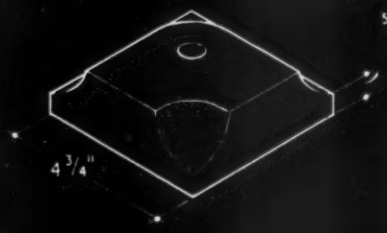

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TYPES OF BLOCK AND FITTINGS

LANGLEY'S SINZIG GLAZED CERAMIC PARTITION BLOCKS. Supplier: Langley London Limited

14.B5 LANGLEY'S ·SINZIG· GLAZED CERAMIC PARTITION BLOCKS

This Sheet describes Sinzig glazed ceramic partition blocks for lavatory, w.c., and shower cubicles. The drawings on the face show a selection from the wide range of fittings available and their application. The blocks are structural and standard wall facing tiles to match them are available from the supplier.

Material

The blocks are fully-vitrified ceramic material, the glaze and body of the block being fired in one operation at a very high temperature. The glaze is frostproof, has never been known to craze and has a high resistance to acids.

Sizes and Types

The dimensions given are converted to the nearest $\frac{1}{16}$ in. from the metric dimensions.
The standard partition block is $4\frac{3}{4}$ in. by $4\frac{3}{4}$ in. by $2\frac{1}{4}$ in. and it is also available in half widths.
The fittings include junctions, coves, bullnosed end and capping blocks, door jambs, and lintels. Special blocks incorporating soap dishes, clothes hooks, and toilet-paper fixtures are also available. The supplier should be consulted for details of the complete range. Special butt hinges, locks and lock housings for doors can be supplied.
Wall facing tiles $4\frac{3}{4}$ in. by $4\frac{3}{4}$ in. by $\frac{5}{8}$ in. are obtainable for use with the partition blocks and the $9\frac{5}{8}$ in. by $4\frac{3}{4}$ in. by $\frac{5}{8}$ in. tiles described in detail on Sheet 18.E2 can also be used if desired.

Fixing

To ensure that special fittings are placed in the correct position and the layout clearly understood before construction begins, individual courses of blocks should be selected and laid out before fixing. This also ensures a uniform width of joint. Joints should be $\frac{3}{16}$ in. minimum but for convenience of calculation and setting out, it is recommended that a 5-in. module be adopted, which means that the joints will be approximately $\frac{1}{4}$ in. at 5-in. centres. To set out the whole construction, a gauge rod marked to this specification should be used. The laying mortar should be 1 part Portland cement to 3 parts sharp, clean, sieved sand. Any tile facing of structural walls should be carried out before the partitions are erected. The partition blocks should be laid not more than three courses at a time over the whole installation.

Reinforcement: $\frac{3}{16}$-in. diameter galvanised steel rods should be inserted at every fourth course at least, and where extra strength is required, e.g. in public amenities, at every other course. The rod is placed in the horizontal joint groove in the blocks and the reinforcement should be tied into the structural walls. Where a partition wall ends without abutting a structural wall, vertical reinforcement should be provided of $\frac{1}{4}$-in. diameter galvanised steel rods not less than 2 ft. 0 in. in length and slightly overlapped; at door jambs they form an anchorage for the door fittings. Door lintels should be reinforced with $\frac{1}{4}$-in.-diameter rods, fixed in situ, supported with timber shuttering or alternatively the lintels can be precast. The same methods apply where an opening is to be provided under the wall to enable cubicles to be sluiced down to a common drainage outlet.

Door fittings: Door hinges, locks and lock housings should be built into the joints of the door jamb blocks. They should be tied into the partition walls by $\frac{1}{4}$-in. galvanised steel rods passed through convenient holes in the fittings. The rods are grouted in cement to give a solid anchorage between door fittings and partition walls.

Pointing: Joints should be raked out as work proceeds and the whole installation pointed in one operation at least 24 hours after fixing is completed. For pointing, one of the following is suitable: neat Portland cement; 2 : 1 white cement/silver sand; 1 : 1 : 1 Portland cement/white cement/silver sand.

Applications

The partitions are suitable for lavatory, w.c. and shower cubicles and changing rooms at swimming pools. They are also used in hospitals, dairies, kitchens, laboratories and any situation where cool, hygienic conditions are desirable.

Colours

The standard colour for the partition blocks is ivory white (21), but other colours are available in quantities of 500 sq. yds. or over; details may be obtained from the supplier.

Further Information

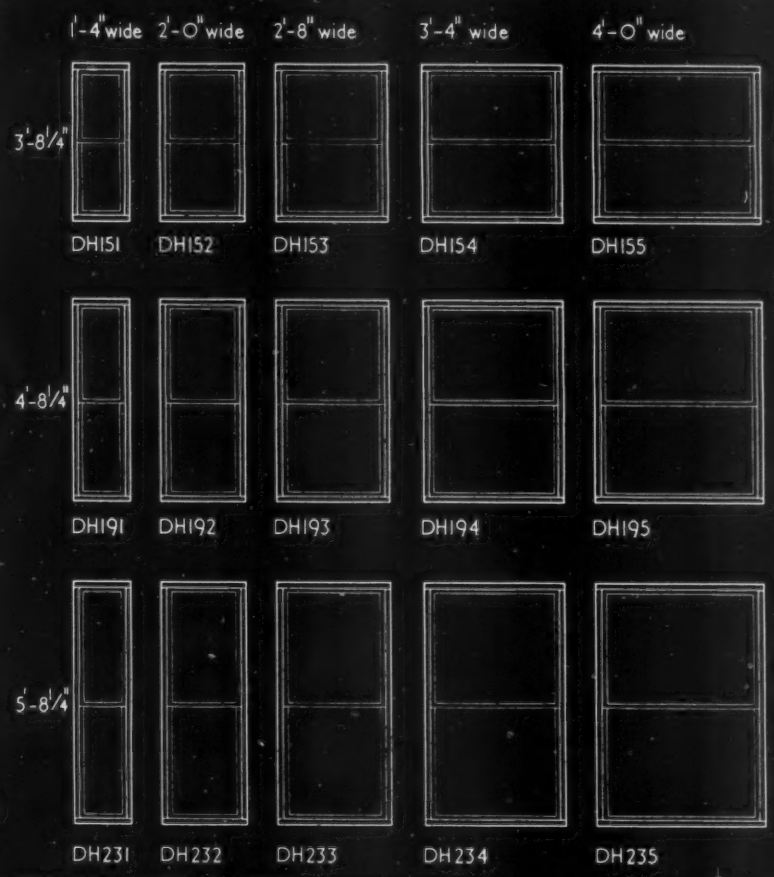
The supplier maintains a technical advisory service which will prepare working drawings, specifications and estimates for any proposed installation.
In addition to the range of blocks described on this Sheet, wall facing tiles, scum channels and other fittings for swimming pools are available in the same material in standard colours; details may be obtained from the supplier.

Compiled from information supplied by:

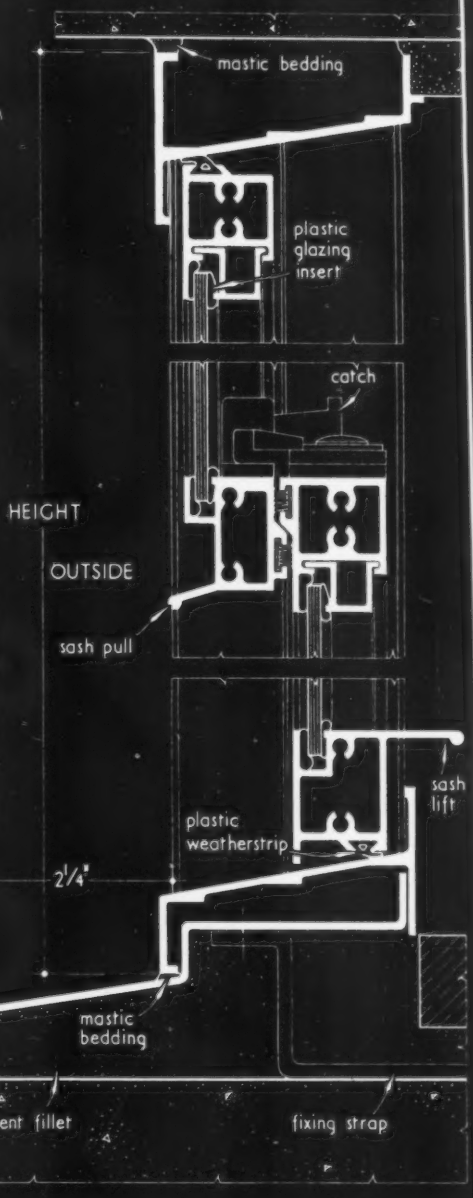
Langley London Limited.
Address: 163-167, Borough High Street, London, S.E.1
Telephone: Hop 4444 (10 lines).
Telegrams: Laglycol, Souphone, London.

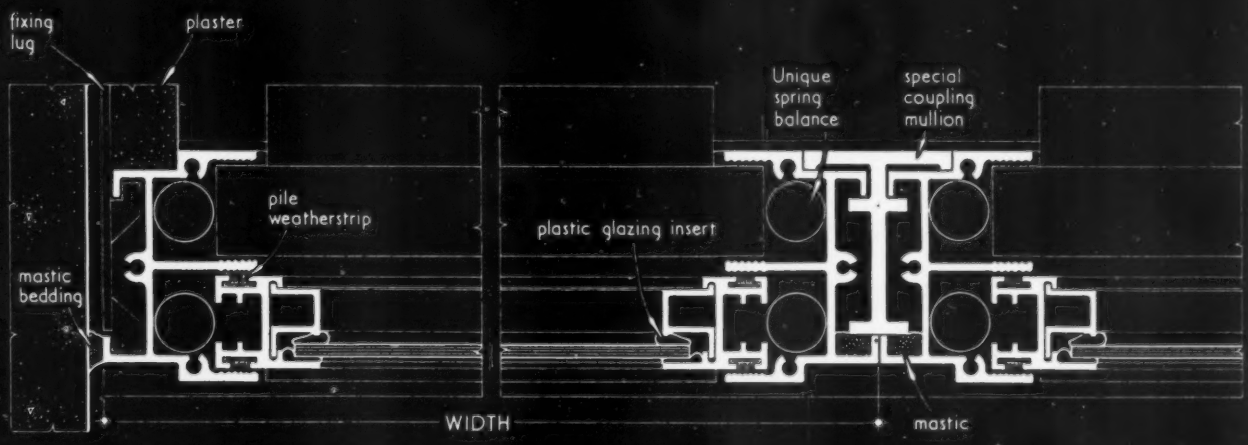
WINDOWS | ALUMINIUM | GENERAL DATA

The Architects' Journal Library of Information Sheets 774. Editor: Cotterell Butler, A.R.I.B.A.



STANDARD TYPES AND SIZES. (outside elevations)





PLAN AND SECTION THROUGH WINDOW.

·CRITTALL MARK III· ALUMINIUM DOUBLE-HUNG SASH WINDOW

24.E1 · CRITTALL MARK III · ALUMINIUM DOUBLE-HUNG SASH WINDOW

This Sheet describes the Crittall Mark III double-hung sash window. It is supplied already glazed with the balances adjusted ready for use.

Material and Construction

The fixed frame and sliding sashes are of extruded aluminium alloy. Sash pulls are integral with the sash sections and a cam fastener is supplied. The standard sub-sill shown in the section on the face of the Sheet is also in aluminium alloy, but is an optional extra and should be specified if required. Adjustable hot-dip galvanised fixing lugs are supplied for the jambs and head of the sub-frame. A special mullion is available for coupling two or more sashes together. The sashes are fitted with woven wool pile weatherstrips.

Sash balances: Coiled spring Unique balances are fitted to the sashes. They have a variable pitch spiral actuating rod which equalises tension at all degrees of opening. They are correctly adjusted at the factory before despatch.

Glazing: Sashes are delivered ready glazed with clear sheet glass bedded in and held by clip-in aluminium beads with plastic inserts. All windows are glazed with 24 oz. glass except DH 194, DH 195, DH 234 and DH 235, which are glazed with 26 oz. glass.

Sizes

The standard sizes in which the windows are available are shown on the face of the Sheet. The heights have been calculated to correspond with brick courses and the widths are based on a 4-in. module. When calculating the combined width of coupled sashes, nothing should be added for the mullion (see plan on lower face of the Sheet).

Finish

The aluminium alloy has a mill finish and is supplied with a protective coating of wax to prevent damage during fixing. When the building is completed the sashes should be cleaned down with white spirit to remove wax and dirt. Painting of the windows is unnecessary, but, where it is desired for decorative purposes, care must be taken to ensure that it is kept clear of the pile weatherstrips.

Ordering

The following information should be given when ordering:

1. Type number.
2. Quantity.
3. Detail of construction to which window is to be fixed, in order to determine type of fixing.
4. Whether subsill is required.
5. Whether sashes are to be used in composite form requiring mullion couplings.

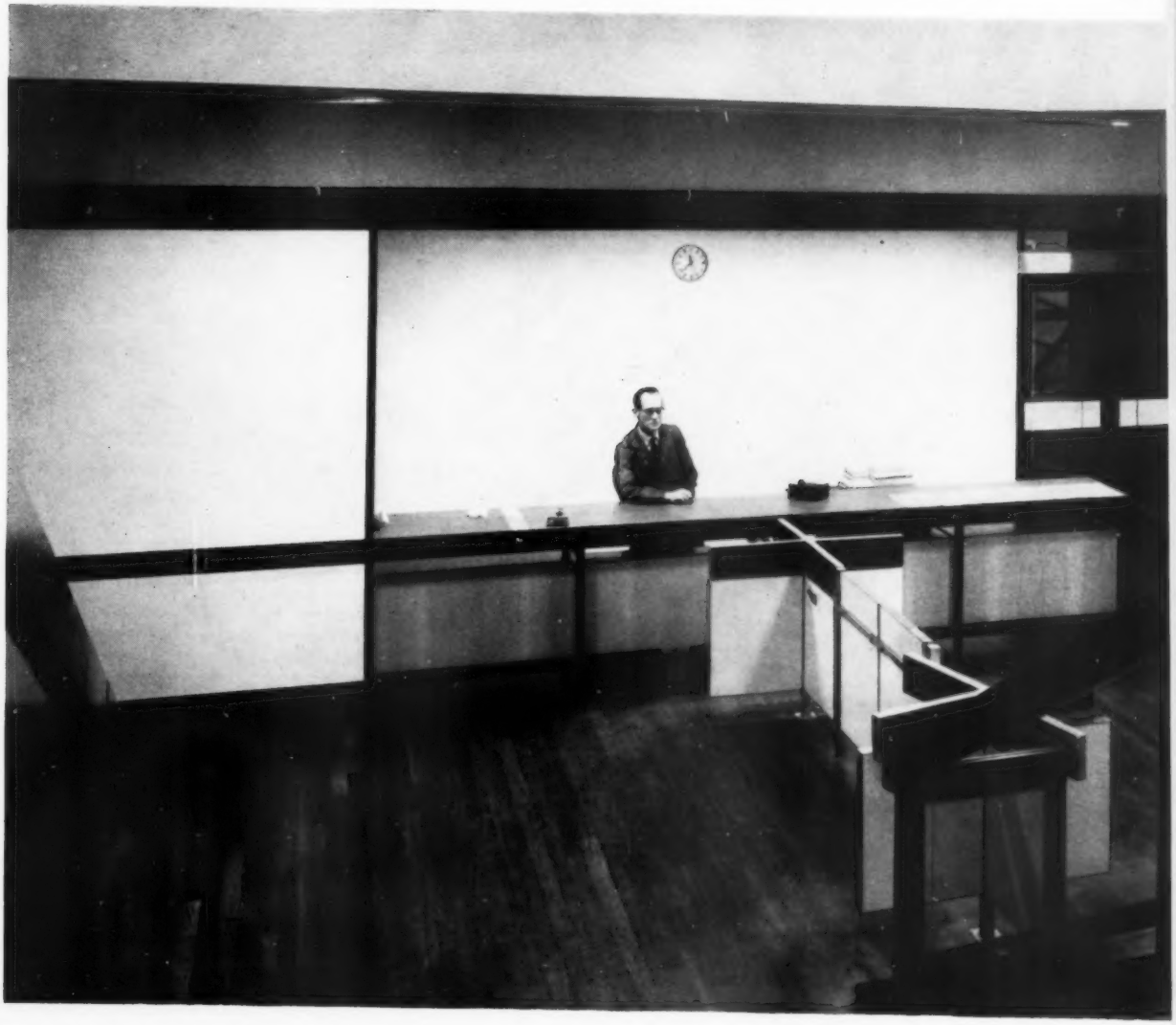
Compiled from information supplied by:

The Crittall Manufacturing Company Limited.
Address : Manor Works, Braintree, Essex.
Telephone : Braintree 106.
London Office : 210, High Holborn, London, W.C.1.
Telephone : Holborn 6612.

working detail

CONTROL DESK: UNIVERSITY LIBRARY IN SHEFFIELD

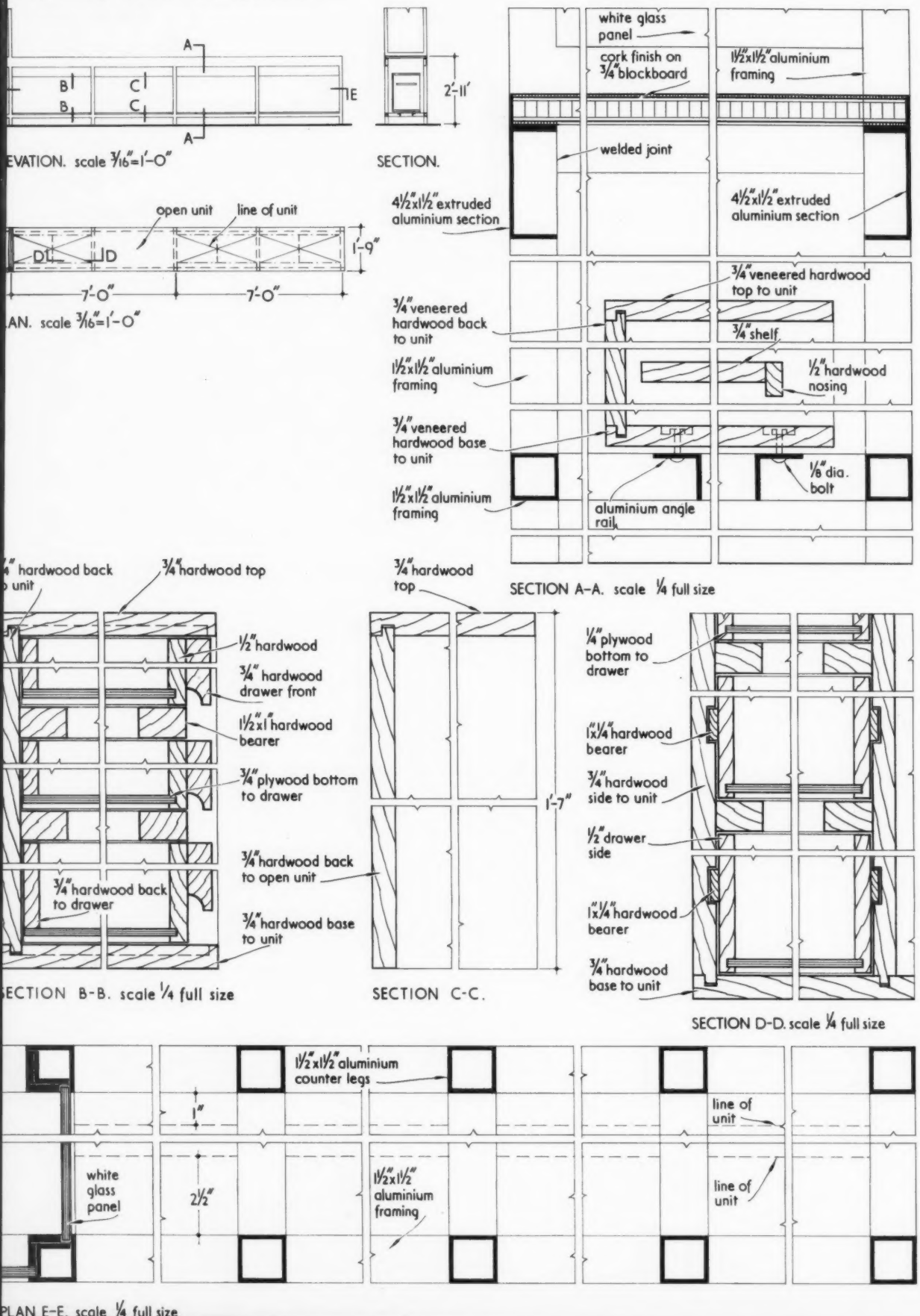
Gollins, Melvin, Ward and Partners, architects



This is another example of metal and wood joinery detailing, using aluminium. As though to emphasise the rigidity of the metal frame, the storage units are supported, not on the visible members of the frame, but on bearers welded to the bottom cross pieces. It is to be noticed that the box sections of the framing are 1½ in. square in place of 1 in. square, as is usual with similar furniture made of steel.

ONTROL DESK: UNIVERSITY LIBRARY IN SHEFFIELD

llins, Melvin, Ward and Partners, architects



EVATION. scale 3/16"=1'-0"

SECTION.

AN. scale 3/16"=1'-0"

SECTION A-A. scale ¼ full size

ECTION B-B. scale ¼ full size

SECTION C-C.

SECTION D-D. scale ¼ full size

PLAN E-E. scale ¼ full size

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Architect: Hubert Bennett, F.R.I.B.A. Architect to L.C.C.
Contractors: Wates Limited

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THE KITCHEN (continued)

ment as is employed in the food preparation factory would also be under skilled supervision. Neither of these advantages is likely to accrue in hospital kitchens; indeed, we found recently that the relatively simple mechanical potato-peeler, may in unskilled hands lead to an additional loss of 20-25 per cent. of the vitamin C in the potato by allowing it to remain in the machine for three minutes instead of the correct time—one minute.

Approximate total costs per in-patient-day for a number of different types of hospital range from £3 (mainly acute) to £5 (London—teaching). The expenditures (for patients and staff) on catering and on provisions are respectively almost exactly 20 per cent. and 12 per cent. of the total cost. The average cost of provisions is from 4s. 2d. to 4s. 7d. per day.* Since they have used pre-prepared foods and micro-wave ovens for heating, Park reports that in the Kaiser Foundation Hospitals they have saved nearly 10 per cent. on the cost of raw food and 20 per cent. on the total cost of catering with, as pointed out above, the prospect of a reduction of approximately 30 per cent. in staff. Furthermore, there have been reports of a release of space when an airliner type of service is introduced. The proposed system may lead to reduction of " plate-waste " which, at the present time in some hospitals in this country, has been found to be high. In a small survey of hospital meals, figures ranging from 7-49 per cent. have been obtained, and averaged 20 per cent. for 259 meals. It is noteworthy that the analysis of the waste was close to that of the meals served, suggesting that the foods were equally wasted. Somewhat lower figures have been obtained in a survey of hospitals in the London area recently.

The factors determining waste are several. One is related to the structure of the hospital diet. Thus, in addition to three main meals, snacks and beverages may be served. The latter tend to take the edge off the appetite for the main meals which are generally better balanced nutritionally. If the patient's likes and dislikes are not allowed for, food may be wasted. The system suggested should offer a reasonable choice at all meals. Other factors affecting " plate-waste " include the method of presentation, particularly the right temperature—hot food should be served hot and the cold food cold. The size of portions should be readily adjustable to the patient's appetite and waste from this factor avoided.

Many problems have still to be solved in achieving acceptable flavours in some of these new products, but already these are improving considerably. The first limitation of the quality of the final product is the quality of the starting material; a homely example is the wide variety of " garden peas " available in the frozen state. With regard to size of portion, acceptability, and good hygiene, it is interesting to note that ice cream as an item on the hospital menu is almost never wasted and yet at one time no product was in greater disrepute, particularly on hygienic grounds; this is an example of how time and technology can lead to improvements in a particular product. By and large, analysis shows that the nutrient content of the products of modern food technology are well preserved during processing and storage. Colours, flavours and certain other features of food quality cannot be so readily measured.

*Costs for year ended March 31, 1959, *Hospital Catering Returns*, Vol. I.

THE KITCHEN (continued)

but in general the conditions that favour the retention of nutrients favour the retention of other desirable qualities. The system proposed offers most of the advantages of centralization of catering facilities for the hospital and introduces the main advantages of decentralization; for example, it affords opportunities for the establishment of personal relationships between the patient and the personnel responsible for assembling and serving the meals. It should be comparatively simple not only to provide, by this system, the regular or normal diet for the hospital patient and meals for the staff but also special or therapeutic diets. I had, indeed, intended to devote more space to the hospital patient; but matters relating to medical nutrition and to " dietetics " will be discussed elsewhere*. Nevertheless I feel that I must end on a human note.

The importance of the food for the patient is epitomized in a little verse from a poem of Walter de la Mare: —

It is a very strange thing
As strange as can be
That all that Miss T eats
Turns into Miss T.

The stuff of which Miss T is made, protoplasm, is indeed made up of the nutrients in the food she eats; and, the fact of being sick, injured (by accident or by the surgeon) or even being at rest in bed causes extra losses of this protoplasm. No wonder then that " patients don't ask their doctors what the hospital looks like, but whether they will be well looked after.†

* B, S. Platt, D. S. Miller and P. L. Pellett in the *British Medical Journal* (to be published).

† Remark of a hospital matron quoted in " Future of Hospital," II, *The Times* June 17, 1960.

NEWS

COMPETITION

Dumbarton Central Area Redevelopment

Results of this competition have just been announced. The first premium (£1,200) is awarded to John Rae, Dereck Preston, Stephen Garner and Walter Strubel (Switzerland); second premium (£900) to Graham Law and J. D. Dunbar-Nasmith and third premium (£500) to Robert W. C. K. Rogerson. The competition was for the design and layout of buildings within the central area of the Royal Burgh of Dumbarton. Sole assessor was Professor Robert Matthew. A full report together with the winning schemes will appear in next week's AJ.

Drawing by Eric Thomas

WPM

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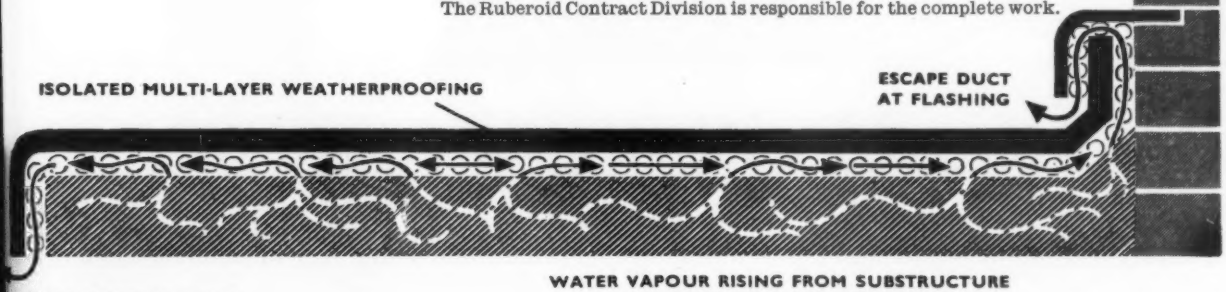

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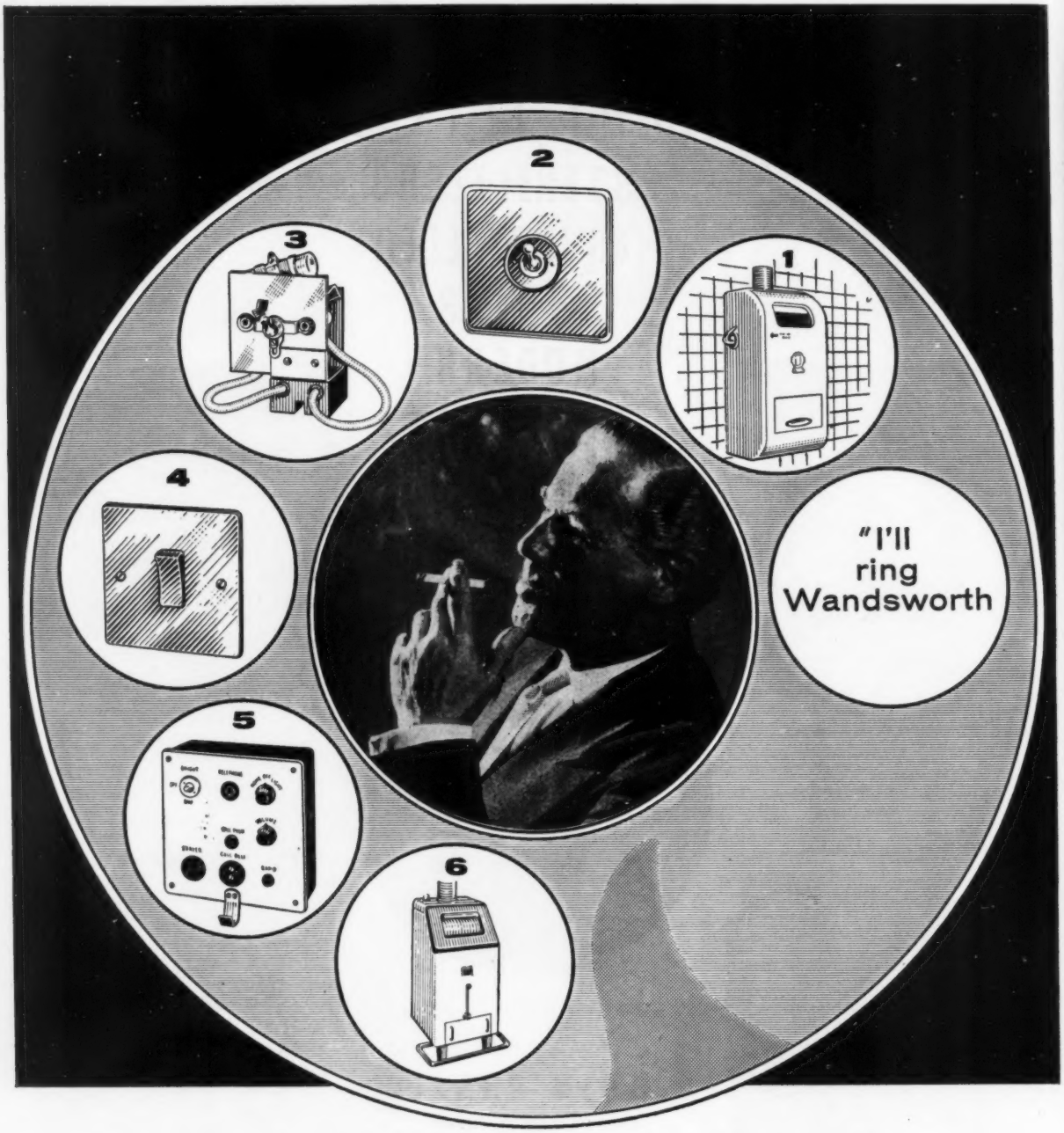

. . . about the electrical items."

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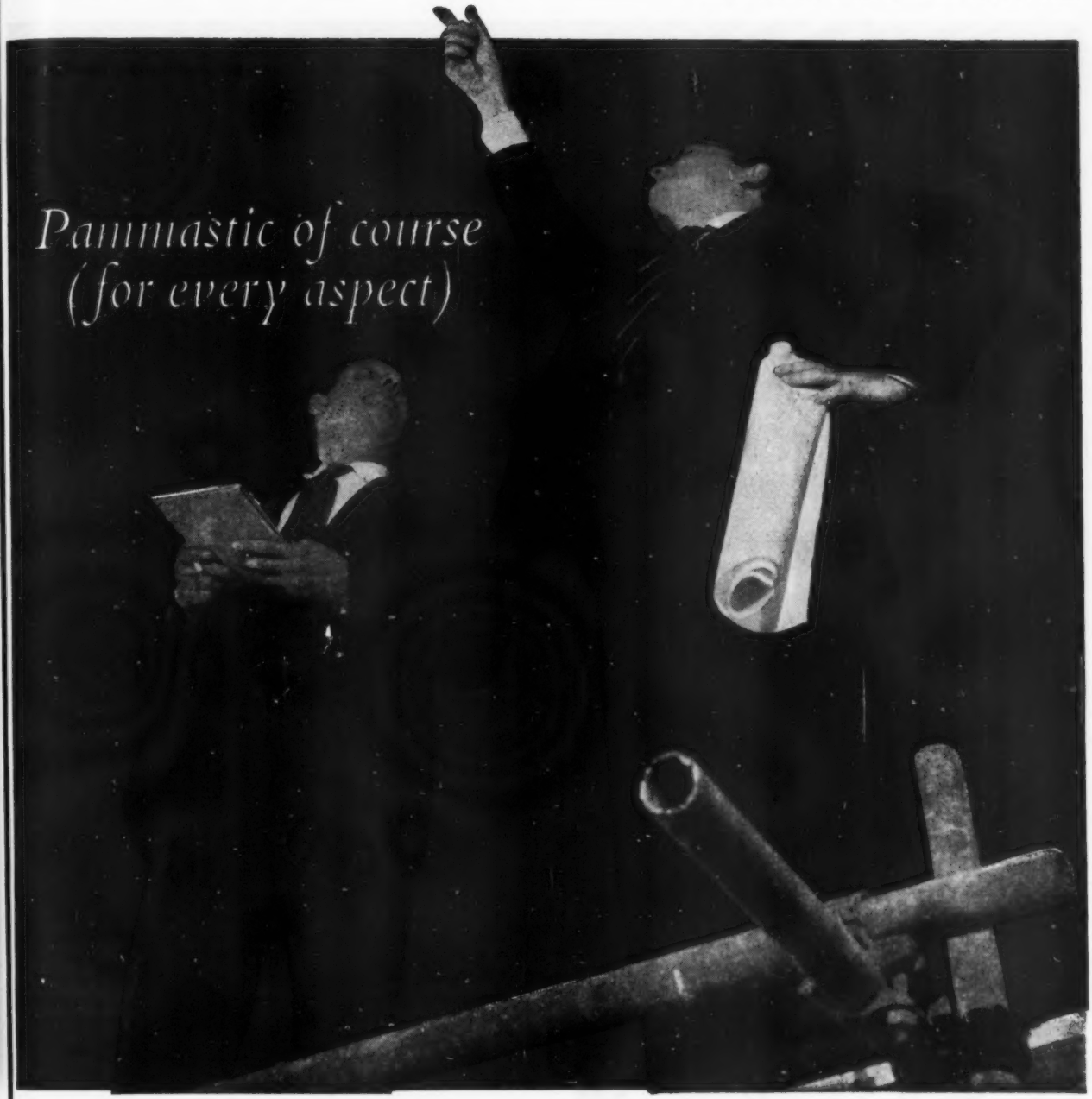

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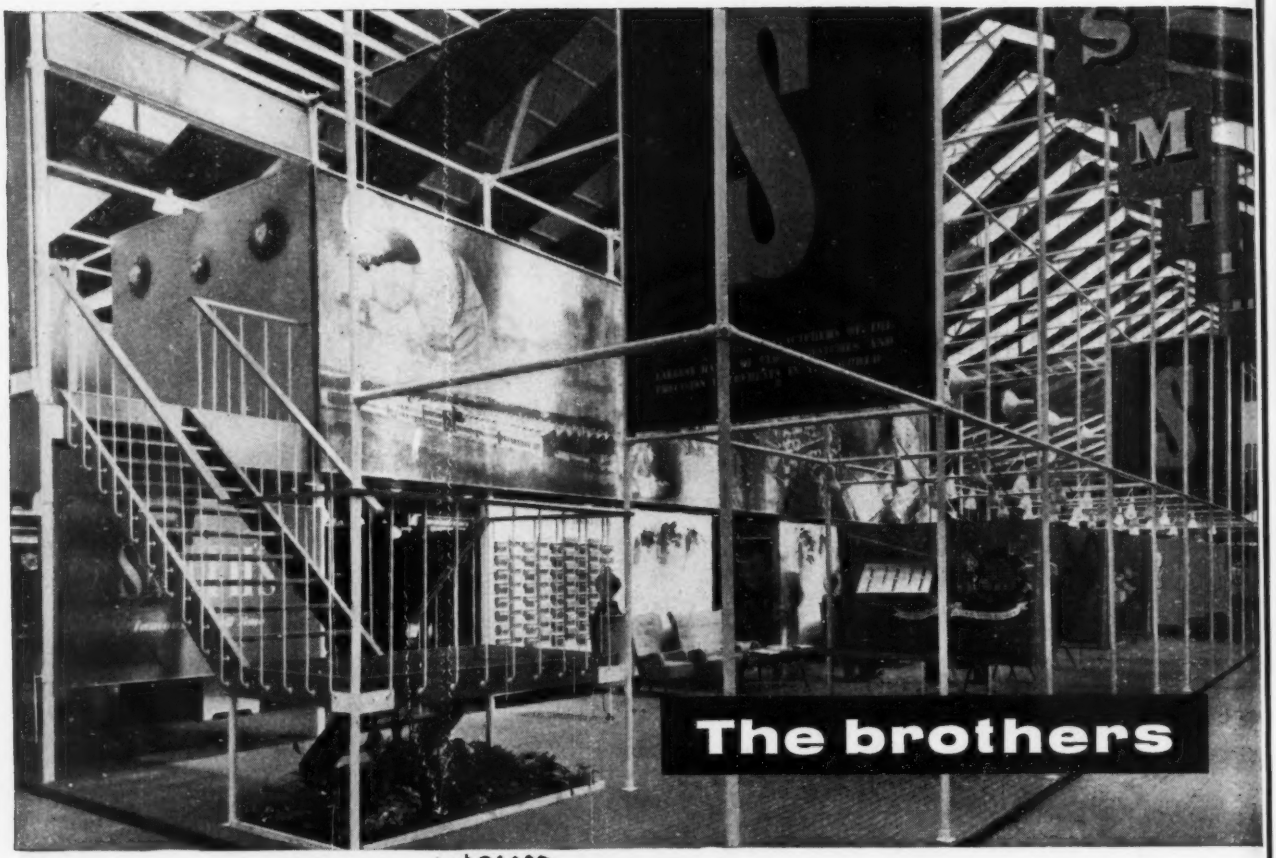

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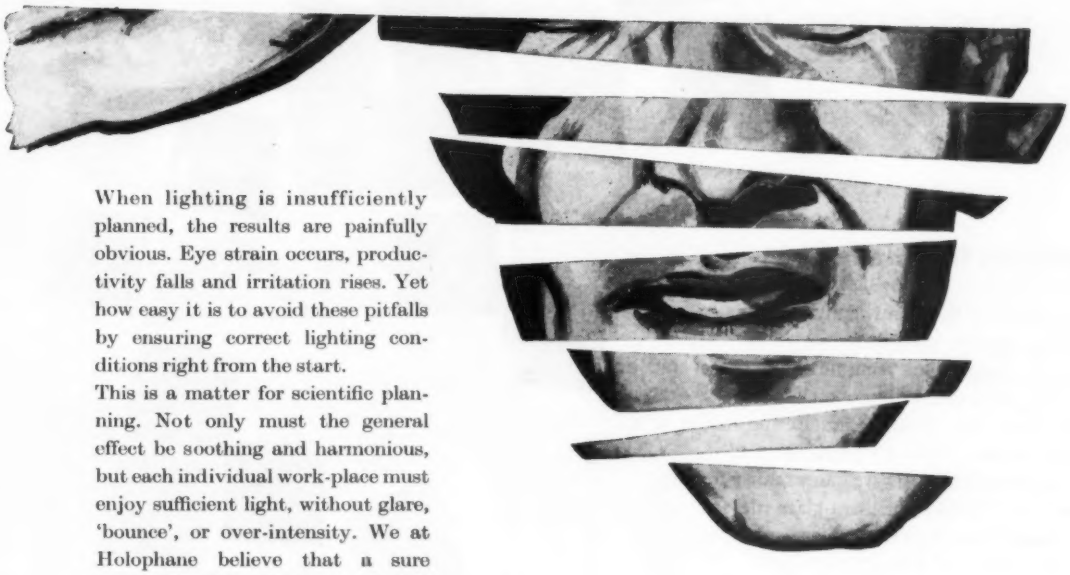

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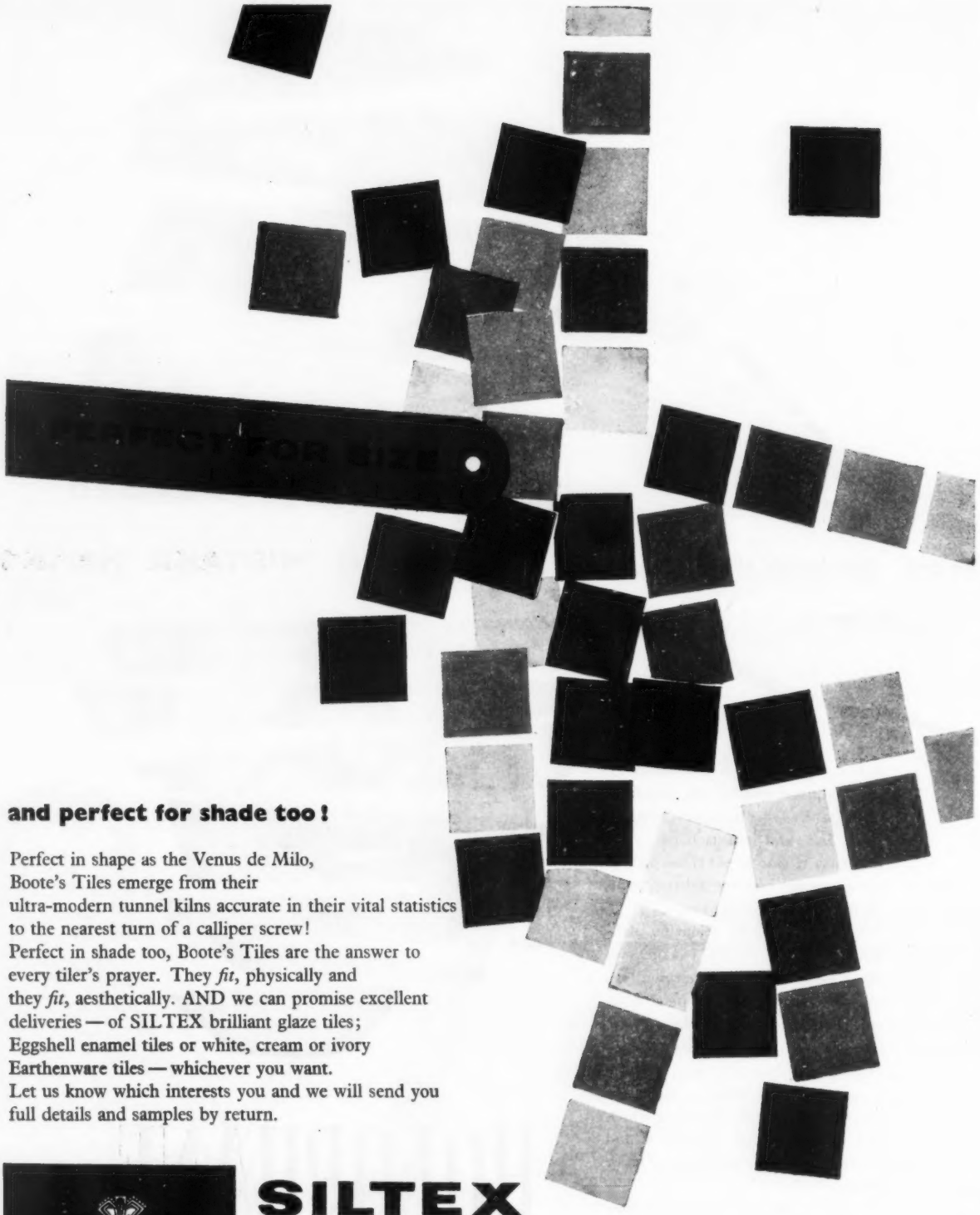

and perfect for shade too!

Perfect in shape as the Venus de Milo,
Boote's Tiles emerge from their
ultra-modern tunnel kilns accurate in their vital statistics
to the nearest turn of a calliper screw!
Perfect in shade too, Boote's Tiles are the answer to
every tiler's prayer. They *fit*, physically and
they *fit*, aesthetically. AND we can promise excellent
deliveries — of SILTEX brilliant glaze tiles;
Eggshell enamel tiles or white, cream or ivory
Earthenware tiles — whichever you want.
Let us know which interests you and we will send you
full details and samples by return.

REGD. ENGLAND

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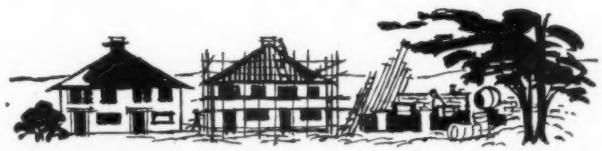
CERAMIC WALL TILES

T. & R. BOOTE LTD.

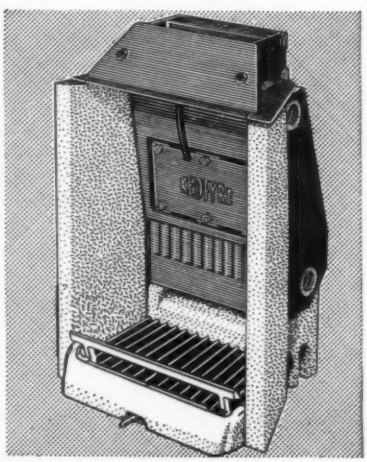
(Established 1842) Burslem, Stoke-on-Trent

Fix tiles with Boote's "TYLOFAST" Tile Fixing Mastic!

There's nothing to touch a Redfyre Bacboiler for successful low-cost water heating



Redfyre 60

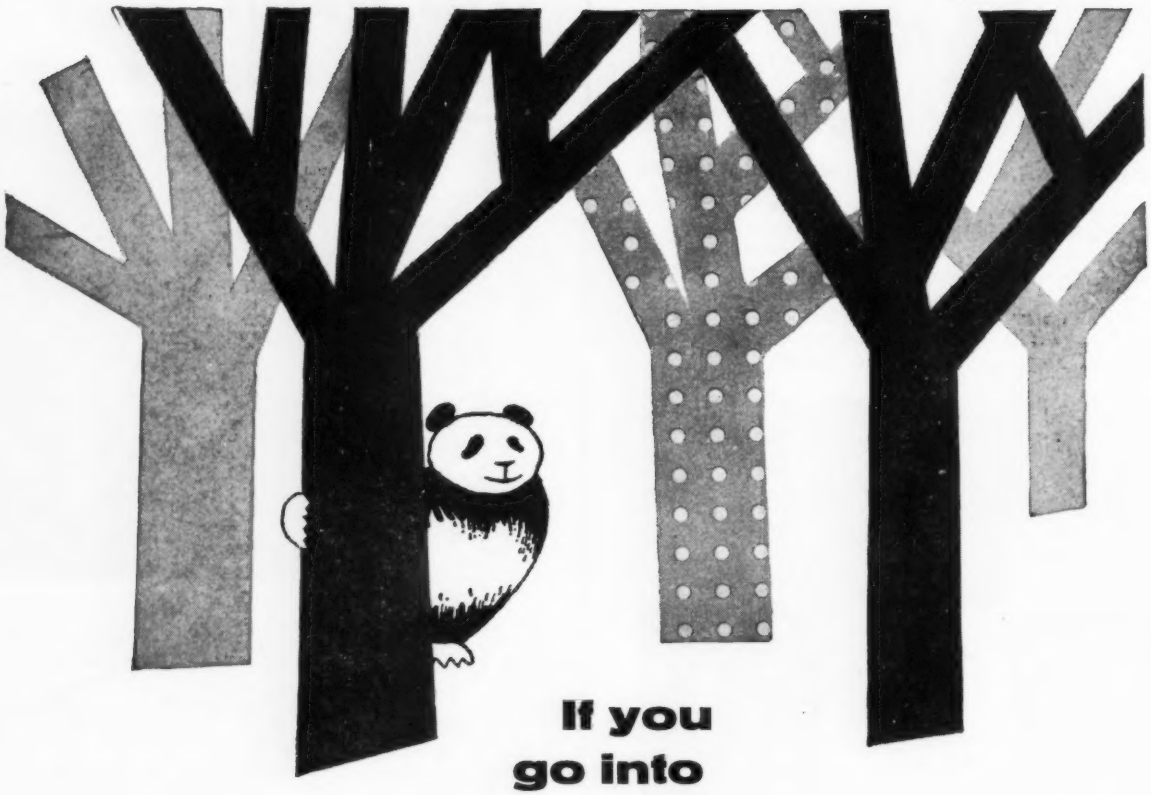


Hearth Redfyre

THAT'S WHAT MAINTENANCE PEOPLE SAY — and that's why huge numbers go into new homes every week. And now there are two *new* Ministry-approved Bacboiler fires—the Hearth Redfyre with underfloor air-feed; and the low-cost Redfyre 60, a controlled-burning fire accepted by the Council of Industrial Design. Both have exceptionally pleasing modern lines. And both (like all the Bacboiler range) supply ample hot water *and* heat one or two radiators—or up to four if hot water isn't needed. May we send you full details?

REDFYRE

NEWTON CHAMBERS & COMPANY LIMITED Redfyre Products Thorncliffe Sheffield



If you go into the woods today

. . . a surprise is waiting for you when you meet PANDA BOARD. This extra tough new hardboard is manufactured by SCHAUMAN—the producers of the largest range of wood-based sheet materials in Europe. Though competitive in price it is immensely tougher and more damp resistant than required by British Standard. PANDA BOARD is light and works like wood because it *is* wood. PANDA BOARD is available in sizes cut from 4′×18′ and 5′ 7″×16′ sheets with a hard flat surface in attractive standard finish in $\frac{1}{8}$″ and $\frac{3}{16}$″ thicknesses, and in ivory-faced finish in $\frac{1}{8}$″ thickness.

Look for this Trade Mark!

PANDA BOARD

REGD. TRADE MARK

Write for literature and samples of plain and perforated PANDA BOARD *to sole agents for U.K. and Ireland:*

PHARAOH'S PLYWOOD CO. LTD.

ADELAIDE HOUSE, LONDON BRIDGE, LONDON, E.C.4. Telephone: MANsion House 5351 (6 lines)

Manufactured by:

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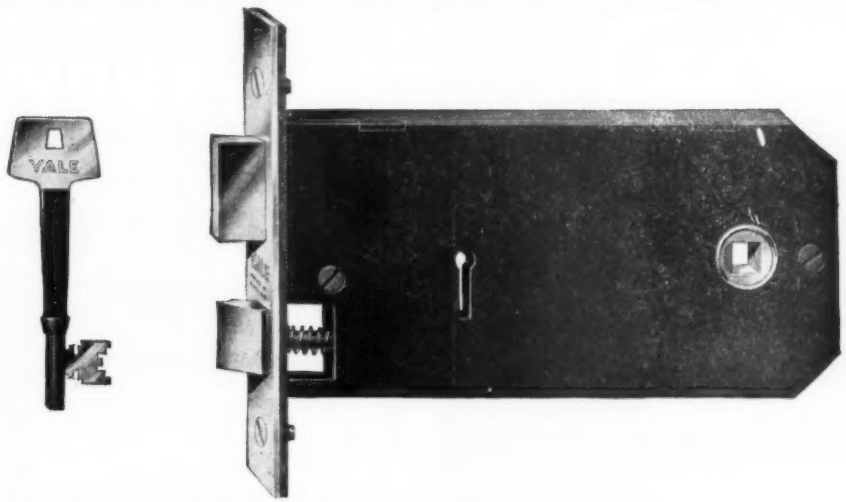
Producers of the largest range of wood-based sheet materials in Europe.

NEW!

A COMPLETE RANGE OF

3 LEVER LOCKS

at a NEW LOW COST

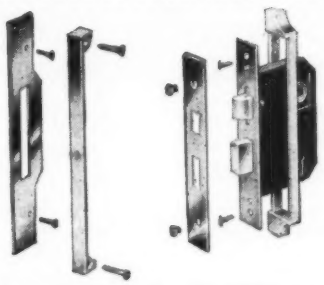


- **144 differs off levers alone (standard).**
- **350 differs off levers (if required).**
- **3,500 differs available off levers *and* wards.**
- **Follower holes brass bushed.**
- **Forend—armoured brass upper and steel lower.**
- **Deadlock bolts reinforced with hardened steel pins.**
- **Key—in line with "contemporary" design, the key is light and attractive—of nickel-plated steel, with nylon-covered shank to give durability and self-lubrication at the point of contact with the lock. Conforms with British Standard 2088 ("Performance Tests for Locks": Tests 7c (II) and 7d).**

This new range of 3-lever mortice locks enables you to specify greater security at a most moderate cost. The range—which includes both horizontal and upright type locks, two deadlocks and a sliding door locking latch—covers every need for a mortice lock.

Master keying. The locks can be master keyed in suites to include sub-masters, sub-grand masters and grand masters . . . and because all differs come from levers alone, a greater degree of security is assured.

Literature. If you have not already received your copy of the booklet giving full specifications, write to the address below.



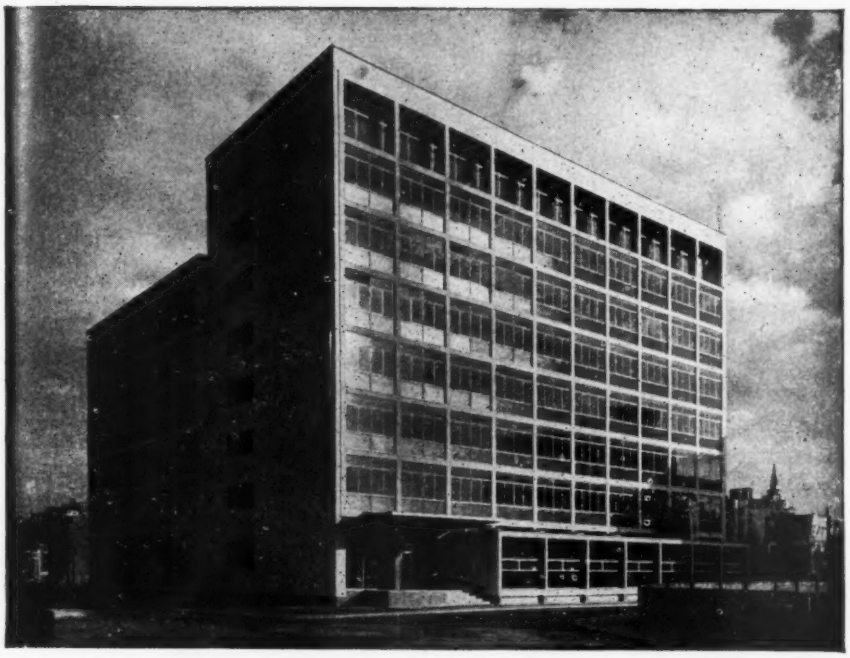
THE YALE REVERSIBLE REBATED FOREND SET

This set enables Yale 3-Lever Mortice Locks *and* all other standard Yale plain forend mortice locks to be converted into fully rebated locks. The set is completely reversible for left or right hand, inward or outward opening doors.

Where there's a door there's a need for YALE

REGISTERED TRADE MARK

THE YALE & TOWNE MANUFACTURING COMPANY · BRITISH LOCK AND HARDWARE DIVISION · DEPT. A.6 · WILLENHALL · STAFFS



Roman House (a Chamberlain Group Project) has risen from the ashes of the Nazi blitz and overlooks the church of St. Giles, Cripplegate. It is an impressive building, a modern building, an eminently SAFE building.

Dreadnought have installed two Protex automatic steel fireproof rolling shutters and seven single hinged automatic fireproof doors. The risk of fire has been reduced to the absolute minimum. Dreadnought Fireproof Doors are fully approved by the Fire Offices Committee and the L.C.C.

Architect: R. N. Wakelin, F.R.I.B.A., of Campbell Jones & Sons.

ROMAN HOUSE London Wall E.C. has been fitted with **DREADNOUGHT**

Fireproof Doors and Rolling Shutters

DREADNOUGHT FIREPROOF DOORS (1930) LTD., 26 Victoria Street Westminster S.W.1. Tel: ABBey 1411

Agents: M.A.C. Engineering (Bristol), G.P.O. Box 60, Avon Works, Winterstoke Road, BRISTOL.

Messrs. F. & M. Fairman, Central Chambers, 93 Hope Street, GLASGOW.

South Wales (Fire Protection) Engineers Ltd., Pomeroy Works, Bute Docks, CARDIFF.

K. Kidson, Esq., Normanhurst Chambers, St. James Road, DUDLEY.

Beckett, Laycock & Watkinson Ltd

An economical combination of Boardroom and Chairman's Office in the modern style. Waring & Gillow executed the natural pine panelling, together with the complete furnishings.

Architects: Percy V. Burnett & Partners F/A.R.I.B.A.

WARING & GILLOW LTD

MAKERS OF FURNITURE & PANELLING TO ARCHITECTS' OWN DESIGNS

Contract Department, 164-182 Oxford Street, London, W.1 (Tel: MUSeum 5000)

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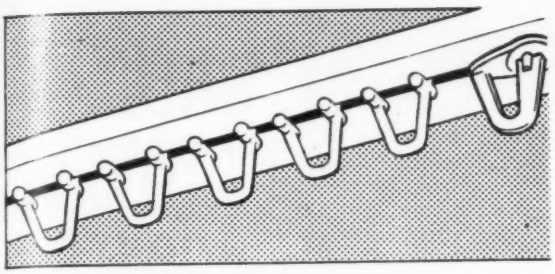

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- . . . looks part of the soffit, reveal, ceiling, etc.
- is clean, non-metallic
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- is extremely simple to fix
- Sesame is smooth, silent, and faultless in operation
- takes any weight of curtain, cannot jam
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Sesame

PATS. PENDING REGD. DESIGNS — TRADE MARK

the reliable curtain rail
on completely new lines

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British Standards

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provide for the inclusion of

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A valuable component of good mastic, on account of its remarkable consistency.

Further particulars on request from

PREVITÉ & CO. LTD.

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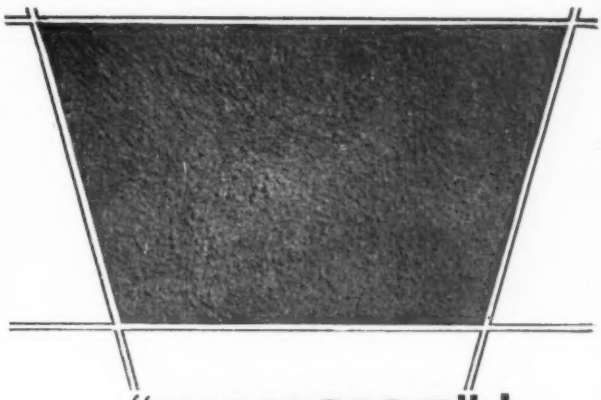

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TRADE MARK

above
for comfort
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HIGHEST SOUND ABSORPTION
GOOD THERMAL INSULATION
88% LIGHT REFLECTION

PLUS Dimensional stability under all humidity/temperature conditions. Fire safety and ease of fixing, either by metal suspension or adhesive.

" KILNOISE " Tiles are *top grade* at a very competitive price.

May we send you full details?

* CELLULAR ACOUSTIC TILES

Wm KENYON & SONS (METAMICA) LTD

DUKINFIELD · CHESHIRE. Telephones: ASHton-under-Lyne 1614/7 and 3673/6

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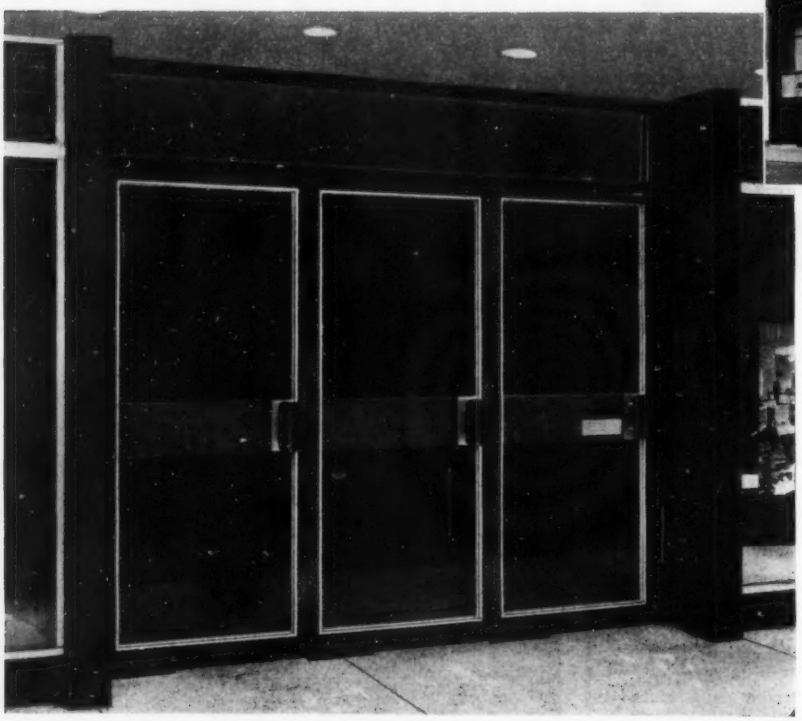
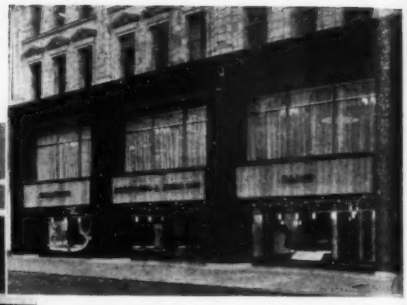
New Showroom in Tottenham Court Rd., W.1.
For John Line & Sons Ltd.





J. E. Dalling & Partners L/A.R.I.B.A.
Chartered Architects.
Higgs & Hill Limited
Main Contractors

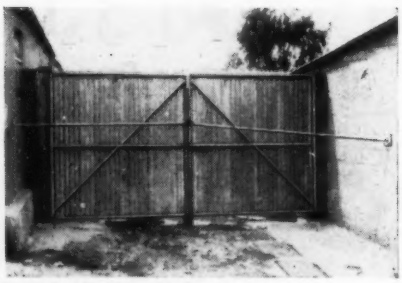
Ajax Aluminium display window sections and 'Jaxita' facings in silver and black anodised finish were used extensively in this imposing modern frontage.

The colourful entrance comprises Ajax Aluminium doors in enamelled finish.

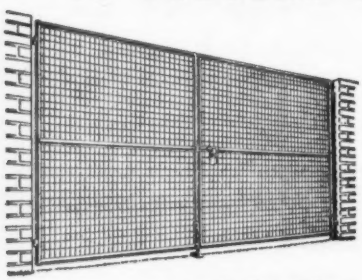
AJAX ALUMINIUM LTD.
Ajax House
Kangley Bridge Rd.
Sydenham, S.E.26

GATES *FOR ALL PURPOSES*

Also: Industrial Pallets; Farm and Dairy Equipment, including: Fencing, Cattle Crushes, Service Crates, Stockpens and Yards; Stunning Pens, Lairage and Cattle Market Pens, etc.



IN TUBULAR STEEL



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Tel.: Alresford 373 (5 lines).
GUSH & DENT (NORTHERN) LTD., Penrith, Cumberland.
Tel.: Penrith 3143 & 3303.
GUSH & DENT LTD., Barnfields Avenue, Leek, Staffs. Tel.: Leek 1138.

ASSISTANT ARCHITECTS

THE DUTIES

The Architects department is at present engaged upon a comprehensive programme of work including a new 17 storey administrative building in the centre of Birmingham, and a completely new high pressure gasification plant at Coleshill. The latter projects offers unique scope in contemporary industrial architecture, embracing not only the cladding of plant, but also the design of all ancillary buildings, canteens, welfare buildings, workshops, garages, etc. In addition, the department is responsible for the whole of the Board's building programme, including a range of new showrooms throughout the West Midlands area.

VACANCIES

Two Assistant Architects are required. Salary will depend on qualifications and experience. The posts are based at Edgbaston, Birmingham, and provide interesting and varied work in pleasant surroundings. There is a pension scheme and attractive conditions of service.

Please Write Fully to:

Industrial Relations Officer,
WEST MIDLAND GAS BOARD
6, Augustus Road,
Edgbaston,
Birmingham, 15.

CLASSIFIED ADVERTISEMENTS

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

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

AIR-MAIL SERVICE available on request.

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

Public and Official Accouncements

36s. per inch: each additional line, 3s.

GLASGOW CORPORATION
ASSISTANT ARCHITECTS
TOWN PLANNERS
QUANTITY SURVEYORS

The Architectural and Planning Department of the Corporation of the City of Glasgow has vacancies for a number of qualified Assistants in the above professions.

The Department has in hand a large, varied and interesting programme of works including comprehensive redevelopment, multi-storey flats, schools and civic buildings. The work will provide scope for personal initiative in the preparation of designs and details of schemes upon which construction work will follow.

The salary scale for these Assistantships is up to £1,385 with placing according to experience.

Form of application may be obtained from the Principal Administrative Officer, 20, Trongate, Glasgow, C.1.

A. G. JURY,
City Architect and Planning Officer.
1938

SOUTH WESTERN REGIONAL HOSPITAL BOARD

Applications are invited for the following posts in the Architect's Department in connection with an expansion of the Board's hospital building programme:—

(a) TWO PRINCIPAL ASSISTANT ARCHITECTS (Scale II) £1,665×£50(1)×£75(2)×£85(2)—£2,035.

(b) TWO SENIOR ASSISTANT ARCHITECTS £1,300×£60(5)—£1,600.

(c) ONE ASSISTANT ARCHITECT £905×£35(1)×£45(6)×£50(2)—£1,310, who would be required either in the Bristol or Plymouth Office.

Applicants must be Registered Architects. Previous hospital experience desirable but not essential. The work offers an opportunity of gaining experience in the field of hospital planning and covers all stages from sketch plans to the supervision of construction.

Applications stating age, qualifications and experience with the names of three referees to reach the Secretary of the Board, 27, Tyndalls Park Road, Bristol, 8, by July 16th. 1957

BRITISH EUROPEAN AIRWAYS

Two ASSISTANT ARCHITECTS required to work under the Chief Staff Architect on an increasing programme of interesting and varied projects involving some travel in the U.K. and overseas. Working conditions are good and a vigorous and practical approach to first class contemporary design is encouraged.

These permanent pensionable posts would suit qualified young men, trained full time at a recognised school of architecture with not less than two years' office experience. Men with experience who are about to qualify will be considered. Sensitive design ability and sound technical competence are essential.

Salary range £1,005—£1,367 10s. depending on qualifications and experience.

Write for full details and Application Form (to be returned by 22nd July, 1960) to Personnel Officer, Head Office BEA, Bealine House, Ruislip, Middlesex. 2048

BOROUGH OF EPSOM AND EWELL
BOROUGH ENGINEER AND SURVEYOR'S DEPARTMENT
APPOINTMENT OF ASSISTANT ARCHITECT—A.P.T. III

Applications are invited for the appointment of an ASSISTANT ARCHITECT on Grade A.P.T. III (£880 to £1,065 plus London weighting).

Applicants should have had experience in the preparation of plans, specifications, etc., connected with the development of housing estates and maintenance of buildings and preference will be given to candidates holding the Intermediate Examination of the R.I.B.A.

Applications, stating age, qualifications and experience, with the names of three referees should be sent to Mr. C. G. Cobbett, A.M.I.C.E., M.I.Mun.E., Borough Engineer and Surveyor, Town Hall, The Parade, Epsom, so as to reach him not later than the 18th July, 1960.

EDWARD MOORE,
Town Clerk.
2004

BOROUGH OF NUNEATON
ARCHITECTURAL ASSISTANT

Applications are invited from suitably qualified persons for this position. Salary—Special Grade £785—£1,070.

This post is suitable for a recently qualified person and will provide scope and opportunity for a varied experience as the Borough Council have much architectural work in hand.

Further details and forms of application, which must be returned not later than the 15th July, 1960, may be obtained from me.

A. A. CRABTREE,
Town Clerk.

Council House,
Nuneaton.
June, 1960. 2051

EAST BARNET URBAN DISTRICT COUNCIL

Applications are invited from suitably qualified persons for the following permanent appointments:—

(i) SENIOR ASSISTANT ARCHITECT—A.P.T. IV (£1,065—£1,220, plus London weighting).

(ii) ARCHITECTURAL ASSISTANT—A.P.T. II (£765—£880, plus London weighting).

(iii) ARCHITECTURAL DRAUGHTSMAN—A.P.T. I (£610—£765, plus London weighting).

(iv) SENIOR ASSISTANT ENGINEER—A.P.T. IV (£1,065—£1,220, plus London weighting).

(v) ASSISTANT ENGINEER—Special Grade (£785—£1,070, plus London weighting).

Application forms, obtainable from the Engineer and Surveyor, Town Hall, Station Road, New Barnet, Hertfordshire, must be returned by not later than Monday, 18th July, 1960. 2015

BENTLEY-WITH-ARKSEY URBAN DISTRICT COUNCIL
APPOINTMENT OF ASSISTANT ARCHITECT

Applications are invited for the position of Assistant Architect at a salary in accordance with Grade IV (£1,065—£1,220 per annum).

Applicants must have passed the final examination of an appropriate professional body or be University graduates, and have considerable experience of municipal housing and other municipal work.

Applications, stating age, qualifications and experience, particulars of present and previous appointments, together with copies of three recent testimonials and endorsed "Assistant Architect," must be delivered to the undersigned not later than noon on Monday, 18th July, 1960.

The successful candidate will be provided, if necessary, with housing accommodation.

The appointment will be subject to (1) the provisions of the Local Government Superannuation Act, 1953; (2) the National Scheme of Conditions of Service; (3) the satisfactory passing of a medical examination and (4) termination by one month's notice on either side.

W. H. ALEXANDER,
Clerk to the Council.

Council Offices,
Cooke Street,
Bentley,
Nr. Doncaster. 2026

ASSISTANT ARCHITECTS
REQUIRED BY
MINISTRY OF WORKS

For employment in London, Reading, Leeds and Cardiff.

GENERAL CONDITIONS

Salary range between £830 (at age 25) and £1,300 per annum (London) slightly less elsewhere.

Starting point according to age, qualifications and experience. 5 day week. Annual leave 4 weeks and 2 days initially. Prospects of promotion and opportunities for permanent and pensionable posts.

QUALIFICATIONS

Candidates must be Registered Architects by examination or Registered Architects who, since registration, have passed a professional examination in Architecture recognised by the Architects Registration Council of the United Kingdom. They must also possess good professional experience.

APPLICATIONS

State age and give full details of training and experience to Mr. E. Bedford, C.B., C.V.O., A.R.I.B.A., Chief Architect, Ministry of Works (E), Room 427, Abell House, John Islip Street, London, S.W.1. 2028

BOROUGH OF BEXLEY

Applications are invited for the following appointments:—

(a) SENIOR BUILDING AND PLANNING ASSISTANT—Grade A.P.T. IV (£1,065—£1,220 per annum) plus London weighting. Applicants must have passed the final examination of an appropriate professional body and have had considerable experience in dealing with all aspects of planning and building Bye Law matters.

(b) ASSISTANT ARCHITECT — Grade A.P.T. III (£880—£1,065 per annum) plus London Weighting. Applicants should have suitable professional qualifications and experience in school and housing projects.

(c) ARCHITECTURAL DRAUGHTSMAN—Grade A.P.T. I (£610—£765 per annum) plus London weighting. Applicants should be good draughtsmen and have a general knowledge of building construction and specification work.

Form of application and conditions of appointment are obtainable from Borough Engineer, West Lodge, Broadway, Bexleyheath, to whom completed applications must be returned by MONDAY, 25th July, 1960. Canvassing will disqualify.

ARTHUR GOLDFINCH,
Town Clerk.
2007

BUILDING SURVEYORS

Architect's Department, L.C.C., has vacancies in Building Regulation Division and District Surveyors' Service for work in connection with applications under the London Building Acts and Byelaws. District Surveyors' offices are located in Metropolitan Boroughs and work involves negotiations with developers and supervision of works in progress.

Up to £1,250, commencing according to qualifications and experience. Form and particulars from Hubert Bennett, F.R.I.B.A., Architect to Council (EK/AJ/1637.7a), County Hall, S.E.1. 1964

CITY OF NOTTINGHAM
ESTATES DEPARTMENT

Applications are invited for the appointment of two ASSISTANT ARCHITECTS in the Chief Architect's Section.

The commencing salary will be within the Special Grade (£785—£1,070).

The appointment will be subject to the National Joint Council's Scheme of Conditions of Service.

Applications stating age, qualifications, experience, present appointment and salary, and naming two referees, should be sent to the Estates Surveyor & Valuer, The Guildhall, Nottingham, by 15th July, 1960.

T. J. OWEN,
Town Clerk.

The Guildhall,
Nottingham. 1987

METROPOLITAN BOROUGH OF BERMONDSEY
BOROUGH ENGINEER AND SURVEYOR'S DEPARTMENT
ASSISTANT ARCHITECT

Applications are invited for the permanent appointment of ASSISTANT ARCHITECT, Grade APT III-IV (salary range from £880—£1,220 p.a.) plus London Weighting, commencing salary according to experience and qualifications. Applicants must have passed Final R.I.B.A. Examination. Applications on forms from the undersigned to be returned by not later than 16th July, 1960.

J. S. LAMBERT,
Town Clerk.

Municipal Offices,
Spa Road,
London, S.E.16. 1994

ELSTREE RURAL DISTRICT COUNCIL
APPOINTMENT OF TEMPORARY ASSISTANT ARCHITECT

Applications are invited for the above temporary appointment in the Department of the Engineer & Surveyor, for a period of not less than two years, on work in connection with the design and erection of a proposed Public Hall, Covered Swimming Pool and other Civic Centre buildings.

Salary J.N.C. Scale "C," £1,385 to £1,620 per annum, commencing salary to be determined according to experience.

Candidates should have passed the Final Examination of the R.I.B.A. or equivalent.

The appointment will be subject to the National Scheme of Conditions of Service: the provisions of the Local Government Superannuation Acts, 1937-1953, and will be determinable by one month's notice, in writing, on either side. The successful candidate will be required to pass a medical examination.

Relationship to any member or Officer of the Council must be disclosed and canvassing directly or indirectly will disqualify.

Applications, stating age, qualifications and experience, together with the names and addresses of two referees, should be sent in an envelope endorsed "Temporary Assistant Architect" so as to reach the Engineer & Surveyor at these offices not later than Friday, 22nd July, 1960.

A. LANCASHIRE,
Clerk of the Council.

Council Offices,
Shenley Road,
Boreham Wood, Herts.
24th June, 1960. 2085

BOROUGH OF BASINGSTOKE

Applications are invited from Associates, R.I.B.A., for the post of SENIOR ASSISTANT in the Architect's Department of a town which is growing rapidly.

The work is varied and interesting, but applicants must have gained considerable housing experience. Salary range £785—£1,070 according to experience. N.J.C. Conditions. Post pensionable. Medical examination. Casual user car allowance. Housing available if required. Assistance with removal expenses.

Details giving age, training, experience, etc., and names and addresses of three referees, to be sent to the Borough Architect, Eric Almond, Dipl. Arch., A.R.I.B.A., Municipal Buildings, Basingstoke, Hants., by 25th July, 1960.

L. WOMERSLEY,
Town Clerk.
2087

COUNTY BOROUGH OF BLACKBURN
ASSISTANT QUANTITY SURVEYOR
GRADE APT SPECIAL £785—£1,070.

Applications are invited for this appointment. Candidates should have passed the Final Examination of the R.I.C.S. (Q.S. section) or equivalent.

Housing accommodation will be available if required.

Applications stating age, qualifications and experience, with names of two referees to be sent to Borough Engineer, Town Hall, Blackburn, by 18th July.

FRANK SQUIRES,
Town Clerk.
2150

BOROUGH OF SCARBOROUGH
JUNIOR ARCHITECTURAL ASSISTANT

Applications are invited for the above appointment (A.P.T. I, £610—£765 per annum).

The appointment will be subject to the provisions of the Local Government Superannuation Acts, 1937 and 1953, and to the passing of a medical examination, and will be terminable by one month's notice on either side.

In a suitable case the Council would be prepared to assist in the provision of housing accommodation and the payment of part removal expenses.

Applications, in envelopes endorsed "Junior Architectural Assistant," stating age, present and previous appointments, training, qualifications and experience, together with names of two referees, must be delivered to the undersigned not later than Wednesday, 20th July, 1960.

V. FORSHAW,
Borough and Water Engineer.

Town Hall,
Scarborough.
July, 1960. 2089

COVENTRY

Enthusiastic imaginative ARCHITECT required in Central Area Division. Programme includes multi-storey commercial and residential development and swimming baths. Salary within A.P.T. V, £1,220—£1,375.

Housing accommodation in approved cases. Removal expenses loan available. Five-day working week. Canteen facilities. Application forms from Department of Architecture and Planning, Council House, Earl Street, returnable 14 days publication. 2149

CITY OF LEEDS EDUCATION COMMITTEE
LEEDS COLLEGE OF ART
LEEDS SCHOOL OF ARCHITECTURE AND TOWN PLANNING

Vacancies exist from September next for qualified ARCHITECTS to help in the training of senior students.

Appointments will be made on a part-time day basis. Further particulars and forms from: The Head of the School, 43a, Woodhouse Lane, Leeds, 2. (Telephone No. 32491-2.)

GEORGE TAYLOR,
Chief Education Officer.

Calverley Street,
Leeds, 1. 2065

CITY OF SHEFFIELD

Applications are invited for the following post on the staff of the Estates Surveyor, Mr. W. H. Rothwell,, B.Sc., F.R.I.C.S.:—

CHIEF ASSISTANT (REPAIRS), PROPERTY MANAGEMENT, Grade A.P.T. IV, £1,065—£1,220.

Qualification A.R.I.C.S. (Building) or equivalent.

Applicants must be able to take charge of the Property Management (Repairs) Sub-Section and have a wide experience in the repair, conversion and demolition of all kinds of property. Experience of a large scale House Repair programme is desirable.

Further particulars of the duties involved may be obtained on written application to the Estates Surveyor.

The post is superannuable, subject to N.J.C. conditions of service and to medical examination.

Applications stating name, address, age, qualifications, experience, previous and present positions with dates and salaries and the names and addresses of two referees should reach the undersigned not later than 27th July, 1960.

JOHN HEYS,
Town Clerk.

Town Hall,
Sheffield, 1. 2130

TOWN PLANNERS AND ASSISTANT TOWN PLANNERS
NEW SOUTH WALES DEPARTMENT OF LOCAL GOVERNMENT

Applications are invited for:

TOWN PLANNER—Salary £A2,004—£A2,069.

ASSISTANT TOWN PLANNER (with Certificate)—Salary £A1,749—£A1,784.

ASSISTANT TOWN PLANNER (without Certificate)—Salary £A1,589—£A1,669.

Commencing salary according to qualifications and experience.

Promotion positions of Senior Town Planner, salary range £A2,194—£A2,259.

Duties.

Field and office investigation of town planning schemes in urban and country districts of New South Wales. Preparation of reports and submissions on matters arising from investigation and enquiries, and objections received by the Department following the exhibition of town planning schemes.

Qualifications.

1. University degree in appropriate Faculties of recognised Universities with studies including either Architecture, Engineering, Surveying, Mathematics, Economics, Geography or Geology.

2. Corporate Membership, by examination, of the Institution of Engineers, the Royal Institute of Architects or the Institution of Surveyors.

3. Associate Membership, by examination, of the Town Planning Institute, London.

Previous experience in town and country planning work should be indicated.

Passage to New South Wales for successful applicants and family under 18 years of age.

For further particulars and application forms, please write to the Agent General for New South Wales, 56, Strand, London, W.C.2, with whom four copies of applications (including a recent photograph of the applicant) should be lodged by 31st July, 1960. 2115

CITY OF BIRMINGHAM PUBLIC WORKS DEPARTMENT
PLANNING AND REDEVELOPMENT SECTION

Applications are invited for the following posts:—

(*a*) SENIOR PLANNING ASSISTANTS.
Grade A.P.T.IV (£1,065/£1,220 p.a.).
(i) Design. (ii) Development Control.

(*b*) PLANNING ASSISTANTS.
Special Scale (£785/£1,070 p.a.).
(i) Design. (ii) Development Control. (iii) Research.

(*c*) PLANNING ASSISTANTS.
Grade A.P.T.II (£765/£880 p.a.).
(i) Design. (ii) Development Control.

Applicants for posts (*a*) and (*b*) should be Corporate Members of the Town Planning Institute or hold other equivalent qualifications, and for posts (*c*) should have passed the Intermediate Examination of the Town Planning Institute or hold equivalent qualifications.

Applications for the appointments in the Development Control Office, should be experienced in the preparation of reports on planning applications in Central Area of City and other areas of intensive development.

Candidates for the research appointment should be experienced in surveys of city development and their analysis, and experience of social surveys would be helpful.

The successful candidates for design appointments will undertake work requiring imagination, perception and initiative.

The appointments are permanent, superannuable and subject to a medical examination.

Applications endorsed with the heading of the post applied for, stating qualifications, age and experience, and naming two referees, should reach the undersigned by the 23rd July, 1960.

Canvassing disqualifies.

HERBERT J. MANZONI,
City Engineer and Surveyor.

Civic Centre,
Birmingham, 1.
30th June, 1960. 2155

COUNTY BOROUGH OF BIRKENHEAD
BOROUGH ARCHITECT'S DEPARTMENT

APPLICATIONS are invited for the following Established Posts:—

(A) CHIEF ASSISTANTS
Grade A.P.T. V (£1,220—£1,375)

(B) PRINCIPAL ASSISTANTS
Grade A.P.T.IV (£1,065—£1,220)

(C) ASSISTANT ARCHITECTS
Special Grade (£ 785—£1,070)
Grade A.P.T.III (£ 880—£1,065)

Applicants for posts (A) must be Associates of the Royal Institute of British Architects and the officer appointed will be responsible for the work in the Education Section or Housing and General Section.

Applicants for posts (B) must be qualified and have a good general experience in design and construction and capable of taking charge of large projects with the minimum of supervision.

Applicants for post (C) must be suitably qualified.

Consideration given to Housing Accommodation or up to 100% Mortgage facilities. The posts offer interesting and responsible work in connection with the Council's extensive programme of Schools and other major building schemes. The appointments are subject to one month's notice on either side. Form of application and further particulars from Borough Architect's Department, 3, Conway Street, Birkenhead. Closing date for applications—20th July, 1960. Relationship to members or senior officers of the Council must be disclosed. 2139

BOROUGH OF STOCKTON-ON-TEES
BOROUGH ARCHITECT'S DEPARTMENT

Applications are invited for the following appointments:—

SENIOR ASSISTANT ARCHITECT—
Salary A.P.T. IV (£1,065—£1,220).

TWO ASSISTANT ARCHITECTS—
Salary Special Grade (£785—£1,070).

ASSISTANT QUANTITY SURVEYOR—
Salary A.P.T. I (£610—£765).

Forms of application from the Borough Architect, 28 The Square, Stockton-on-Tees, to be returned not later than the 12th July, 1960.

Any person applying at present employed in Local Government Service with less than two years' service with his existing employer will not be considered.

Housing accommodation will be available for married applicants for the architectural posts.

JOHN B. HAWORTH,
Town Clerk.
2148

NORTHERN IRELAND HOUSING TRUST
SENIOR ASSISTANT ARCHITECT

The Trust invites applications for the post of Senior Assistant Architect, Grade II, on scale of £1,150—£1,300.

Candidates must be Associate Members of the Royal Institute of British Architects. Placing will be according to experience.

The person appointed will be required to contribute to a superannuation scheme which allows for the transfer of benefits in Local Government Schemes in suitable cases.

Housing accommodation may be arranged for married candidates.

Please apply not later than 5th August, 1960, giving full details of age, education, qualifications and experience, including present post and salary, to the General Manager, Northern Ireland Housing Trust, 12, Hope Street, Belfast, 12.

Please mark envelope 33/83. 2074

NEWTON-LE-WILLOWS URBAN DISTRICT COUNCIL
APPOINTMENT OF ARCHITECTURAL ASSISTANT

Applications are invited for this post. Salary Grade A.P.T. II. Usual service conditions. Provision of housing accommodation considered.

Preference will be given to applicants who have had experience in municipal housing.

Applications, stating age, qualifications and experience, and the names of two referees, to be received by Clerk of the Council, Town Hall, Market Street, Newton-le-Willows, Lancashire, not later than 13th July, 1960. 2154

NATIONAL CAPITAL DEVELOPMENT COMMISSION, CANBERRA, AUSTRALIA

Vacancies: Town Planning and Architectural Divisions.

TOWN PLANNING

Applications are invited for appointments to the Town Planning Division of the Commission at salaries from £1,730 to £2,590 per annum, according to experience and ability. Applicants should give evidence of aptitude and qualifications in one or more of the following fields:—Survey, Investigation and Analysis; Master Planning; detail Development Planning; Three-dimensional Site Planning; Development Control; Presentation Drawing and Illustration.

ARCHITECTURAL

Applications are also invited for the position of SENIOR ARCHITECT for design and supervision co-ordination duties, the salary range from £2,135 to £2,330 per annum. Applicants must be qualified Architects and eligible for admission to the R.A.I.A. and/or R.I.B.A.

Duties: Responsible to the Chief Architect for co-ordination and control of design and construction of architectural works for which private Architects and other agencies have been commissioned.

General Conditions: Fares to Australia of the successful applicant, his wife and dependent children, will be paid by the Commission. Housing will be available and superannuation scheme applies.

Applications to be made on forms obtainable form the Public Service Board Representative, Australia House, The Strand, London, W.C.2, and returned to this office by 30th July, 1960.

Note: Salary ranges quoted are Australian currency. 2164

WAR OFFICE, WORKS DIRECTORATE
SCOTTISH AND NORTHERN IRELAND QUANTITY SURVEYING ASSISTANTS

If you have passed either the FIRST or INTERMEDIATE examination of the RICS and are eligible to sit your next examination in the Quantity Surveying Section, you are invited to apply for QUANTITY SURVEYING ASSISTANT vacancies in the WAR OFFICE, CHESSINGTON, SURREY.

The Quantity Surveying Division offers wide experience in all aspects of quantity surveying work on major building and civil engineering projects.

On appointment, applicants will be given a special training course in English Quantity Surveying Practice, coupled with a free evening course, for one term, at the College of Estate Management, London.

Salaries range from £402 at age 19 to £900 per annum, according to age, qualifications and experience. Five-day week, generous leave, sick pay and assistance for external training. There will be opportunities later for promotion to pensionable appointment.

APPLY IMMEDIATELY for interview, giving age, details of education, training and experience, to THE CHIEF QUANTITY SURVEYOR, THE WAR OFFICE, CHESSINGTON, SURREY. 2142

CITY OF NEW SARUM
CITY ENGINEER'S DEPARTMENT

Applications are invited for the appointment of ASSISTANT QUANTITY SURVEYOR at a salary within the range of A.P.T.II £765—£880 to Special Scale (£785—£1,070) according to age, qualifications and experience.

Candidates should have passed at least the intermediate examination of the Royal Institution of Chartered Surveyors (Quantities) or its equivalent and have had at least five years' experience in a Quantity Surveyor's office.

The appointment is superannuable and will be subject to the provisions of the National Scheme of Conditions of Service and to the passing of a medical examination. Housing accommodation may be made available to the successful candidate if required.

Applications stating age, qualifications, present and previous appointments with salaries, details of experience together with names of two referees should be sent to the City Engineer, The Council House, Bourne Hill, Salisbury, not later than 19th July, 1960.

GEO. RICHARDSON,
Town Clerk.
2141

THE UNIVERSITY OF MANCHESTER
APPOINTMENT OF PLANNING ASSISTANT

Applications are invited from registered Architects for the post of Second Assistant to the Planning Officer in the Bursar's Department. The successful candidate will be required to assist in the co-ordination and control of an extensive building development programme, and the salary will be in the range £1,200—£1,400 per annum.

Further information may be obtained from the Bursar, University of Manchester, Oxford Road, Manchester, 13. 2066

FIFE COUNTY COUNCIL
COUNTY ARCHITECT'S DEPARTMENT

Applications are invited for the undernoted appointments:—

(*a*) SENIOR ARCHITECTS—Grade £1,096/£1,366.

(*b*) ARCHITECTS—Admin. Grades "C" and "D" £980/£1,120.

(*c*) DRAUGHTSMEN—Executive II and III. £675/£795.

(*d*) JUNIOR DRAUGHTSMEN—Executive I and II, £605/£735.

Appointments (*a*) and (*b*) are to a large office mainly engaged on new school work. Candidates should have contemporary outlook and be Associates of the R.I.B.A. Applicants for posts (*c*) should be experienced draughtsmen. Applicants for posts (*d*) should have completed their apprenticeship and be desirous of obtaining further training and experience. Housing accommodation may be available. Superannuation Scheme. Applications, stating post applied for, details of age, experience, qualifications, present position and salary, accompanied by copies of recent testimonials, by 29th July, 1960, to the County Clerk, County Buildings, Cupar, Fife. No canvassing. 2182

COUNTY BOROUGH OF CROYDON
ARCHITECTURAL STAFF

Applications are invited for appointments on the Corporation's Housing and General Architectural work, which includes a variety of interesting projects:

(*a*) ASSISTANT ARCHITECTS (Team Leaders). R.I.B.A. Final required, Grade A.P.T. IV (£1,110 to £1,265 p.a.).

(*b*) ARCHITECTURAL ASSISTANTS, Grade A.P.T. I (£630 to £805 p.a.), or, with R.I.B.A. Intermediate, Grade A.P.T. II (£790 to £920 p.a.), both progressing to £1,115 p.a. with R.I.B.A. Final.

Housing—advances up to 100 per cent. of Borough Valuer's valuation will be made available where needed, for the purchase of suitable houses in Croydon by successful applicants.

Further particulars and application forms from the Borough Engineer, Town Hall, Croydon. Closing date 20th July, 1960.

E. TABERNER,
Town Clerk.
2184

CANNOCK URBAN DISTRICT COUNCIL
(Population 43,020)
SENIOR ASSISTANT ARCHITECT
ARCHITECT'S DEPARTMENT

Applications are invited for this appointment at a commencing salary up to the maximum of Grade A.P.T. IV (£1,065—£1,220 per annum). The successful applicant will have an opportunity of gaining experience on a variety of capital schemes including new swimming baths, public offices, etc., in addition to a continuous housing programme.

HOUSING ACCOMMODATION AVAILABLE, if married.

Further particulars may be obtained from the undersigned to whom applications should be submitted by Tuesday, 26th July, 1960.

The area of the Authority is not adversely affected by proposals of the Local Government Commission.

H. C. ALLEN,
Clerk of the Council.
Council House,
The Green,
Cannock,
Staffs.
June, 1960. 2164

(AMENDED ADVERTISEMENT)
BOROUGH OF BEBINGTON
SENIOR ARCHITECTURAL ASSISTANT—
GRADE IV A.P.T.

Applications are invited for the above post, commencing salary of which will be fixed according to qualifications and experience. A car allowance on the casual user scale will be payable.

A five-day week is in operation.

Applicants must hold appropriate architectural qualification and should also be capable of undertaking development schemes of housing and public buildings.

Application forms are available from the Borough Engineer and Surveyor, Town Hall, Bebington, Cheshire, and when completed should be returned to the Town Clerk so as to be received by him, at the same address, not later than first post on Friday, 15th July, 1960.

The candidate appointed, if married and considered by the Council to be in need of housing at the time of appointment, will be found accommodation within a reasonable period of time.

Canvassing will be a disqualification. 2071

CITY OF BELFAST
CITY ARCHITECT'S DEPARTMENT

Applications are invited for the following posts:—

(*a*) ARCHITECTS, CLASS I.
Applicants must be registered and qualified by examination and should be capable of supervising architectural staff. Extensive experience in modern design and construction will be an advantage.
Salary: £1,010 × 6/£40 × £50—£1,300 per annum.

(*b*) ARCHITECTS, CLASS II.
Applicants must be registered Architects with experience in general design and construction of modern buildings.
Salary: £825 × 6/£35 × £40—£1,075 per annum.

(*c*) ARCHITECTURAL ASSISTANTS, CLASS I.
Applicants must have passed the Intermediate Examination of the R.I.B.A. and should have a sound practical experience in modern design and construction.
Salary: £610 × 6/£30 × 2/£40—£905 per annum.

(*d*) ARCHITECTURAL ASSISTANTS, CLASS II.
Applicants should be registered students of the R.I.B.A. or be prepared to register as students if appointed. Previous experience would be an advantage.
Wages at the rate of £285 × 2/£30 × £35 × 4/£30 × £40 × £35—£575 per annum.

(*e*) QUANTITY SURVEYOR, CLASS I.
Applicants should be Associates or Fellows of the R.I.C.S. and have a sound experience in the preparation of Bills of Quantities, valuations for certificates and preparation of final accounts and have a sound knowledge of preparing estimates.
Salary: £1,010 × 6/£40 × £50—£1,300 per annum.

(*f*) ENGINEER, CLASS II.
Applicants must have a University degree in Civil Engineering or be corporate members of the Institute of Civil Engineers.
Salary: £825 × 6/£35 × £40—£1,075 per annum.

(*g*) TECHNICAL ASSISTANTS, CLASS I.
Applicants should have a wide experience in land surveying, measuring existing buildings and assisting in civil engineering projects.
Salary: £620 × £30—£860 per annum.

This new Department under the City Architect offers considerable scope in all classes of municipal work including housing, schools, slum clearance, redevelopment, etc., with a number of interesting projects proceeding or envisaged, such as public baths, abattoir, crematorium, public libraries and welfare homes, and consideration will be given to applicants' stated preference for any particular type of development.

Commencing remuneration determined according to qualifications and experience. Superannuation contributions of approximately 6 per cent. of remuneration payable. Reciprocal pension arrangements exist between the Corporation and certain public authorities.

Canvassing will disqualify.

Application forms, etc., may be obtained from the City Architect's Office, Room 53, City Hall. Completed applications must reach the undersigned by 2nd August, 1960.

JOHN DUNLOP,
Town Clerk.
City Hall,
Belfast.
P.O. Box 234. 2081

QUANTITY SURVEYING ASSISTANTS
GRADE III
REQUIRED BY
AIR MINISTRY
IN THE PROVINCES

Duties include abstracting and billing, site measurement and preparation of estimates. Candidates must hold O.N.C. (Building or Builders Quantities) or equivalent and have good experience under Quantity Surveyor or Building Contractor. Knowledge W.D. Schedule an advantage. Financial assistance and time off given for recognised courses of study. Promotion and pension prospects. Five-day week with 18 days' paid leave a year initially. Overseas tours for which special allowances granted. Salary ranges from £680 (at age 26) to £850. Commencing salary dependent upon age, qualifications and experience.

Applicants, who must be natural born British subjects, should write stating age, qualifications and previous appointments including type of work done, to Manager (P.E.2), Ministry of Labour, Professional and Executive Register, Atlantic House, Farringdon Street, London, E.C.4. No original testimonials should be sent. Candidates selected will normally be interviewed in London and certain expenses reimbursed. Only applicants selected for interview will be advised. 1309

CORPORATION OF LONDON invites applications for temporary appointments in the City Engineer's Department in connection with the construction under contract of a large municipal building, for the duration of the works estimated at 2½ years:—

SITE ARCHITECT IN CHARGE. Salary: £1,375 by £50 to £1,475.

ASSISTANT SITE ARCHITECT. Salary: £1,325.

ASSISTANT ARCHITECT. Salary: £1,120.

CLERK OF WORKS. Salary: £1,025.

Candidates for architectural posts should be Corporate Members of R.I.B.A., have had good general experience, particularly of site management; the Site Architect in Charge must be capable of controlling a large contract and supervision of staff.

The appointments are subject to the Standing Orders of the Corporation and medical examination.

Applications, stating age, appointments held and experience, with names of two referees, to The City Engineer, Guildhall, London, E.C.2, by 18th July, 1960. 2070

KINGSWOOD URBAN DISTRICT COUNCIL
ARCHITECTURAL ASSISTANT

Applications are invited for the above post from persons experienced in surveys, layout, house plans and roads and sewers work. Varied work of a rapidly developing district.

Salary A.P.T. II (£765—£880).

Housing accommodation will be available if required. Casual car allowance. Alternate Saturdays free. Near Bristol and Bath.

Applications, stating age, qualifications (if any), experience, etc., and naming two referees, should reach the Engineer and Surveyor, Council Offices, Kingswood, Bristol, by 12th July, 1960.

I. H. DEARNLEY,
Clerk of the Council.
23rd June, 1960. 2075

LANCASHIRE COUNTY COUNCIL

Applications are invited for the post of PRINCIPAL ASSISTANT COUNTY ARCHITECT. Senior Officers Scale I—£2,325—£2,610.

The successful applicant will be required to collaborate with the Architect and his staff principals, and will be concerned with the co-ordination of the work of Technical Staff Groups within the Department, on a varied and large scale building programme, and overall responsibility for contract progress on site.

Applicants should possess a keen sense of architectural design and a high standard of administrative ability.

Application forms from the County Architect, P.O. Box No. 26, County Hall, Preston, returnable by 22nd July, 1960, quoting reference A/AJ. 2160

AIR MINISTRY require JUNIOR and SENIOR WORKERS UP in Quantities Division in London. Must be fully experienced and competent to Work Up entire Bills of Quantities. Candidates must hold O.N.C. or C. & G. (Quantities) or equivalent technical qualification. Financial assistance and time off given for recognised courses of study. Promotion and pension prospects. Five-day week with 18 days paid leave a year initially. Salary ranges (Junior) from £720 (at age 26) to £900 and (Senior) £794 (at age 26) to £1,065. Applicants, who must be natural born British subjects, should write stating age, qualifications and experience to the Manager (PE.1234), Ministry of Labour, Professional and Executive Register, Atlantic House, Farringdon Street, London, E.C.4. No original testimonials should be sent. 1603

HARLOW DEVELOPMENT CORPORATION

Architect/Planner: FREDERICK GIBBERD, C.B.E., F.R.I.B.A., M.T.P.I.

Executive/Architect: VICTOR HAMNETT, B.SC., A.R.I.B.A., A.M.T.P.I.

STAFF VACANCIES

Vacancies occur within the following grades for staff to work on industrial buildings, housing, theatre, offices, shops, and similar programme of work in the town of Harlow:—

ARCHITECT, A.P.T. VI (£1,163—£1,390).

ARCHITECT, A.P.T. V (£1,220—£1,375).

ASSISTANT ARCHITECT, A.P.T. IV (£1,065—£1,220).

ASSISTANT ARCHITECT, A.P.T. III (£880—£1,065).

ASSISTANT ARCHITECT, A.P.T. II (£765—£880).

A.R.I.B.A. required for Grade III upwards. Housing available.

Applications with full details to be sent, within ten days, to the General Manager, Terlings, Harlow, Essex. 2066

ADMINISTRATIVE COUNTY OF LEICESTER
ARCHITECTS required to join special group, engaged on the design of NEW COUNTY OFFICES.

(*a*) SENIOR ASSISTANT ARCHITECT £1,220—£1,375.

(*b*) ASSISTANT ARCHITECT £785—£1,070.

Candidates for (*a*) must be A.R.I.B.A. and have had considerable office experience, preferably on large contracts and for (*b*) have passed parts one and two of the R.I.B.A. examination and be capable of executing working drawings.

Further particulars and forms of application may be obtained from The County Architect, 123 London Road, Leicester, to whom they should be returned not later than 15th July, 1960.

Removal expenses and lodging allowance may be paid to a married man. 2163

GOVERNMENT OF ADEN
TOWN PLANNING OFFICER
PUBLIC WORKS DEPARTMENT

To undertake detailed Town Planning and the scrutiny of building plans submitted by private builders. Contract appointment. Salary range £1,232—£2,004. Gratuity. Free passages. Furnished quarters at moderate rent. Children's allowances. Generous home leave. Preference given to candidates who are A.M.T.P.I. with the additional qualification of A.R.I.B.A.

Write Director of Recruitment, Colonial Office, London, S.W.1, giving full names, age, qualifications and experience, quoting ECD 112/2/022/E2. 2133

STEPNEY M.B.C. require temporary BUILDING SURVEYING ASSISTANT. Salary £830—£1,115. Applicants must have suitable qualifications and be experienced in preparation of drawings and specifications for the improvement and conversion of residential properties. Apply to Borough Engineer at Municipal Offices, 227, Commercial Road, E.1. 2117

LONDON COUNTY COUNCIL
ARCHITECT'S DEPARTMENT
VOLUNTARY SCHOOLS SECTION

Vacancies for ARCHITECTS (up to £1,250 commencing according to qualifications and experience) to design and supervise the erection of pavilions, small houses and school kitchens at Church schools and grammar schools, and to advise on the suitability of sites and on major schemes of development to be carried out by voluntary authorities.

Forms, returnable by 22nd July, 1960, from Hubert Bennett, F.R.I.B.A., Architect to the Council (EK/AJ/1754/7), County Hall, S.E.1. 2124

STATES OF GUERNSEY
PUBLIC WORKS DEPARTMENT

Applications are invited for the following pensionable appointments in the States Engineer's Department:—

1. SENIOR ARCHITECTURAL ASSISTANT at a salary of £1,039/£1,191. Applicants must have passed the Final Examination of the R.I.B.A. and should have had considerable experience with a local authority.

2. ARCHITECTURAL ASSISTANTS at a salary of £735/£857, according to qualifications and experience. Applicants must have passed Parts I and II of the R.I.B.A. Final or special Final Examination, or their equivalent, at one of the recognized Schools of Architecture, and should have had experience with a local authority.

The appointments are subject to the States of Guernsey Conditions of Service and to the successful applicants passing a medical examination. The appointments will be permanent, subject to one month's notice on either side.

Particulars of pension and the transfer of pension rights under the Local Government Superannuation Acts obtainable on application. Casual user car allowances will be paid.

Applications, stating age, qualifications, experience and present and previous appointments, together with the names and addresses of two referees, to be delivered to the States Supervisor, States Office, Guernsey, C.I., not later than Monday, 25th July, 1960. 2118

ANTRIM COUNTY COUNCIL
PLANNING ASSISTANT

Applications are invited from holders of a qualification in Planning and/or Architecture for the position of Planning Assistant in the Council's Planning Department.

Salary Scale: A.P.T. Grade IV, £1,065—£1,220, subject to deductions under the Local Government (Superannuation) Act (N.I.), 1950.

Applications, together with the names and addresses of two referees, must be delivered to the Secretary, County Courthouse, Crumlin Road, Belfast, 14, not later than 16th July, 1960. 2078

BOROUGH OF EALING
TEMPORARY CLERK OF WORKS. £825 p.a. Miscellaneous Conditions of Service. To supervise external painting contracts and flat conversions.

Forms of application and full particulars from Borough Engineer, Town Hall, Ealing, W.5. Closing date 18th July, 1960.

E. J. COPE-BROWN,
Town Clerk.
2119

METROPOLITAN WATER BOARD
ARCHITECTURAL STAFF

Applications are invited for the following appointments in the Surveyor's Department:—

(*a*) ASSISTANT ARCHITECTS. Proposed salary scale £1,180—£1,300 per annum.

(*b*) TECHNICAL ASSISTANT. Proposed salary scale £730 (at age 21)—£1,110 per annum.

Commencing salaries within the above scales according to age and experience.

Applicants for posts (*a*) must be corporate members of the Royal Institute of British Architects and should have had experience in the design preparation of plans and working drawings and specifications for the erection of houses and offices. The provision of housing accommodation would be considered.

Applicants for post (*b*) must have passed the Intermediate Examination of the Royal Institute of British Architects.

These are permanent pensionable posts offering interesting work with good conditions of service.

Further particulars and forms of application from the undersigned (quoting ref. A.J. and position applied for) to be returned by 20th July, 1960.

S. D. ASKEW,
Clerk of the Board.

New River Head,
Rosebery Avenue, E.C.1. 2121

LONDON COUNTY COUNCIL
ARCHITECT'S DEPARTMENT

Vacancies for ARCHITECT/PLANNERS. Tasks include three-dimensional planning in Comprehensive Development Areas and all other important areas of new development throughout London, including those associated with road improvements. Up to £1,250 according to experience and qualifications. Forms and particulars from Hubert Bennett, F.R.I.B.A., Architect to the Council (EK/AJ/1790/7), County Hall, S.E.1. 2130

BOROUGH OF DARTFORD

THREE ENGINEERING ASSISTANTS and TWO ARCHITECTURAL ASSISTANTS required. Starting salary within Special Grade or Grade A.P.T. II and plusage of £25 to £45 per annum. Housing accommodation available.

Applications, with full details, to be sent to the Borough Engineer and Surveyor, The Bridge House, Dartford, by the 18th July, 1960.

THOMAS ARMSTRONG,
Town Clerk.
2107

COUNTY BOROUGH OF BARNSLEY
BOROUGH ENGINEER AND SURVEYOR AND PLANNING OFFICER'S DEPARTMENT

Applications are invited for the following appointments:

(*a*) CHIEF PLANNING ASSISTANT, A.P.T. IV (£1,065—£1,220), commencing salary may be up to £1,170 per annum. Essential User Car Allowance.

(*b*) ARCHITECTURAL ASSISTANT (SPECIAL CLASSES), A.P.T. I (£610—£765), or Special Grade (£785—£1,070). Commencing salary may be up to £730 on A.P.T. I or £990 on Special Grade.

(*c*) ASSISTANT ARCHITECT, A.P.T. II (£765—£880), commencing salary may be up to £850 per annum.

For appointment (*a*) applicants must be suitably qualified and have had considerable planning experience including development control and redevelopment work. For (*b*) and (*c*) candidates should have had previous experience in the design of housing and public buildings although municipal experience is not essential. Applicants requiring Special Grade must hold a recognised Diploma in Architecture or be A.R.I.B.A.

The posts are superannuable and subject to passing of medical examination, N.J.C. Conditions of Service, and one month's notice on either side.

Housing accommodation can be provided if necessary and 50 per cent. of removal transport expenses will be paid in approved cases.

Applications, stating age, present and previous appointments, qualifications, experience, etc., together with the names of two persons for reference, should reach the Borough Engineer, Town Hall, Barnsley, by Friday, 15th July, 1960.

Canvassing will disqualify.

A. E. GILFILLAN,
Town Clerk.

Town Hall,
Barnsley.
June, 1960. 2064

CITY OF NEW SARUM
ARCHITECTURAL ASSISTANT

Applications are invited for the appointment on the established staff of the City Engineer of: ARCHITECTURAL ASSISTANT (Grades A.P.T. II, III or Special).

The salary will be dependent upon age, experience and qualifications.

The post is pensionable and subject to National Joint Council conditions, medical examination and one month's notice on either side. Housing accommodation may be made available if required.

The appointment offers, *inter alia*, an interesting variety of design problems in connection with the Council's capital development programme.

Applications, stating age, qualifications, present and previous appointments with salary, together with the names of two referees, to the City Engineer, The Council House, Bourne Hill, Salisbury, by Tuesday, 19th July, 1960.

GEO. RICHARDSON,
Town Clerk.
2112

THURROCK URBAN DISTRICT COUNCIL
ARCHITECTURAL ASSISTANT
A.P.T. I/II, £610—£880 p.a.

Applications are invited for the above appointment under the Architect to the Council, from candidates who should have passed the Intermediate Examination of the R.I.B.A. Good architectural experience is necessary, and applicants must be capable of preparing working drawings in all categories. The Council have interesting projects in hand, including an Indoor Swimming Bath. Appointment pensionable.

Applications, stating age, qualifications and experience, and quoting two referees, should reach the undersigned not later than 18th July, 1960. Canvassing disqualifies. Relationship with members or Senior Officers of the Council must be disclosed.

A. E. POOLE,
Clerk of the Council.

Council Offices,
Grays, Essex. 2110

WOKING U.D.C.
ARCHITECTURAL ASSISTANT
A.P.T. GRADE SPECIAL (£785—£1,070)

Applicants for this appointment in Architectural Section of Engineer and Surveyor's Department should be A.R.I.B.A.

Appointment offers competent Assistant excellent opportunity for work on variety of architectural projects in a town that has rapidly grown to 63,000 population.

Housing accommodation if required. Casual User's car allowance.

Forms of application from Engineer and Surveyor, Council Offices, Woking. Closing date 18th July, 1960. 2109

STEPNEY M.B.C. require temporary ARCHITECTURAL ASSISTANT for design and construction of point blocks of flats. Salary £1,110—£1,265. Apply to Borough Engineer at Municipal Offices, 227, Commercial Road, E.1. 2116

LONDON COUNTY COUNCIL
ARCHITECT'S DEPARTMENT

ARCHITECTS (up to £1,250) required for Housing, Schools, General and Special Works Divisions. Full and varied programme of new work including schools, multi-storey flats and town development. Starting salaries according to qualifications and experience. Particulars and form from Hubert Bennett, F.R.I.B.A., Architect to Council (EK/AJ/1639/7), County Hall, S.E.1. 1874

COUNTY BOROUGH OF SOUTHAMPTON
BOROUGH ARCHITECT'S DEPARTMENT

Applications are invited for the following permanent posts:—

ARCHITECTS' SECTION

(*a*) SENIOR ASSISTANT ARCHITECT, A.P.T. IV (£1,065—£1,220).

(*b*) SENIOR ASSISTANT ARCHITECTS, Special Grade (£785—£1,070).

(*c*) ARCHITECTURAL ASSISTANT, Grade A.P.T. I (£610—£765).

Applicants for post (*a*) should be members of the R.I.B.A. fully experienced in the design and administration of major building projects.

TOWN PLANNING SECTION

(*d*) SENIOR ASSISTANT PLANNING OFFICER (LANDSCAPE), Grade A.P.T. IV (£1,065—£1,220).

Applicants should be members of T.P.I. and hold a qualification in Landscape Architecture, to be in charge of small landscape group, with considerable opportunity for preparing and carrying through schemes of urban landscaping.

QUANTITY SURVEYOR'S SECTION

(*e*) SENIOR QUANTITY SURVEYORS, Special Grade (£785—£1,070).

(*f*) ESTIMATING ASSISTANT, A.P.T. Grade II (£765—£880).

Applicants for post (*f*) should be experienced in estimating for small jobbing works and knowledge of "working up" and/or site measuring will be advantageous.

BUILDING INSPECTORS' SECTION

(*g*) BUILDING INSPECTOR (ADMINISTRATION), A.P.T. Grade II (£765—£880).

Applicants must be experienced in all aspects of the model Bye-laws, examination of plans, the administrative duties of a Building Inspector's office and hold a recognised Building Inspector's Certificate.

(*h*) DISTRICT BUILDING INSPECTOR, A.P.T. Grade II (£765—£880).

Applicants should be experienced and hold a recognised Building Inspector's Certificate. The post requires the use of a car for which an Essential User Car Allowance is payable.

(*i*) TECHNICAL ASSISTANT (IMPROVEMENT GRANTS), A.P.T. Grade II (£765—£880).

Applicants must be conversant with Improvements Grant procedure and have had wide experience in general building construction; service with a local authority and the possession of a recognised qualification by examination an advantage. An Essential User Car allowance is payable.

Housing accommodation available in approved cases, and approved removal expenses reimbursed up to a maximum of £50.

Applicants should possess appropriate qualifications. Commencing salary within grade according to experience and qualifications.

Application forms from the Borough Architect, Civic Centre, Southampton, returnable by 20th July, 1960. 2111

JUNIOR ARCHITECTURAL DRAUGHTSMAN required by Chelsea Borough Council. Salary £618—£765 plus 'weighting.' (A.P.T.I) N.J.C. Conditions. Candidates must have sound knowledge of architectural drawing, building construction and the measurement of buildings.

Application by 18th July, 1960, on form to be obtained from Borough Engineer & Surveyor, Town Hall, King's Road, S.W.3. 2145

DENBIGHSHIRE COUNTY COUNCIL
COUNTY PLANNING DEPARTMENT

Applications are invited from suitably qualified persons for the following appointments, viz.:

(*a*) SENIOR COUNTY PLANNING ASSISTANT, A.P.T. Grade IV. (Salary £1,065—£1,220 per annum.)

(*b*) ARCHITECT, Special Scale. (Salary £785—£1,070 per annum.)

(*c*) COUNTY PLANNING ASSISTANT, A.P.T. Grade I. (Salary £610—£765 per annum.)

Application forms and further particulars can be obtained from me. Completed applications, giving the names of two referees, must be returned by 29th July, 1960.

W. E. BUFTON,
Clerk of the County Council.

County Offices,
Ruthin,
Denbighshire. 2096

METROPOLITAN BOROUGH OF HACKNEY
ASSISTANT ARCHITECT OR ARCHITECTURAL ASSISTANT
ENGINEER AND SURVEYOR'S DEPARTMENT

Applications are invited for the above-mentioned permanent appointment. Candidates must have passed the Final or Intermediate Examination of the R.I.B.A. and appointment will be made as Assistant Architect in A.P.T. IV (£1,065—£1,220) or as Architectural Assistant in A.P.T. II (£765—£880), A.P.T. III (£880—£1,065) or Special Grade (£785—£1,070) per annum according to qualifications and experience.

In all cases appropriate London weighting allowance is payable in addition, and commencing salaries will be according to training, qualifications and experience. Staff canteen; alternate Saturdays; post-entry educational training facilities. Application forms obtainable from the Town Clerk, Town Hall, Hackney, E.8, returnable by 9 a.m., 18th July, 1960. 2103

ARCHITECT required by the National Coal Board in Edinburgh. Salary within the scale: £815—£1,125 per annum. Applicants must be Associate Members of the R.I.B.A. Applications, stating age, education, qualifications, experience, present post and salary, to Staff Department, National Coal Board, 3, Eglinton Crescent, Edinburgh, 12. 2072

AYR COUNTY COUNCIL invite applications for the following posts in their Planning Department:—

(1) SENIOR PLANNING ASSISTANT. Salary scale £915 × £25 (5), £50 (1) and £30 (1) to £1,120 p.a. Applicants should be Corporate Members of Town Planning Institute and preference will be given to those who also hold architectural qualifications. They should be experienced in preparation of town maps and in particular preparation of schemes of comprehensive development. House available near Ayr if required; (2) ASSISTANT APPLICATIONS OFFICER. Salary scale £675 × £20 (8) and £30 (1) to £865 p.a. Applicants must have passed the Intermediate Examination of Town Planning Institute and have had good practical experience of procedure for dealing with applications for planning permission. Both posts superannuable and placing on scales will be given according to qualifications and experience. In each case, applications giving age and particulars of qualifications and experience, with names of two referees, should be lodged with the County Clerk, County Buildings, Ayr, before 20th July. Canvassing disqualifies. 2100

BLETCHLEY URBAN DISTRICT COUNCIL
APPOINTMENT OF CLERK OF WORKS

Applications are invited from experienced persons for the position of Clerk of Works in connection with the further expansion of the town under the Town Development Act, 1952, which is likely to include the erection of Houses, Flats, Bungalows, Shops, Factories, etc.

Salary will be in accordance with the National Joint Council Scale of Salaries, Miscellaneous Division, Grade VI (£715—£775). The appointment will be in accordance with the National Scheme of Conditions of Service, one month's notice on either side and to the passing of a medical examination.

Housing accommodation will be made available if required.

Application, stating age and full details of experience, together with the names and addresses of two persons to whom reference may be made, should be delivered to the undersigned by first post on Monday, 18th July, 1960.

J. F. SMITHIE, M.I.Mun.E.,
Engineer & Surveyor.

Council Offices,
Bletchley.
29th June, 1960. 2097

NORTH-EASTERN REGIONAL HOSPITAL BOARD, SCOTLAND
ARCHITECTURAL DEPARTMENT

In view of an expanding Hospital Building Programme, the Regional Board proposes to make appointments in the following grades:—

DEPUTY REGIONAL ARCHITECT: Salary £1,450 × 50(2) × 70(1) × 75(2) to £1,770. As deputy to the Regional Architect, must be a Registered Architect and should preferably have worked in a supervisory capacity with experience in hospital architecture.

ASSISTANT ARCHITECT: Salary £905 × 35(1) × 45(6) × 50(2) to £1,310. Applicants must be Registered Architects; experience in hospital work not essential.

In addition, it is proposed to appoint an ASSISTANT ARCHITECT (DECORATION AND FURNISHINGS) whose particular duty it would be, under the Regional Architect, to advise on schemes of decoration and on equipment and furnishings. Candidates should be Registered Architects or otherwise suitably qualified. The salary will depend on the qualifications and experience of the successful applicant but, in the case of a qualified architect, the salary would be £905 rising as above to £1,310.

ARCHITECTURAL ASSISTANT: Salary £625 × 30(8) × 35(1) to £900. Candidates, if not Registered Architects, should at least have passed the Intermediate Examination of the R.I.B.A.

These posts offer good opportunities of gaining experience in the specialised field of hospital work.

Applications for the above posts should state age, qualifications and previous experience together with the names and addresses of two referees (three in the case of the Deputy post) and should be sent to the Secretary of the Board, P.O. Box No. 28, 1 Albyn Place, Aberdeen, not later than 23rd July, 1960. 2179

Architectural Appointments Vacant

3s. per line; minimum 12s. Box Number, including forwarding replies, 2s. extra

EXPANDING practice with varied work in different parts of the country, require keen and capable Intermediate standard ASSISTANTS. Good salary and prospects for the right men. Holiday commitments honoured. Dalling and Partners, 14, Bloomsbury Square, W.C.1. CHAncery 4725. 9469

ARCHITECTURAL ASSISTANTS required in busy Bloomsbury office with varied practice. Good salary and prospects for suitable applicants. Five-day week. Write giving particulars of age, qualifications, experience, etc., to Box 910, c/o 7, Cootie Street, W.C.1. 8815

ASSISTANT ARCHITECTS required by firm with offices in Middlesbrough and Billingham-on-Tees. The work is interesting and of considerable variety. Salary according to experience and ability. Elder and Lester, A/A.R.I.B.A., Grosvenor Buildings, 65, Albert Road, Middlesbrough. 8820

SENIOR ASSISTANTS required immediately. Salary by arrangement. Theo. H. Birks, 38, Portland Place, London, W.1. LAN 7236. 1486

RONALD WARD & PARTNERS have immediate vacancy for ASSISTANT ARCHITECTS with initiative and some experience, for interesting, commercial, industrial and civic projects. Salaries commensurate with ability. Apply, 29, Chesham Place, S.W.1. BELgravia 3361. 5638

LEWIS SOLOMON, KAYE & PARTNERS, rapidly expanding practice require ARCHITECTS and ASSISTANTS with initiative and competence to work on major design projects in the London area. These projects include Comprehensive Development Schemes, Hotels, Schools, Offices, and Luxury Flats. Good salaries according to ability and experience, luncheon vouchers, five-day week, and excellent working conditions. Write 5, Holborn Circus Thavies Inn House, E.C.1, or telephone CITy 8811, quoting SLB in both instances. 7700

£750 - £1,000 — KEEN YOUNG ARCHITECTS WANTED URGENTLY. Senior and Junior Assistants required to work on a variety of interesting contracts, including flats, hospitals, offices, hotels, shops and interiors, etc. Opportunities for modern design and control of contracts. Salaries as above or according to experience. R. Mountford Pigott & Partners, South Kensington. Tel. KENsington 1242. 9543

MONRO AND PARTNERS require ARCHITECTURAL ASSISTANTS of Intermediate/Final R.I.B.A. standard in their London, Watford, and Glasgow Offices for work on interesting industrial and commercial projects. Salary range £800—£1,000 p.a. Non-contributory Pension Scheme. Five-day week. Apply in writing to 32, Clarendon Road, Watford. 8649

ARCHITECTURAL ASSISTANT, about Intermediate standard, required for general practice in North Devon Office. Pension scheme. Box 9744.

ARCHITECTURAL ASSISTANT required, with at least two years' office experience. Apply in writing to Thomas Mitchell & Partners, 20, Bedford Square, London, W.C.1. 7282

£1,000/£2,000 p.a. will be paid to experienced competent ARCHITECTS by a private practice in the City of London. The work will be primarily on the drawing board on new and interesting projects of magnitude. A high standard of design and detailing ability is required. Please apply in writing to Box 9360.

ARCHITECTURAL STAFF, all grades, required for interesting work. Good salary, bonus, superannuation scheme. House Purchase Assistance Scheme. Excellent working conditions, five-day week. Please apply, giving details of qualifications, experience and salary required to: George Brown & Partners, A./A.R.I.B.A., F.I.A.S., and Eric Ross, F.R.I.B.A., Equity & Law Building, Baldwin Street, Bristol, 1. 9458

ARCHITECTS and ASSISTANT ARCHITECTS required for interesting commercial, industrial and civic projects. Responsibility and initiative encouraged. Five-day week, good salary commensurate with ability and experience. Ronald Ward & Partners, 29, Chesham Place, S.W.1. BELgravia 3361. 9246

BUSY City Firm engaged in industrial and commercial work requires ASSISTANT of Final standard with several years' office experience. Five-day week. Luncheon vouchers. Salary by arrangement. Box 9227.

C. H. ELSOM & PARTNERS require ASSISTANTS for work on theatres, laboratories, shops, stores and town centre redevelopment, etc. Apply 10, Lower Grosvenor Place, S.W.1. VIC. 4304. 9584

SENIOR ASSISTANT ARCHITECT required by Devereux and Davies. Good salary to applicant with the requisite ability and experience. 3, Gower Street, Bedford Square, London, W.C.1. 1733

BASIL SPENCE & PARTNERS require qualified and experienced ARCHITECTS to fill positions of responsibility on a major building programme. Write to 48, Queen Anne Street, W.1, stating experience and salary required. 9824

EXPERIENCED SENIOR ASSISTANT ARCHITECT required in Architect's Department of commercial firm in the West Riding of Yorkshire. Must be prepared to work on projects of varying size, also willing to travel throughout the country. Five-day week, Pension Scheme, canteen facilities. Salary by arrangement according to age and experience. Apply Box 1077.

DONALD ROWSWELL urgently requires capable ASSISTANTS of various grades for Croydon office. Salary by agreement. Holiday arrangements honoured. Apply with full details to 5a, Friends Road, Croydon, or telephone CROydon 4080. 1045

ASSISTANT required by busy City office engaged mainly in industrial and commercial work. Five-day week; luncheon vouchers; salary by arrangement. Holiday arrangements will be honoured. Please apply: Eric Firmin & Partners, Thavies Inn House, 5, Holborn Circus, E.C.1. Tel.: CITy 8811. 1623

SENIOR AND INTERMEDIATE STANDARD ARCHITECTURAL ASSISTANTS required for London and Weston super Mare. Write full particulars including salary required: R. H. Gallannaugh, L.R.I.B.A., 54, Queen Anne Street, London, W.1. 1678

APPLICATIONS are invited to fill posts as ASSISTANT ARCHITECTS. Five-day week. Compulsory Superannuation Scheme. Salary range £730—£1,080 per annum according to age and experience. Apply: R. C. Steel, A.R.I.B.A., Chief Architect, C.W.S. Ltd., 99, Leman Street, London, E.1. 1534

ARCHITECT required to take charge of old established West Riding practice, to be controlled by architects closely connected but some few miles away. Modern approach essential but need not be uncompromisingly brutalistic. Hope not, but may be necessary to nod at tradition occasionally. Salary and arrangements according to demonstrable ability. In confidence to Box 1626.

ARCHITECTURAL ASSISTANTS required in busy West End office. Varied work, excellent salary and prospects. Apply to Maurice Sanders, F.R.I.B.A., 24, Harley Street, W.1. 1441

WATKINS, GRAY & PARTNERS, 57, Catherine Place, S.W.1, require SENIOR and JUNIOR ASSISTANTS for work on large hospital projects. Excellent opportunities for those seeking first hand experience in this most interesting and rapidly developing field. Luncheon Vouchers and pension scheme in operation. Write giving full particulars. 1524

JUNIOR and SENIOR ASSISTANTS required. Five-day week. Excellent prospects. Bernard Gold & Partners, 4/6, Savile Row, W.1. Phone REGent 7551. 1248

EXCELLENT OPPORTUNITIES exist in busy, medium size firm of Chartered Architects in West End. Vacancies are available in the drawing office and for Assistants who wish to acquire experience in contract supervision and survey work. Qualifications an advantage but not essential. Salary and promotion according to experience and ability to accept responsibility. Please apply to Box 1773.

ARCHITECTS AND ASSISTANTS

REQUIRED for work on interesting Industrial Project affording first class design and technical experience.
Apply in writing to:
Sir William Halcrow & Partners,
(B.A. Architects' Section),
47, Park Lane, London, W.1.
1752

INTERMEDIATE to Final ASSISTANTS required immediately. Salary according to ability and experience. Theo. H. Birks, 38, Portland Place, London, W.1. LAN. 7236. 9739

ERNÖ GOLDFINGER requires ASSISTANTS with sound knowledge of construction. Expanding programme of work includes office buildings, schools, shops, factories, local authority and private housing. Local Authority Rates. Telephone: HYDe Park 5657. 1738

ARCHITECT'S ASSISTANT, Intermediate and Final, for Solihull (Nr. Birmingham) Architects. The work is varied with experience in all phases of the job. Five-day week. Offices in very pleasant surroundings. Salary by arrangement. Apply in writing, giving age, experience to Box No. 1970.

GRINLING—Exceptional qualified ASSISTANTS required at Hyde Park Corner office—salary £900—£1,100 per annum. Summer holiday by arrangement. Telephone for appointment: BELgravia 6595. 1977

CO-OPERATIVE WHOLESALE SOCIETY LTD. ARCHITECT'S DEPARTMENT, MANCHESTER have vacancies for
SENIOR AND JUNIOR
ARCHITECT'S ASSISTANTS
TO work on a variety of interesting commercial and industrial projects.
Five-day week. Three weeks' holiday. (Existing holiday arrangements honoured.) Pension scheme.
Commencing salary up to £1,300 according to experience and qualifications.
Apply in writing with details of age, qualifications and experience to:
G. S. Hay, F.R.I.B.A.,
Chief Architect,
Co-operative Wholesale Society Ltd.,
1, Balloon Street,
Manchester, 4. 2023

REQUIRED immediately, ARCHITECTURAL ASSISTANT, Intermediate to Final standard, with at least three years' experience to work on large contract in Exeter. Five-day week and salary up to £800 according to experience. Reply with full particulars to Box 2029.

A BUSY general practice, within easy reach of London, the West Country and the coast, wishes to increase the staff in their unusually attractive office as follows:—
(a) ASSISTANT ARCHITECT, preferably qualified, for work on all stages of medium sized contracts under direct supervision of partner.
(b) ARCHITECTURAL ASSISTANT wishing to specialise on conservation of old buildings.
(c) EXPERIENCED TRACER.
Apply to Robert Potter & Richard Hare, F/R.I.B.A., De Vaux House, Salisbury, Wilts. 2009

ASSISTANT required by firm of Architects and Surveyors in Beds. and Herts. General practice. Apply, stating experience, salary, etc., to Box 2022.

BRYAN & NORMAN WESTWOOD & PARTNERS require JUNIOR ASSISTANTS. Please apply at 21, Suffolk Street, S.W.1. Trafalgar 4411. 9914

W. S. HATTRELL & PARTNERS invite applications to fill the following vacancies in COVENTRY and MANCHESTER.
(a) Fully qualified ARCHITECTS with some years' office experience to work on a wide range of contracts, including a large central redevelopment scheme; Television studios; Schools, Church; Licensed premises; Factories, Shops, etc.
Applicants must have good design sense and first-class knowledge of construction and administration and be capable of controlling junior staff.
Salary within the range £1,000—£1,500 depending on ability.
(b) ASSISTANTS of Intermediate to Final standard, capable of preparing full working drawings, specifications, etc., under supervision and of taking responsibility for smaller contracts.
Salary within the range £750—£1,000 depending on experience and ability.
Salaries reviewed annually. Pension Scheme. Five-day week. Travelling expenses paid to interviewed applicants.
Replies to: 1, Queens Road, Coventry; 15, Piccadilly, Manchester, 1. 2027

ARCHITECTS urgently require ASSISTANTS, R.I.B.A. Intermediate to Final standard. Please reply stating qualifications, experience and salary required to Herbert, Son & Sawday, 18, Friar Lane, Leicester. 2032

FRY, DREW & PARTNERS require qualified ASSISTANTS for interesting and important work in England. Salary range £750—£1,000. Apply 63, Gloucester Place, W.1. (WEL 3318.) 2033

COMPETENT SENIOR ASSISTANTS required for a variety of interesting contracts including Shops, Ecclesiastical work in a busy and expanding office in S.W.1 district. Good opportunities to take complete charge of large projects. High salaries available for experienced applicants with good prospects for advancement. Box 2057.

EXCELLENT opportunity, with prospects, for young, qualified (or near) ASSISTANT in busy practice, Sidcup, Kent. If you are energetic and ambitious this is worth a visit. Telephone Footscray 7008. 2058

ARCHITECTURAL ASSISTANT required for Surveyor's Department of South Coast Brewery. Experience in alterations and decorations to licensed premises essential. Appointment will include work in connection with Brewery buildings and some experience of reinforced concrete structures will be an advantage. Age under 45. Permanent appointment. Pension scheme. Salary range £900—£1,000 according to experience. Write stating age and experience to Box 2056.

J. M. AUSTIN-SMITH & PARTNERS require qualified ASSISTANTS (Maximum age 30) to work in conjunction with senior assistants. Apply in writing giving all relevant details to 29 Sackville Street, London, W.1. 2061

J. M. AUSTIN-SMITH & PARTNERS require fully qualified ARCHITECTURAL ASSISTANTS with office experience and the ability to design, run and supervise contracts on their own initiative. Salary according to age (limit 35) and experience. Apply in writing to 29 Sackville Street, London, W.1. 2060

SMALL progressive and contemporary London office with staff of four requires SENIOR ASSISTANT. Good opportunity for person who wishes to gain experience in all aspects of a varied practice. Also very interested in Intermediate to Final ASSISTANT with experience. Good salary to right people. Box 1903.

BRIGHTON AND HOVE

EXPERIENCED ASSISTANTS in all grades required. Details please to:—H. Hubbard Ford & Associates, F/A.R.I.B.A., 51, Church Road, Hove, 3, Sussex. 1906

MELBOURNE, AUSTRALIA. SENIOR ARCHITECT required by leading firm handling large scale university and commercial projects. Salary range £A1,800 to £A2,300. Air passage paid, three-year contract, accommodation assured. Box 1833.

H. A. HALPERN AND ASSOCIATES require STAFF of ability, who consider architecture of paramount importance; to work on major and lesser redevelopment schemes in our Chatham office. Salary commensurate with ability. Intermediate to qualified standard. Apply to 7, Edgware Road, Marble Arch, W.2, or telephone AMBassador 2471/3. 1834

ARCHITECTURAL ASSISTANTS required of Senior and Intermediate standard for busy private practice engaged on varied domestic housing, commercial and industrial schemes. Salary according to ability. Apply Walter P. P. Grant, 19, Central Road, Worcester Park, Surrey. Tel.: Derwent 0041. 1857

PROPERTY GROUP requires ARCHITECTS and all grades of architectural staff for West London office. Appointments will be permanent and subject to company's pension scheme. Full particulars of previous experience and salary required to Box 1856.

ASSISTANTS required. Final or Intermediate standard, upon varied work—industrial, laboratory and commercial, ecclesiastical, agricultural, and domestic works. Apply to C. B. M. Smith, A.R.I.B.A., 4, Bath Road West, Slough, Bucks. 1848

CLIFFORD CULPIN requires experienced qualified and "post-Intermediate" ASSISTANTS to work on a wide variety of schemes including luxury flats, an office building, a comprehensive school, London banks, a town hall and a Civic Centre. Opportunities to take responsibility. Paid holiday this year. Phone CHAncery 5396 or write 39, Doughty Street, W.C.1. 1849

£1,200 for SENIOR ARCHITECTURAL ASSISTANT in Architect's Dept. of leading Building and Civil Engineering Contractors in the Manchester Area. Should be qualified with experience. Industrial and housing projects; varied and interesting. Canteen facilities. Box 1956.

BRISTOL. ARCHITECTURAL ASSISTANTS of Intermediate or Final standard required for varied private practice engaged on school, university, hospital and commercial work. Salary according to experience. Eustace Button & Partner, 23, Berkeley Square, Bristol, 8. 1841

FOUR ARCHITECTURAL ASSISTANTS required to work on a number of large schemes. Salary grades ranging from £550 to £1,020. R.I.B.A. Intermediate or Final standard. Five-day week. Pension Scheme after twelve months. Three weeks holiday. Car Allowance. Holiday arrangements honoured. Apply Gordon Payne and Preece, Rockleigh House, London Road, Gloucester. 1845

ARCHITECTURAL ASSISTANT required. R.I.B.A. Intermediate standard with some office experience. Varied and interesting work. Five-day week. Good salary for keen and competent person. William Crabtree, F.R.I.B.A., 8, Robert Adam Street, W.1. (WELbeck 9909). 1942

£900-£1,100—A private firm of Oxford Architects urgently require a capable DESIGNER to be in charge of a major project. Salary as above, depending on experience and qualifications. JUNIOR ASSISTANTS are also required. It is a friendly and progressive office, conditions are good, and prospects for a keen and conscientious man are excellent. Apply with details, Box 1879.

SENIOR and INTERMEDIATE ASSISTANTS required by Oliver Law & Partners, 36, Ebury Street, S.W.1. 1878

ASSISTANTS required by City Architects. Varied practice. Five-day week, 9.30—5.30. Of special interest to those who seek a position offering scope for responsibility, initiative and opportunity for experience in running jobs from conception to completion. Salaries in accordance with ability and up to £1,400 per annum. Kenneth Lindy, Joseph Hill & Partners, 24, St. Mary Axe, E.C.3. 1936

ARCHITECTURAL ASSISTANTS required by busy Architect's Dept. of large multiple firm. Applicants should be experienced in preparation of working drawings and details. Good salary and prospects to suitable applicants. Five-day week. Pension Scheme and canteen facilities. Apply Box 1947.

F. W. WOOLWORTH AND CO. LIMITED
ARCHITECT'S DEPT.
KING STREET, DUDLEY
WORCS.

REQUIRE ASSISTANTS of Final standard in their Architect's Dept. for interesting development programme in multiple stores. Applicants must have previous experience in preparation of working drawings and details.
Starting salary depending on qualifications and experience.
The positions are permanent and pensionable. Good working conditions. Five-day week. Canteen facilities. 1948

FARMER AND DARK have vacancies for:—

ASSISTANT ARCHITECTS (min. five years' Office experience)
JUNIOR ASSISTANTS

Wide variety of interesting projects both here and abroad; including Schools, Offices, Laboratories, Factories, Power Stations and Military Establishments.

Scope for people with initiative and ability.
Five-day week.
Holiday arrangements honoured and travelling expenses paid to those interviewed.
Please write or telephone:—Romney House, Tufton Street, S.W.1. ABBEY 6311. 1961

AN ARCHITECTURAL ASSISTANT required in small but busy London West End Office. Work includes Churches, Schools, Homes for old people, Factories, etc. Must be capable of preparing working drawings from sketch plans. Luncheon voucher scheme. Salary by arrangement. Telephone WELbeck 8863 for appointment. 1963

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LOUIS DE SOISSONS, PEACOCK, HODGES & ROBERTSON have immediate vacancies in their Welwyn Garden City Office for SENIOR and JUNIOR ASSISTANTS. Write stating age, salary and experience to the above at: Midland Bank Chambers, Welwyn Garden City, Herts. 1966

NORTH & PARTNERS, Chartered Architects, Broadway, Maidenhead, require additional ARCHITECTURAL ASSISTANTS for widespread and varied practice. Salary range £750—£1,000 p.a. 1890

ARCHITECTS with busy practice in Brighton require ASSISTANTS with practical experience for varied work. Salary up to £750 per annum. Five-day week, pension scheme, etc. Box 5848.

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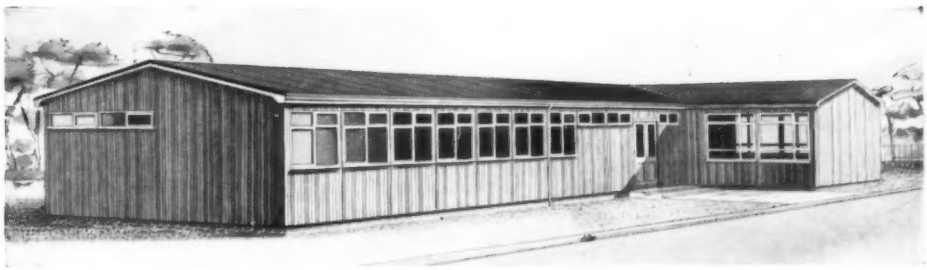

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