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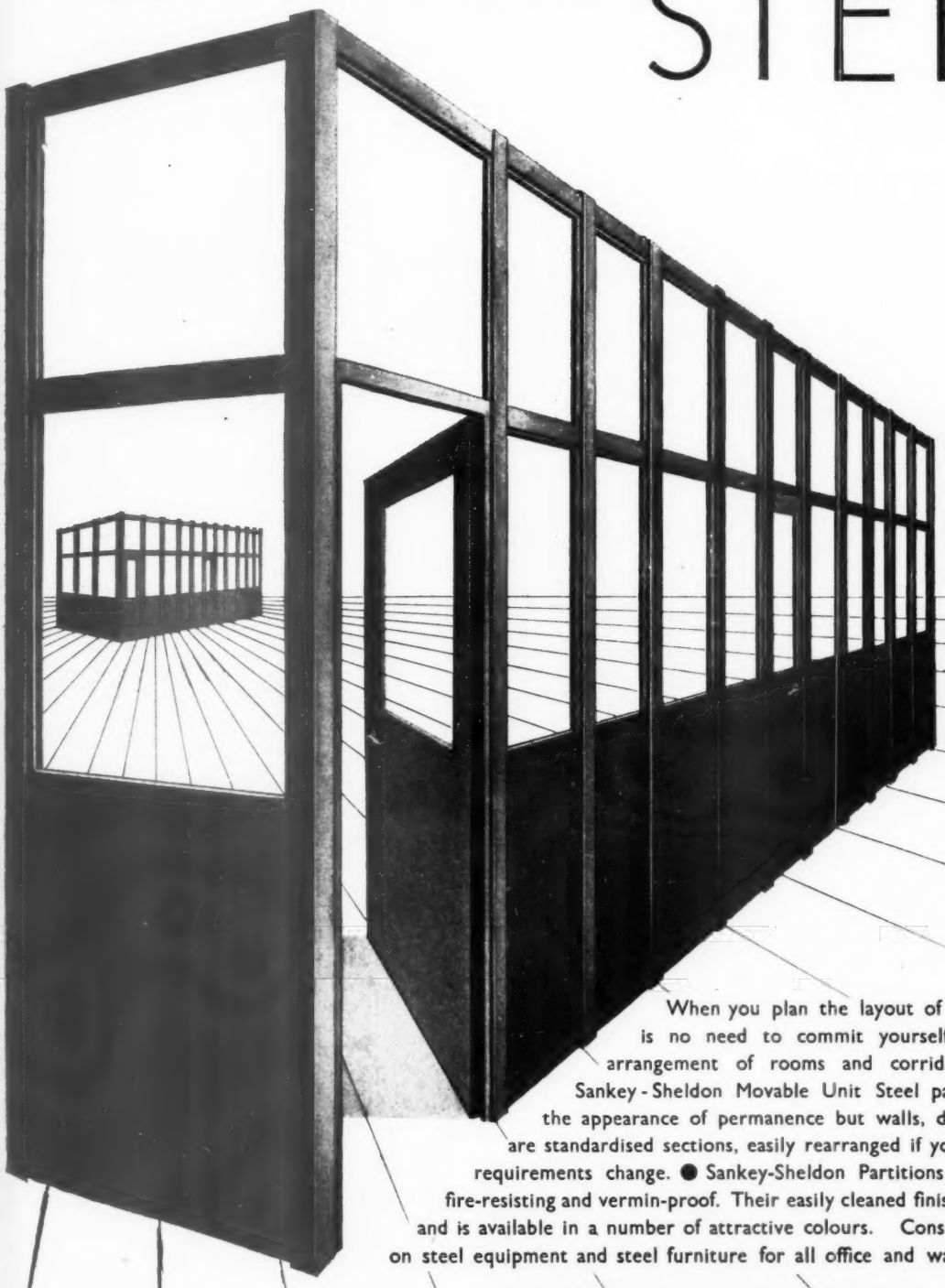

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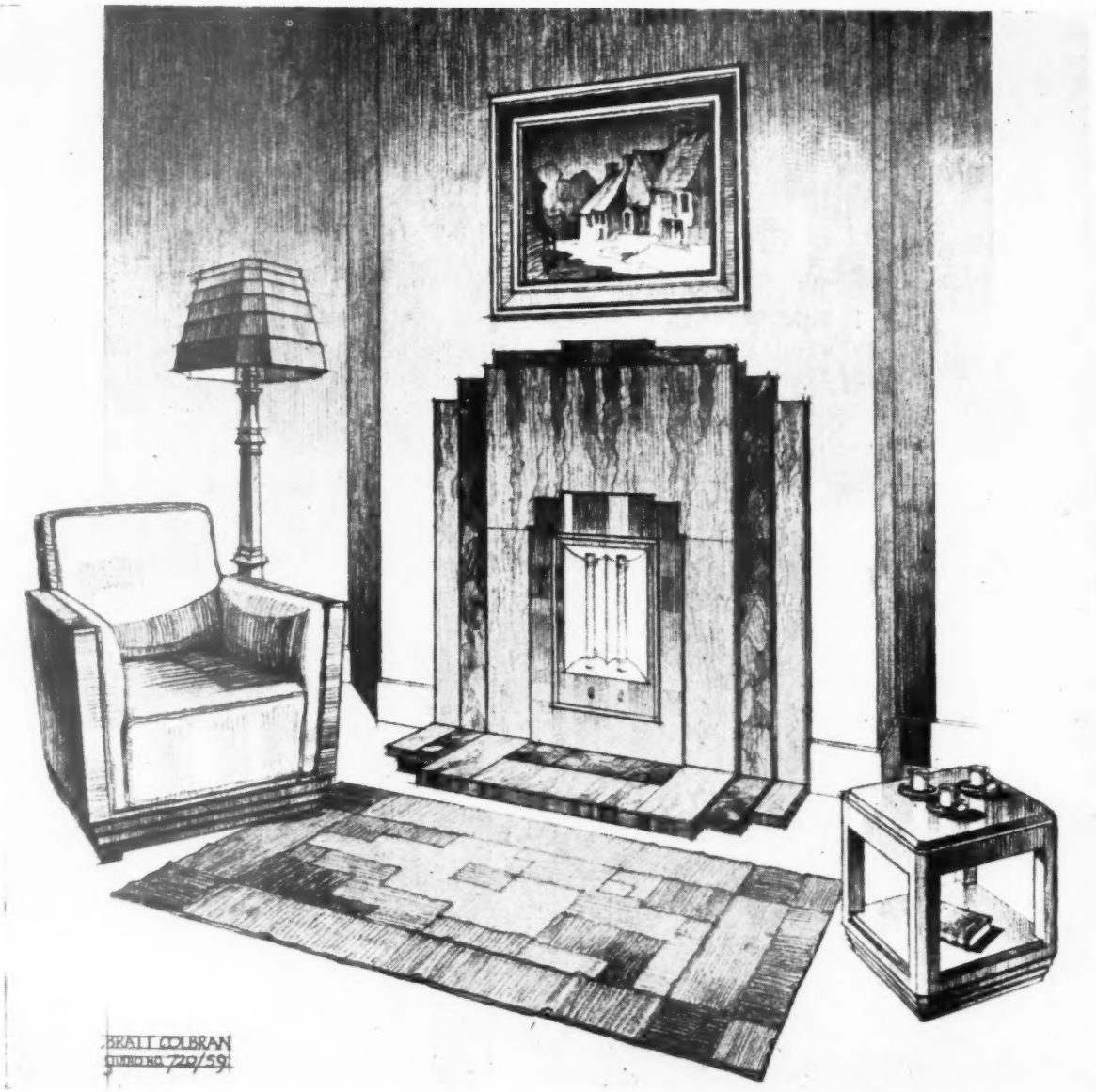

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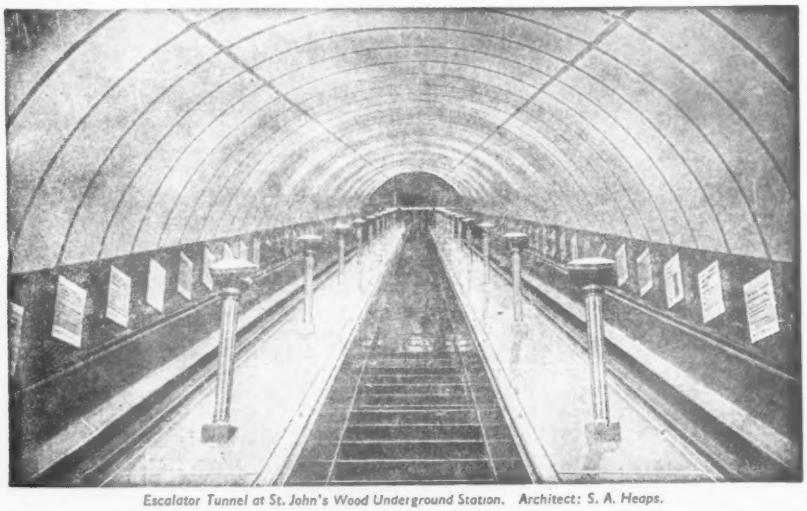
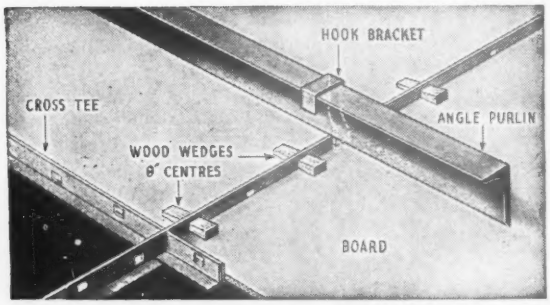
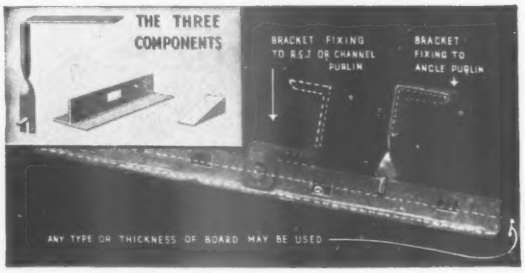


Escalator Tunnel at St. John's Wood Underground Station. Architect: S. A. Heaps.





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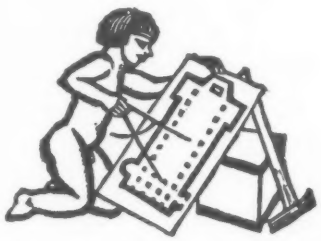
IMPERIAL CHEMICAL INDUSTRIES LIMITED, LONDON, S.W.1

P.134

In common with every other periodical this JOURNAL *is rationed to a small part of its peacetime needs of paper. Thus a balance has to be struck between circulation and number of pages. We regret that unless a reader is a subscriber we cannot guarantee that he will get a copy of the* JOURNAL. *Newsagents now cannot supply the* JOURNAL *except to a "firm order." Subscription rates: by post in the U.K. or abroad, £1 15s. 0d. per annum. Single copies, 9d.; post free, 11d. Special numbers are included in subscription; single copies, 1s. 6d.; post free, 1s. 9d. Back numbers more than 12 months old (when available), double price. Volumes can be bound complete with index, in cloth cases, for 15s. each; carriage 1s. extra. Goods advertised in the* JOURNAL, *and made of raw materials now in short supply, are not necessarily available for export.*



DIARY FOR FEBRUARY MARCH AND APRIL

Titles of exhibitions, lectures and papers are printed in italics. In the case of papers and lectures the authors' names come first. Sponsors are represented by their initials as given in the glossary of abbreviations on the front cover.

BEDFORD. *Octavia Hill Exhibition.* At the High School. (Sponsor, HC). FEB. 24-28

DERBY. *Homes to Live In Exhibition.* At the School Museum. (Sponsor, BIAE) FEB. 24-APRIL

LONDON. *Colour in the Home.* Exhibition at the Royal Academy, Piccadilly, W. There are units representing dining, sitting, nursery and bedrooms, colour in everyday ware, and some building materials such as paints. There are also suggestions for the interior decoration of civil aircraft. (Sponsor, British Colour Council.) FEB. 24-26

Swedish Factory-Made Timber Houses. Exhibition of photographs and drawings lent by the Swedish Timber House Export Association of Stockholm. At the Building Centre, Maddox Street, W.1. 10 a.m. to 4 p.m. (Saturdays 1 p.m.) FEB. 24-26

Exhibition of drawings of Landscape, Seascape, Industry and War subjects. By E. B. Musman. At the AA. 34-36, Bedford Square, London, W.C.1. Mr. Musman's drawings are in water colour, pastel, pen and wash, and pencil. Most of them have been done since September, 1939, as a relaxation from wartime duties. Weekdays 10 a.m. to 6 p.m., Saturdays until 2 p.m. FEB. 24-26

Living in the Country Exhibition. At YMCA, Great Russell Street, W.C.1. (Sponsor, HC) FEB. 24-26

Etchings, Engravings and Drawings Exhibition. By Fellows and Associates of the Royal Society of Painter-Etchers and Engravers. At RWS. Galleries, 10 a.m. to 5 p.m. Saturdays 10 a.m. to 1 p.m. FEB. 24-MAR. 9

Design in Daily Life Exhibition. At Heal's, 196, Tottenham Court Road, W.1. (Sponsor, BIAE.) Weekdays, 9 a.m. to 5 p.m. Saturdays, 9 a.m. to 1 p.m. FEB. 24-MAR. 11

The Present Discovers the Past Exhibition. At the Geffrye Museum, Kingsland Road, E.2. Photographic exhibition arranged by the Institute of Archæology and distributed by CEMA. The exhibition shows how an understanding of the problems of modern life can be helped by seeing something of the difficulties of everyday existence in the past. Ancient and modern agriculture, domestic life, materials, tools, roads and instruments of war are compared, scientific methods of excavation are described and the concluding section deals with the part played by the State and by the public in this connection. Daily, 10 a.m. to 4.30 p.m., excluding Sundays and Mondays FEB. 24-MAR. 11

E. B. Bailey. *The Natural Resources of Great Britain.* Lecture 2. *Underground Water.* At Royal Society of Arts, John Adam Street, Adelphi, W.C.2. 1.45 p.m. Feb. 28

W. S. Haines. *The English Tradition of Textile Designing.* At AIA, 84 Charlotte Street, W.1. 7.30 p.m. MAR. 1

Sir William Halcrow. *The Natural Resources of Great Britain.* Lecture 3. *Hydro-Electric Power.* At Royal Society of Arts, John Adam Street, Adelphi, W.C.2. 1.45 p.m. MAR. 6

Ronald Horton. *Children's Art in Wartime.* At AIA, 84 Charlotte Street, W.1. 7.30 p.m. MAR. 8

Film Evening. Films selected by Paul Rotha, who will give an informal talk. At 34-36, Bedford Square, W.C.1. 6 p.m. (Sponsor AA). MAR. 14

Quantity Surveyors Meeting. General meeting of Members of the Chartered Surveyors' Institution, qualified as quantity surveyors. At 12, Great George Street, Westminster, S.W.1. Subject for discussion introduced by Alfred Harris (Member of the Quantity Surveyors' Committee) *Post-War Problems for the Quantity Surveyor.* 4.30 p.m. MAR. 15

P. Schiller. *An Analysis of the Load on a Modern Electricity Supply System.* At Institution of Electrical Engineers, Savoy Place, Victoria Embankment, W.C.2. 5 p.m. MAR. 16

Professor C. H. Reilly. *Planning London.* At AIA, 84 Charlotte Street, W.1. 7.30 p.m. MAR. 29

LUTON. *Rebuilding Britain Exhibition.* At the Museum. (Sponsor, BIAE) FEB. 26-MAR. 11

READING. *Recording Britain Exhibition.* At the Art Gallery. (Sponsor, CEMA) FEB. 24-26

RISCA, MON. *Living in the Country Exhibition.* (Sponsor, HC) FEB. 24-29

SHEFFIELD. *Your Inheritance Exhibition.* (Sponsor, HC) FEB. 26-MAR. 1

SOUTHEND. *Design in the Home Exhibition.* At the Municipal College. (Sponsor, CEMA) FEB. 25-MAR. 1

WORTHING. *Town and Country Life in the Reign of King George III: Exhibition.* At the Public Art Gallery. (Sponsor, CEMA.) FEB. 24-MAR. 4

NEWS

THURSDAY, FEBRUARY 24, 1944
No. 2561. VOL. 99

Though no feature in the JOURNAL *is without value for someone, there are often good reasons why certain news calls for special emphasis. The* JOURNAL'S *starring system is designed to give this emphasis, but without prejudice to the unstarred items which are often no less important.*

★ *means spare a second for this it will probably be worth it.*

★★ *means important news, for reasons which may or may not be obvious.*

Any feature marked with more than two stars is very big building news indeed.

On his retirement from the Presidential chair of NFBTE, Mr. Leslie Wallis was PRESENTED WITH A GRANDFATHER CLOCK.

The clock is inscribed: Thos. Bridge. Londini. Fecit. It has a William and Mary marquetry case inlaid in a design of flowers and birds. Britten's *Clocks and Watches* says that Thomas Bridge was a member of the Clockmakers Company in the year 1700, and mentions that there is extant a long case clock by this maker inlaid in marquetry with flowers and birds. This is in all probability the clock referred to. The clock has an engraved brass dial and its original movement with weights and pendulum.

from AN ARCHITECT'S *Commonplace Book*

MOVING A BUILDING IN THE 16TH CENTURY. [*From* The Survey of London, *by John Stow (1598)*]. On the south side, and at the west end of this church, many fair houses are built, namely, in Throgmorton Street, one very large and spacious, built in the place of old and small tenements by Thomas Cromwell, Master of the King's Jewel House, after that, Master of the Rolls, then Lord Cromwell, Knight, Lord Privy Seal, Vicar General, Earl of Essex, High Chamberlain of England. This house being finished, and having some reasonable plot of ground left for a garden, he caused the pales of the gardens adjoining to the north part thereof on a sudden to be taken down; twenty two feet to be measured forth right into the north of everyman's ground; a line then to be drawn, a trench cast, a foundation laid, and a high brick wall to be built. My father had a garden there, and a house standing close to his south pale; this house they loosed from the ground and bare upon rollers into my father's garden twenty two feet ere my father heard thereof; no warning was given him, nor other answer when he spake to the surveyors of that work, but that their master, Sir Thomas, commanded them so to do; no man durst go to argue the matter, but each man lost his land and my father paid his whole rent which was 6/6d the year for that half which was left. This much of mine own knowledge have I thought good to note that the sudden rising of some men causeth them to forget themselves.

★

Last week a general assembly of Academicians and Associates ELECTED PROFESSOR A. E. RICHARDSON A ROYAL ACADEMICIAN. Mr. Alfred F. Hardiman, A.R.A., sculptor, was also elected. Professor Richardson, who is Professor of Architecture in London University, has been an A.R.A. since 1936. Most of his work has been done in conjunction with Mr. C. L. Gill. It includes Moorgate Hall, Finsbury Pavement, Southampton Hall, Holborn, and the facade of the Regent Street Polytechnic. He is keenly interested in Georgian architecture and in English antiquities in general, and is the author of several books. Mr. Hardiman, who has also been an A.R.A. since 1936, is best known as the sculptor of the Haig memorial in Whitehall.

A committee of the Borough Council WANTS THE WHOLE RIVER FRONTAGE OPENED at Hammersmith. A scheme for opening up the river front, says the Hammersmith Committee, should be substituted for the one open space shown in the County of London Plan. While approving generally of the plan, the committee urges that all railway viaducts should be removed and the underground railways placed underground. The committee also objects to the rehousing standard of a maximum of one and a half persons per room in working-class dwellings.

★

Funds are being raised to provide a SCHOLARSHIP IN MEMORY OF ARTHUR LOUIS AARON, the first architect V.C. of the war, at the Leeds School of Architecture. The Committee, composed of the Board of Governors of Leeds College of Art and Roundhay Boys' School, has been formed to administer the fund. Arthur Aaron joined the R.A.F. from the School of Architecture at Leeds College of Art, where he was a second-year student and previously he was at the Roundhay School. The scholarship will be available for Roundhay and other Leeds Secondary School boys. As announced in the JOURNAL for November 25 last, the V.C. was posthumously awarded to Aaron in recognition of his great act of self-sacrifice in bringing his damaged bomber to a North African aerodrome after it had been damaged over Turin on the night of August 12. Aaron died nine hours after landing and the citation of the award stated that had he been content while grievously wounded to conserve his failing strength he would probably have recovered. In appalling conditions he showed the greatest qualities of courage, determination and leadership, and though wounded and dying, he set an example of devotion to duty which has seldom been equalled and never surpassed. Donations to the fund should be sent (and cheques made payable) to the Arthur Louis Aaron V.C. Memorial Fund, c/o The Westminster Bank Ltd., Park Row, Leeds, 1.

★

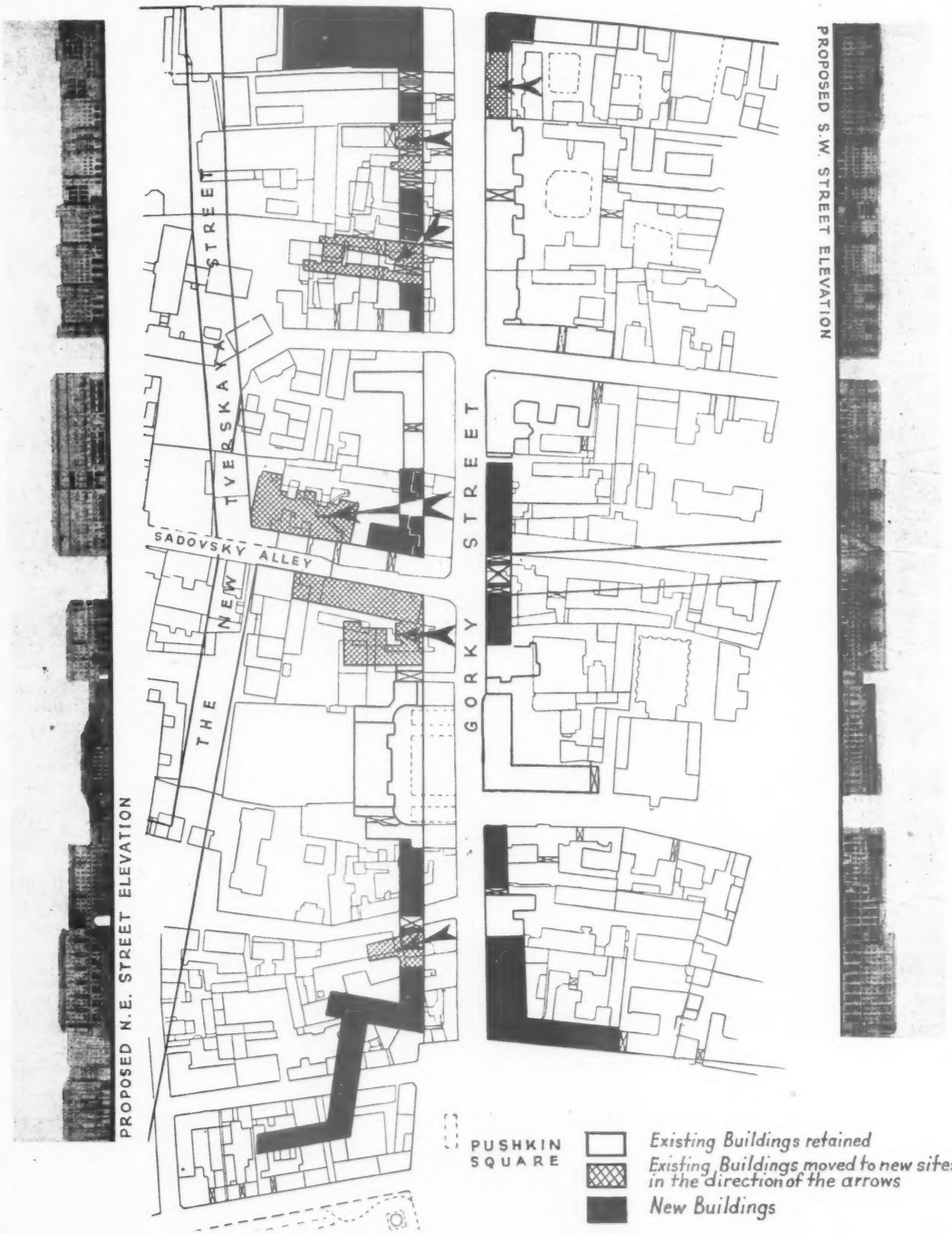
The RIBA has announced RELAXED PROBATIONERSHIP REGULATIONS for men serving in the Forces. Under the existing regulations candidates for the Probationership who had not started their architectural training before June 30, 1943, are not permitted to make special applications for the Probationership, and are required to have passed one of the recognised examinations. The Council, on the recommendation of the Board of Architectural Education has decided that some relaxation shall be made in this regulation in the case of candidates serving with the Forces. The Council has accordingly agreed that candidates who joined the Forces before June 30, 1943, but had not started their architectural training, shall be permitted to make special applications for the Probationership in the same way as candidates who had started architectural training before that date. This will, of course, involve their being interviewed by the Headmaster of a Recognised School of Architecture.

Flight Sergeant Arthur Louis Aaron, V.C., in whose memory funds are being raised for a Scholarship at Leeds School of Architecture.

On Thursday last the ASHES OF SIR EDWIN LUTYENS WERE INTERRED IN ST. PAUL'S CATHEDRAL. The service was private and attended only by a few relatives and representatives of the Royal Academy. A memorial tablet will be erected later by the Royal Academy on the pier wall above the grave in the crypt.

ARCUK reports that last year TWO HUNDRED AND EIGHT ARCHITECTS WERE ADMITTED to the REGISTER Two hundred and forty-eight applications for admission to the Register were rejected. The total number of names on the Register, says the annual report, is 14,984. Owing to costs of the Appeal Tribunal and increased working and other expenses, the Council find that an increase in the retention fee is unavoidable. It has therefore decided that the retention fee be increased to £1 from January 1 next, and has applied to the Privy Council for approval in accordance with section 13 of the principal Act.

The following architectural students won the Friends of Old Maidstone Society's COMPETITION FOR MEASURED DRAWINGS of the Parish Church Tower. First Prize, M. R. Francis. Second Prize, N. J. Burren. Hon. Mention, J. L. Hanington. The assessors were Professor A. B. Knapp-Fisher, F.R.I.B.A., and Sidney H. Loweth, F.S.A., F.R.I.B.A. At the annual general meeting of the Society, Professor Knapp-Fisher gave a criticism of the students' work, followed by an address.



Moscow on the Move

Almost the whole of this issue of the JOURNAL is devoted to a special study of the moving of buildings, now a subject of importance in view of post-war re-planning. Above is a plan of reconstruction for part of Gorky Street, Moscow, which is being widened from 50 feet to 154 feet. A co-ordinated design incorporating new and existing buildings as well as a number moved to new sites has been prepared for the whole street. The six buildings, shown cross-hatched, have been, or will be, moved. The procedure is described in detail in the article on pages 151 to 162.

★

Mr. Pethick-Lawrence stated in the House of Commons that the PRIME MINISTER MUST BE THE REAL MINISTER OF RECONSTRUCTION.

Speaking on the vote for salaries and expenses for certain Ministers, Mr. Pethick-Lawrence asked how far the creation of a Ministry of Reconstruction, and the appointment of Lord Woolton as Minister, was merely an attempt to allay criticism at the Government's handling of these problems. He said · The real question in my mind is how far the Government mean business in their avowed intention of laying the foundations of reconstruction while the war is still in progress, and how far they are merely seeking to gain time to postpone decisions on all the major issues until the war is over. It is quite clear that whatever action the Minister of Reconstruction takes is bound to affect the Treasury and all the principal ministries of the Government. That being so, the real Minister of Reconstruction, in the sense in which the House and the country want to have a Minister of Reconstruction, must not be a particular Minister, but the Prime Minister himself. It is not unnatural that, as the Prime Minister's attention is largely devoted to the prosecution of the war, he must devolve his duties on to a particular Minister, and that is what he is really doing in appointing Lord Woolton. He believed that the work which Lord Woolton has done at the Ministry of Food has won the approval of the House and, to an astonishing degree, the approval of the country. He is a man of decision and a man who never makes promises until he is sure of fulfilling them. In post-war life an attitude must be taken towards the land which sets aside individual prejudice or individual prerogative, in so far as they conflict with its best use for the country as a whole, and the same applies to minerals. In transport, rights and privileges after the war must equally be subordinated in order to serve the nation. The Government must remain the purchaser of raw materials. Mr. Molson said there should be no idea of creating for Lord Woolton a super-department which will go over again all the work which has been done in each of the administrative departments concerned with the various branches of reconstruction. This could mean only delay.

Watford Isolation Hospital is PLANNING A NEW NURSES HOME.

Other nurses' homes will be visited by the Joint Hospital Committee before the designs are prepared. In addition to the nurses' home, which will accommodate fifty-five nurses and nine maids, the Board is contemplating an extension of the hospital.

MOT is considering a scheme to construct a MOTOR HIGHWAY BRIDGE OVER THE SOLWAY FIRTH.

The bridge, nearly two miles long, will join Cumberland with Dumfries-shire. It is part of a scheme to connect Scotland with England by a radiating system of modern motorways, linking up railway centres with civil airports. It is stated that the bridge will save more than 50 miles in the existing route via Carlisle between the industrial areas of Northern England and Western Scotland. It is understood that it will be constructed over the same foundations as the old Caledonian viaduct.

THE MOVING OF BUILDINGS

WE are apt to take it for granted that buildings once erected are immovable except by demolition. As a result many road and town-planning improvements await the slow decay of buildings or are abandoned altogether. New or important buildings are often the determining factor in deciding the line of a new road. They deter the planner from advising, or the local authority from carrying out, the widening of an existing road even though this would be the correct solution to the particular traffic problem; or if such widening is decided upon, the new road is forced to weave its limited way through the existing buildings and the efficiency and the design of the road suffer. Where the idea of widening is abandoned a new parallel route is sought through cheaper property—usually residential—and a confused double road system is produced with the new road forcing an unnatural re-orientation on the residential communities or neighbourhoods it has cut in two.

To suggest that these difficulties can be overcome by moving obstructive buildings bodily to new sites may perhaps sound somewhat fantastic, for the moving technique is not a familiar one in this country. Several months ago a fifty-ton air raid shelter, which obstructed the road traffic at a south-coast town, made head-lines in the daily papers as an unusual engineering feat; it was moved along the road on steel rollers travelling on old tram lines. But before the war such events were of frequent occurrence in America and Russia, with the difference that instead of a 50-ton air raid shelter, the buildings moved ranged up to thirteen storeys in height and 23,000 tons in weight.

Looking through the pre-war technical journals of our Allies one can read such head-lines as these: Hospital moved round the corner while doctors carried out operations: Army post buildings moved across river: 13-storey building cut in two and set back 5 feet to widen street: County morgue takes a ride on a steel cradle. The Americans were the first to realise the value of the moving process as an aid to road planning reconstruction—they were moving buildings more than fifty years ago. The latest and most enthusiastic exponents of the art are the Russians; in order to speed up the execution of the 1935 Moscow Plan, the City Soviet scheduled 150 buildings to be moved bodily to new sites, including their own offices.

One of the great advantages of the moving technique is that valuable accommodation can be maintained in use; in most of the buildings moved in America and Russia the occupants have continued to live or work in the buildings during the preparatory operations and during the actual move, temporary connections being made for all the services. This is particularly valuable at a time when accommodation, labour and materials are scarce—a position with which we shall be faced after the war. Serviceable buildings can be

maintained and yet at the same time road re-planning and reconstruction can proceed.

It is encouraging to read in its recent Report, that MOW's Mission to the USA studied the moving of buildings in America in view of its value in reconstruction.

It is encouraging too to see that the County of London Plan has something to say on the subject: "The success of this process in America and Russia and its value in facilitating and speeding up road improvements should not be overlooked when considering similar problems in the reconstruction of London. It frees road reorganization from the dictates of the existence of new or valuable buildings. There are instances in London where the moving back of buildings might provide the best solutions of the traffic problems. Although the process may not give unlimited scope for rearrangement of buildings and opportunities may not be numerous, nevertheless we are of the opinion that the process warrants serious consideration and should be adopted where practicable."

Before we can give it such consideration most of us will want to have more detailed information. To this end, the JOURNAL is devoting the bulk of this issue to the technique of moving buildings as developed in the USSR.

The Architects' Journal
War Address: 45, The Avenue, Cheam, Surrey
Telephone: Vigilant 0087-9

NOTES & TOPICS

THE REAL LAW-MAKERS

The other day I was complaining to a barrister of the esoteric wording of Parliamentary Bills, and of legal phraseology in general. His reply was interesting, and ran as follows.

★

"At some stage or other in public affairs an idea, a report, a speech, an undertaking has to be reduced into the words of a Parliamentary Bill. That is done by the Parliamentary draughtsmen. They are virtually all barristers in the Civil Service. They work in Treasury Chambers in Whitehall and every Government department that wants a Bill prepared calls on their services. They move from drainage regulations to international treaties with the greatest of ease."

★

"Drafting a Bill involves not only an extremely accurate knowledge of the English tongue but also extensive research into every other Act that does, or may, deal with the same ground. Writing a sentence which cannot be twisted into an ambiguity is not easy. Writing a Bill of a hundred clauses, each of which is clear and none of which is inconsistent with any other, is even more difficult. The hardest task is tidying up amendments made in either House. An amendment to one clause may make nonsense of another in a different part of the Bill, and that has to be corrected against a rigid parliamentary timetable. Draughtsmen say that their worst headaches are the lawyers in the House of Lords who put down amendments solely to clarify a Bill. Their expert minds but inexpert pens are apt to make confusion worse confounded."

★

"The results of all that the draughtsmen do are very creditable. The percentage of cases in the courts that do turn on an obscurity in an Act of Parliament is very small. Laymen sometimes complain that they cannot understand an Act of Parliament. Their criticism is ill-founded. The task of a lawyer in drafting any document is to produce something that conveys one meaning, and one meaning only, to another lawyer, and readability may sometimes have to be sacrificed to this end."

★

He *didn't* add, "Can you, in any case, expect lawyers to produce documents that will make the use of other lawyers unnecessary?"

AN EDWARDIAN CLASSIC

Architectural Hygiene or Science as Applied to Buildings, by Sir Banister Fletcher and Major H. Phillips Fletcher (Pitmans, 18s. 6d.) has gone into its eighth edition. Once the formidable barrier of the first chapter on Acts and By-laws has been surmounted, there is much instruction, some laughter, and to some perhaps even a nostalgic tear, to be enjoyed in the bouquet of its ancient vintage.

★

The effort spent on this "good, tall volume" must have been prodigious. Its object is to present the subject of architectural hygiene to architects, surveyors, engineers, medical officers of health, sanitary inspectors, plumbers, students and householders. It covers not only plumbing and sanitation, but choice of site, planning, construction, fittings, refuse disposal, water supply, ventilation, heating and lighting. But that's not all. The book is full of snippets of variegated information such as: "Where cupboards are provided in bedrooms they should have a depth of not less than 20 ins. from front to back to allow coats to be hung sideways from a central rod."

★

The Preface to the book states that the new edition has been brought up to date by an extensive revision, but, though the book certainly contains a mass of useful information, this claim is rather surprising in view of the following extracts from the book:—

"Lavatories, water closets and bathrooms are usually planned with regard to privacy.

On the ground floor a lavatory and water closet are generally placed in proximity to the front or garden entrances with cloaks accommodation, and provided they are properly screened, it is often a very suitable place. An ideal arrangement is to have a sanitary wing, cut off from the main building by cross ventilating lobbies; but this is not often carried out on account of the disinclination to mark these conveniences too prominently."

★

"The pantry, which is used for the cleaning and storing of china, glass and silver, should be in connection with the kitchen, and may form part of the service room. It may be fitted with a deep stoneware or fireclay sink, and hot and cold water should be laid on. Special pantry sinks are made in oiled teak and sycamore, and these can be lined, if desired, with lead or pewter."

★

"The entrance hall and staircase (of a house) are often on a free site, best placed on the north side, so that the sitting-rooms may face south. A good square hall, containing an open newel staircase well lighted by a large window and warmed by an open fireplace or an anthracite stove, enhances the homelike effect of any house, and it can be used as an extra sitting-room or lounge."

★

"Artificial lighting. This is produced by the heating of some substance till it becomes incandescent. . . . Owing, however, to the great gas monopolies and the conservative tendencies of the inhabitants of Great Britain, the progress (of electricity) has been much slower than in other countries. On the American Continent electricity plays a far more important part in public and private enterprise."

★

"The billiard room is usually placed in a retired position. It is often possible to plan the ground floor lavatories in connection therewith. . . . A billiard room is very often difficult to ventilate because of the large amount of glass in the lantern and the quantity of gas necessary for lighting. The first thing which should be done whenever possible is to substitute electricity for gas."

★

In these uncertain days, now that middle-class security has left with the servants, the bourgeois soul will find solace in these pages when the gas fire burns low on winter nights and there is no shilling for the slot. He will dream that the butler's in his pantry again and all's right with the world (for some people). He will hear once more the click of a cannon splitting the deep, dark silence of the neo-baronial billiard room—the clop of the mallet enhancing the summer stillness on the well-kept lawn.

★

Architectural Hygiene rests in its proper place on my shelves where it flirts gallantly with its neighbour—a very lady-like little book in the tightest of stays—an heirloom from a great-aunt (shares in Home Rails), who doubtless found it invaluable in catering for those garden parties beneath the great chain-laden yew tree. It's called *Récherché Sidedishes*.

POETS' CORNER

". . . *THE WORK SOME PRAISED, AND SOME THE ARCHITECT.*"

(*The Radcliffe Camera seen from within*).

Beneath the upturned basin of its dome,
Plugged with acanthus where a lantern-vent
Could filter sight towards the firmament,
Sprout up eight groves of columns (such as Rome
Still called Ionic); shields festooned are foam
To breaking billows which are arches, meant
With egg-and-dart to ladder eyes ascent
To cyma's curve, and consoles' palindrome.

Beyond eight swags, which equal windows light,
The creamy bubble muses, poised for flight,
Ignores the caverned crypt its span implies.
Not so the bust of the designer, Gibbs;
His marble breastbone does not end in ribs,
Yet the full belly glistens in the eyes.

R. A. Bell.

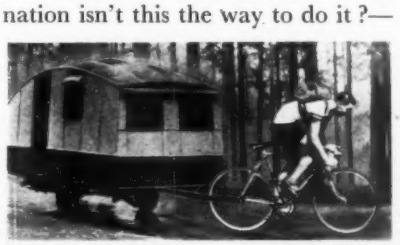
HOW TO MOVE BUILDINGS

As this photo indicates, Californians

seem to have taken happily to the mobile house. No bother with jacks, rollers, railway tracks or other elaborate machinery to move a building. Just nip into the saddle and you and your home are off for a spin down the boulevard. Take your home with you when you go shopping, prop it against the wall outside the office or leave it in the hall when dining out—a little grey home in the vestibule.

★

But that's the lazy mechanical way of solving the housing-planning problem. To provide mobile housing and at the same time maintain the health of the nation isn't this the way to do it?—



ASTRAGAL

LETTERS

H. J. Venning
(*Hon. Sec. Chartered Surveyors' Institution, Quantity Surveyors' Committee.*)

Arthur Wise, A.R.I.B.A.

Building Methods in the USA

SIR,—The authors of the Report on Methods of Building in the USA Mission seem to have assumed that Englishmen had scarcely heard of America. This is hardly fair to our American friends, in whose methods we have found so much of interest and admiration. Many of us, including myself, have been to the United States, and we hope that before long we shall see more of our American friends, whether over here or over there, and resume the exchange of views, which is bound to be fruitful.

But Mr. Bossom's Report assumes, apparently, that because the use of bills of quantities has not been developed in America as it has in England, therefore England is out of date and the independent quantity surveyor is a survival of the past. Surely, in this respect at any rate, it is England which leads America, and I believe that America would be the first to acknowledge it.

It is important to note that the Report does not suggest the abolition of bills of quantities, but that they should be prepared by the contractor—a return, in fact, to the mid-Victorian method by which every one of a dozen or more builders tendering for a contract, was obliged to accept unnecessary trouble and expense whether he was successful or unsuccessful in obtaining the work. Is it really suggested that this makes for economy in building?

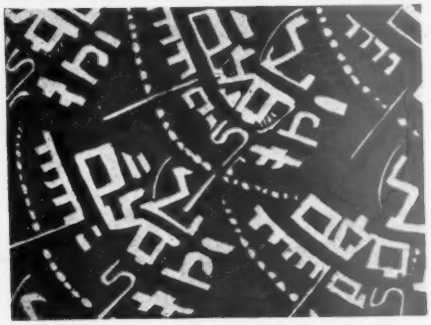
We believe that our way of issuing a bill of quantities, prepared on well defined principles, is the best means so far evolved of securing to the contractor and the building owner a fair deal and the avoidance of disputes. American and British thought will not disagree in this aim.

I need not say more, except that my Committee will naturally bring before the proper authorities the facts necessary to correct any wrong impression that Mr. Bossom's Report may give in this respect.

H. J. VENNING

London

TEXTILE DESIGNS OF THE LONDON PLAN



Last week Astragal wrote about textile designs by Hilly, published in It, *a textile trade journal, which have been inspired by the book on the County of London Plan. Four of them are reproduced here. Above, left, a scarf design based on the Open Space Plan. Above, right, a repeat pattern suggested by the Hyde Park Corner improvement scheme. Left, a design suggested by the axonometric of the South Bank. Right, a pattern based on two drawings, one showing the existing use of the riverside, the other its proposed redevelopment.*

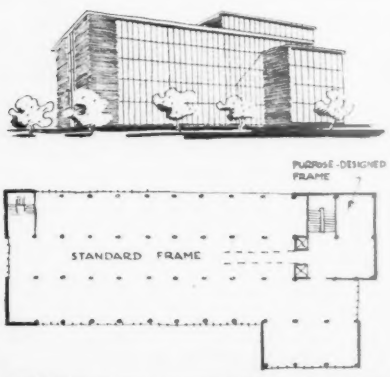
Prefabrication

SIR,—Apart from the needs of the Services, consideration of prefabrication and limited life building has been entirely confined to small housing. I suggest that there is another aspect that has not received due attention.

In buildings below, say, three or four storeys, the brick wall has been a reasonably satisfactory and economic means of combining three functions—namely, keeping out the weather, keeping in the warmth, and giving support to upper floors and roof.

In multi-storey framed buildings, however, brick walls have performed only two of those functions—the first two.

I suggest that in so far as prefabrication is concerned with external walling, it has a better chance in buildings of this type. Bricks in framed buildings offered support that was never used, and resulted in enormous and largely redundant loads which had to be carried by the frame. The Bye-laws seemed quite content to separate indoors from outdoors by a piece of stuff only ½ in. thick—but only so long as one called it window. Why not a light prefabricated wall-window unit in a few simple standard forms, either interlocking or fixed in pre-cast concrete mullions? The unit could be fixed by dry methods, and being interchangeable would permit flexibility in internal planning. It would considerably reduce the loading of the frame and thereby its cost. It would be a non-structural member in a frame that is there in any case, and ought, therefore, to be reasonably inexpensive.



Prefabricated multi-storey building. (*See letter on this page.*)

A second point: The R.C. or steel frame with R.C. floors, like the brickwork in the orthodox house, is a sound and practicable proposition. Due Stability happens to be accompanied by a considerable measure of permanence, and in fact, it is not easy to dissociate the two. But it is not necessarily the structural frame that becomes out of date. It is the way in which it has been clothed.

Up to now it has been customary to plan accommodation first and then design a tailor-made frame for it. Why not establish a form of standard frame based on a unit bay that is convenient for a variety of purposes, and then design various types of accommodation round it? With the use of more or less demountable prefabricated units, both in external walling and in partitioning, a building could be re-planned or switched from one purpose to another with the minimum fuss and mess and at moderate cost.

The main purpose of such a standardized frame would be to facilitate limited life building in a long life frame. The same permanent frame could have two or three separate leases of life, so that the whole building need never be hopelessly out of date. There might be some economic advantage in steel fabrication; there might be some in having standard spans in concrete floors; it might even develop a form of standard shuttering for beam and stanchion casing that really works.

I do not, of course, suggest that the whole frame consist of standard bays. Part, including stairs, lifts, and wing connections at odd angles, would need to be purpose-designed to suit circumstances. There is, too, an obvious disadvantage in dealing with an expensive and restricted site.

Working back from the large building to the small, one can envisage the same or similar prefabricated units used in a composite brick and frame domestic shell—and this without being tied to a rigid plan. There are the same factors of extensibility and flexibility of accommodation. The prefabrication method would be supplementing and speeding up the orthodox instead of competing with it and thus tending to set up two quite different building industries. (Short-life emergency housing is a different matter).

But if one cares to regard a bare frame as a series of superimposed building sites, a number of interesting possibilities emerge—for instance, the very large municipally owned frame, on a bombed area, that is let off bay by bay on what amount to short building leases.

ARTHUR WISE.

Launceston, Cornwall

150.

THE ARCHITECTS' JOURNAL LIBRARY OF PLANNED INFORMATION

THE HADLEY CLIP, (patent applied for).
For fixing building board roof and wall lining to steel-frame structures.

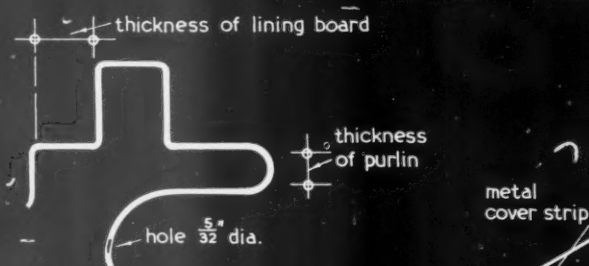


DIAGRAM 1:
CROSS SECTION THROUGH CLIP.

DIAGRAM 2: ISOMETRIC SKETCH SHOWING CLIP, LINING BOARD, AND COVER STRIP.

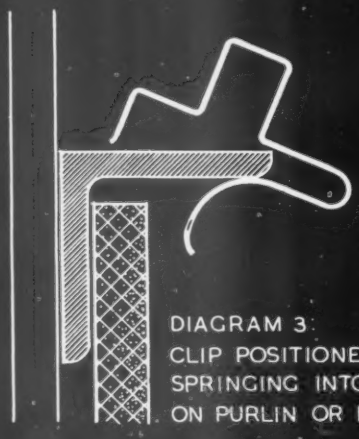


DIAGRAM 3:
CLIP POSITIONED FOR SPRINGING INTO PLACE ON PURLIN OR RAIL.

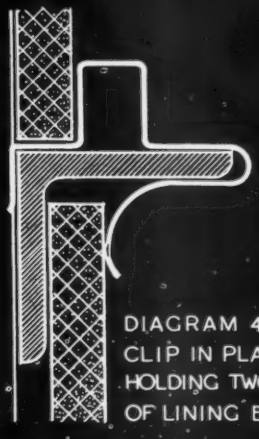


DIAGRAM 4:
CLIP IN PLACE HOLDING TWO SHEETS OF LINING BOARD.

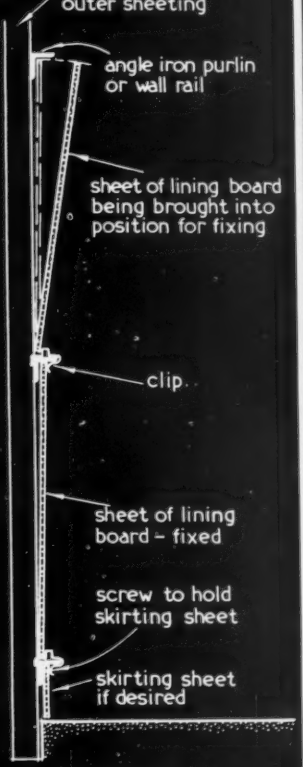


DIAGRAM 5:
TYPICAL ARRANGEMENT FOR WALL LINING.

Issued by The TenTest Fibre Board Company Ltd.

144 INFORMATION SHEET: FIXING CLIP FOR WALL AND ROOF LININGS.
Sir John Burnet Tait and Lorne Architects One Montague Place Bedford Square London W C I

THE ARCHITECTS' JOURNAL
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INFORMATION SHEET

• 930 •

FIXING BUILDING BOARDS

Product : Hadley Clip (patent applied for).

General :

The Hadley Clip is designed for use with metal cover strip to provide an economical method of fixing insulating or other linings to steel-framed structures covered externally with corrugated sheeting. The system is fundamentally simple, enabling linings to be fixed with maximum economy under all conditions. By this method linings may be attached to structures erected some time previously, or to new buildings where it is desirable to fix the lining after the outer covering. Typical cases where this order of operations may be desirable are :

1. Where the lining material is susceptible to damage by exposure to weather before or during fixing.
2. On exposed sites or during rough weather —especially on vertical or curved work.
3. Where it is desirable to avoid the necessity of synchronizing the delivery and fixing of lining and outer covering.

The Hadley Clip may be used with any thickness or type of building board, such as insulating board, plaster board, asbestos cement sheets, etc., and can be made to fit any type of purlin. Provision can be made, if required, for fixing the lining clear of the outer covering of the building so as to provide an uninterrupted air-space.

Principle of System :

The Hadley Clip holds the lining board adjacent to the outer covering and at the same time secures a metal cover strip, preferably of "T" section over the joint between adjacent lining boards, to prevent sagging or bulging.

The clip is sprung into position on the purlin or wall rail after the board below it has been placed in position. The downward portion of the clip presses this board against the purlin while the upward projection holds the bottom of the board above, when this, in turn, is fixed. (*See diagrams* 3 *and* 4.)

Method of Fixing :

1. A row of clips is placed in position along the lowest (or first) rail or purlin.

2. Sheets of lining board, cut to fit between the first and second rails, are then brought into place with their lower edges behind the upward projections of the clips on the first rail, and their upper edges lying against the downward leg of the second rail (*See diagram* 5.)

3. As each sheet comes into position, clips are sprung into place on the second rail so as to hold the upper edge of the sheet firmly in position.

4. A space of $\frac{3}{16}$ in. to $\frac{1}{4}$ in. is left between adjacent sheets of lining board and a "T" section metal cover strip inserted to support the edges and cover the joint, the metal cover strip being held in position by means of clips at the top and bottom in the same manner as the lining boards themselves. (*See diagram* 2.)

Sizes of Sheets. Sheets are normally used 2 ft. wide (metal cover strips at 2 ft. centres). Where the lining boards are comparatively rigid and the purlins or wall-rails close together, wider sheets may sometimes be used but each job should be considered on its merits.

Spacing of Clips. With sheets 2 ft. wide, the maximum possible spacing of clips will also be at 2 ft. centres. This is satisfactory with light-weight boards (e.g. insulating board) on vertical work, but for heavier boards (e.g. plaster board), and on sloping or horizontal work, one or more intermediate clips are necessary to avoid sagging.

Screws. Where desired, a self-tapping screw about $\frac{1}{2}$ in. by 4 gauge may be inserted through the hole in the downward projection of the clip and into the web of the metal cover strip to lock these two components together.

Curved Work :

Curved work may be carried out satisfactorily by using correctly curved metal cover strips. The method has been found particularly suitable for lining huts or sheds of semi-circular or other curved section.

Advantages of System :

1. *Fixing under Cover.* All lining work is carried out under cover. This avoids possibility of damage to the lining board by weather, or interference with progress of work from this cause.

2. *Simplicity.* Normally only two simple components, namely, the clips and cover strips, are employed ; the comparatively small sheets of lining board are easy to handle, even overhead ; the action of the clip itself is very simple and positive and it can be sprung into position with one hand far quicker than driving a nail or screw. No special skill is necessary.

3. *Speed and Economy.* Because of the simplicity of the system and because it enables linings to be fixed under cover, an unusually high and therefore economic rate of fixing is obtainable.

4. *Removing Sheets.* Any sheet or sheets of lining may be removed and replaced without disturbing other sheets, or the whole lining may be removed and re-used without damage.

Issued by : The TenTest Fibre Board Co., Ltd.

Address : 75, Crescent West, Hadley Wood, Barnet, Herts.

Telephone : Barnet 5501 (5 lines).

Telegrams : Fiboard, 'Phone, London.

Above, the removal of the Krimsky (Crimean) Bridge, Moscow, to a new location in 1936. This bridge of welded iron, built for horse traffic, has been replaced by a new steel bridge. In order to avoid a traffic hold-up, the old bridge was moved some fifty yards down stream, while construction of the new bridge was going on. The photo shows the moment when the bridge, having been raised about 9 in. and mounted on steel supports, was moved 10 yards on the first stage of its journey.

MOVING BUILDINGS IN THE USSR

[by Arthur Ling, A.R.I.B.A., A.M.T.P.I.]

A branch of building technique which has been developed extensively in America and Russia but which has so far received little attention in this country, is the moving of buildings. In the widening and rapid reconstruction of main roads lies its most important application. An architect, who has made a special study of the subject, here describes the pre-war experience of Soviet engineers in rolling back some of the 150 buildings which have been scheduled for moving in the Moscow Plan of Reconstruction.

The High Chamberlain's unneighbourly act recorded in *The Survey of London* by John Stow (1598) seems to have impressed the author much more than his pioneer work in the rolling back of buildings.* Perhaps if Stow's father had not been one of the unfortunate victims, this remarkable engineering feat might have been chronicled as a great invention, providing the solution to the chaos and congestion caused by the narrowness of the City streets. As it is, the process has been neglected in this country, and since this incident, little progress has been made. It has been left first to the Americans to develop the technique, and then to the Russians to use it on a large scale. Even now, in spite of the proven advantages and practicability of the process, we are still either uninterested or sceptical. In discussion with town planners and architects I have found many who are ready to be amused at the prospect of buildings being rolled hither and thither, but few who are prepared to give the serious consideration which this new and important branch of building technique deserves. The main reason for this is, I believe, the lack of information on the subject.

It is from the Russians, the most recent and enthusiastic exponents of the process, that the latest information is to be gained. From information collected during a visit to the Soviet Union in 1939 and with the aid of translations of the most recent articles on the subject from Soviet technical journals, I hope to give sufficient data to show the importance of the moving technique and its possibilities.

*See *From an Architect's Commonplace Book* on page 145

Fig. 1. The general height of buildings on the Sadovoya ring-road is being increased with a result that some of the smaller buildings are dwarfed in scale. If the buildings are of architectural or historic interest, they are to be moved to new sites as, for instance, in the case of the building in the centre, next to the new offices of the People's Commissariats.

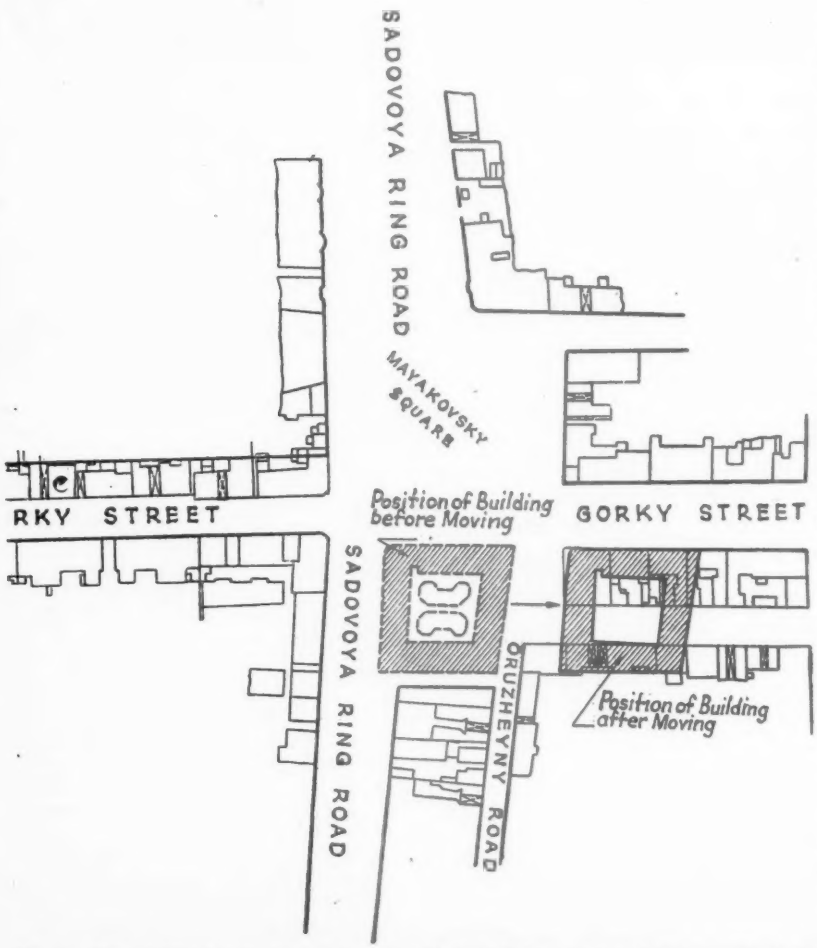


Fig. 2. Plan of Mayakovsky Square showing a block of flats to be moved back to enlarge the square and give room for the construction of a traffic underpass.

The plans of reconstruction which the Russians put into operation for their towns and cities from 1932 onwards, involved extensive street widening and re-alignment. Soviet planners and engineers were quick to realize the value of the moving process in facilitating and speeding up the work. Successful moving of buildings in America encouraged them to make a serious investigation into its possibilities as regards both its practicability and cost. Moscow was the chief testing ground; so successfully did the process stand up to the test, that in the city's great reconstruction plan 150 large buildings were scheduled for moving. An indication of the extent of the use of the process can be seen in the plans for widening part of Gorky Street (see page 146). In this section of the street—one-third of a mile long –six buildings have been moved or are scheduled to be moved in the directions shown by the arrows.

FACTORS TO BE CONSIDERED

Is the moving of buildings worth while? Would it not be better to demolish them and build new ones on sites which allow the necessary road widenings? These were the first questions which Soviet engineers and planners had to answer. To do so several factors had to be considered: the historic or architectural value of the buildings; the duration of the work; the availability of labour and materials, and the availability of accommodation.

Moscow, like most ancient cities, has many architectural and historic monuments. In some cases, new multi-storeyed buildings make the smaller of these appear insignificant, and if a unified architectural composition is to be obtained they cannot be left on their present sites (Fig. 1). In other cases their sites are required for road widenings. But for the process of moving, the alternatives would be either demolition or the abandonment of the project for one in which the avoidance of certain buildings was the deciding factor.

It is clear that the moving of buildings of architectural or historic value can be decided almost independently of economic considerations. Their preservation in most cases is worth even more than the cost of demolition and erection of a new building.

For buildings of negligible architectural value, economic considerations must play a greater part. Architects, anxious to see their ideas translated into solid buildings and to leave their mark on the world, are apt to assume that to erect a building of their design is sufficient reason for destroying an existing one of no architectural merit. (On showing the photograph (Fig. 21) of the moving of 24, Gorky Street to architects, I have invariably received the comment "Fancy bothering to move that building."). Soviet architects have proved themselves no less keen than others in this respect, and I. T. Ivanov, in an article in *Moscow Construction*, September, 1940, takes them to task. "Architects to whom the reconstruction of a whole street is entrusted, must not," he says, "be allowed to demand the demolition of all buildings regardless of the accommodation value, on grounds that they will design better ones." Housing and office accommodation, in spite of the many new buildings erected in Moscow since the revolution, is still inadequate, and the demolition of a building means that the occupants have to be temporarily rehoused for a considerable period, whereas in the process of moving a building they remain undisturbed, temporary connections being made for all the services.

Before the War, the Soviet building materials industry was particularly backward; Molotov singled it out for special mention at the 1938 Congress and a separate government department was later set up for the industry. With a shortage of building materials the case for moving buildings was strengthened, as very little new material is required, and steelwork and machinery may be used again and again.

The time factor must also be taken into account. Russian engineers have calculated

TABLE I.—COSTS OF MOVING A BUILDING COMPARED WITH DEMOLITION, AND ERECTION OF A NEW ONE.

Item of Expense	*Amount*	*Cost per Unit*		*Total Cost of each item*			
				Moving		*Demolition and New Construction*	
		In roubles	in £.s.d.	In roubles (to the nearest 25,000 roubles)	In £.s.d.	In roubles (to the nearest 25,000 roubles)	In £.s.d.
1. Demolishing the old buildings on the new site and preparatory work	1,273,000 cubic feet	·18	1·39d.	225,000	7,373	225,000	7,373
2. Distribution of financial assistance to inhabitants evicted from these buildings	550 persons	2,500	£80 15s.	1,375,000	44,412	1,375,000	44,412
3. Financial assistance to the evicted inhabitants of No. 72, Gorky Street, in the case of its demolition	950 persons	2,500	£80 15s.	—	—	2,375,000	76,712
4. Demolition of No. 72	1,769,000 cubic feet	·18	1.39d.	—	—	325,000	10,245
5. Construction of new building	1,769,000 cubic feet	3·1	2s.	—	—	5,500,000	176,900
6. Moving of No. 72 to the new site	1,769,000 cubic feet	1·55	1s.	2,750,000	88,450	—	—
TOTAL EXPENDITURE	—	—	—	4,350,000	£140,235	9,800,000	£315,642

from experience that the construction of a new building of approximately 250,000 cubic feet (equivalent to a building 60 feet high, 30 feet deep and 500 feet long) requires :—

preliminary site work	1 month
constructional work, services, etc.	8 months
finishes and equipment ..	1 month
Total ..	10 months

This estimate is based on favourable building weather and continuous speedy construction. In practice, some buildings have been under construction for two or three years.

On the other hand, the moving of a similar size building requires :—

preparatory works	3 months
works after moving	2 „
Total ..	5 months

The actual moving operation requires a period of hours only. These times are based on average figures, and do not take into account recent advances made in technique. In 1940, for instance, a three-storey house, No. 83 Ostapov Road, was moved in 24 days inclusive of all preparatory work, and another building at the Kim Works was moved in 23 days.

Even taking the lowest estimate for new construction and ignoring possible improvements in moving technique, there is a saving in time of 50 per cent. If one adds the saving in material and accommodation, the case for moving a building is a strong one.

A COMPARISON OF COST AND MATERIALS

An instructive analysis (Table I) of the economics of moving a building in comparison with its demolition and erection of a new one has been given in *Moscow Construction*. It is in the form of comparative estimates for a four storey block of flats, No. 72 Gorky Street, which was scheduled for moving as part of the Mayakovsy Square improvement, which includes the construction of an under-pass to solve the traffic intersection of Gorky Street and the " B " Ring Road (Fig. 2). This block of flats was to be moved on to an already cleared site on which a number of old and useless buildings had stood. The building has a cubic content of 1,769,000 cubic feet, an internal courtyard, and a continuous basement ; 950 people live there.

The equivalent values in £ s. d. are based on a rouble = 7¾d. This figure is arrived at by estimating for item No. 5 the cost per cubic foot of a similar building in this country at 2s. 0d. This gives a comparative value of the rouble for building work only and cannot be taken as the value generally. The value of the rouble varies according to the relative cost of commodities from ¾d. to 2s. 0d., and sometimes more. For instance, a watch costing 150 roubles in Russia would cost 10s. 0d. here, whereas an 800-mile aeroplane journey from Moscow to Simferopol in the Crimea costing 150 roubles, would cost £15 here. It should be noted that for converting the financial payments to evicted inhabitants into £ s. d. the same equivalent value has been taken in order to maintain the same proportion between the costs of various items. In view, however, of the lowness of the rents (there is a maximum of 10 per cent. of income), this exchange is probably, if anything, on the low side. This table is interesting in that it reveals the generous compensation paid to those evicted on account of road widenings and reconstruction generally. A family of four would receive £323—rather different to the story of brutal and dictatorial eviction told by the Riga Correspondent in his hey-day.

This table shows that the cost of moving the building is approximately 44 per cent. of the cost of demolition and construction of a new one. The estimated time is six months in the case of moving, and 18 months for demolition and new construction. On both time and cost the moving process therefore has considerable economic advantage.

Estimates for the percentage ratios of the details of expenditure in each case have also been calculated as follows :—

Item of Expenditure	*Percentage*	
	Moving	*New Construction*
1. Labour	10·6	12·5
2. Materials	30·8	56·1
3. Transport	8·0	6·0
4. Mechanism ..	3·1	1·8
5. Administrative and Overhead expenses	15·5	6·5
6. Other expenses ..	32·0	17·1
Total ..	100·0	100·0

This table shows that in the moving process, a considerable reduction in working processes is obtained. The proportional expenditure on materials is reduced, and the part played by mechanism and productive labour is increased The increase in transport costs in the case of the moving process is explained by the two-way movement of equipment from and back to the store.

Item No. 2 in the above table has been further analysed to show the expenditure of the principal building materials.

Material	*Unit of Measure*	*Amount used per 100 cubic metres of building*	
		Moving	*New-Construction.*
Cement	Tons	1·75	2·30
Timber—Unsawn	Cu.Metres	·57	2·50
Timber—Sawn ..	„	1·20	6·40
Metal	Tons	·70	1·20
Bricks	1,000	1·80	6·60

This table shows that considerably less building material is required for the moving process. The expenditure on cement in this process—75 per cent. of that used for a new building—is considered excessive by Soviet engineers, and experiments have been made to reduce the amount. The high tonnage of non-returnable metal—60 per cent. of that used in a new building—is due to the lack of standardized construction and the excessive sizes of members used. The experimental stage in which the engineers played for safety had been passed and it was expected that considerable saving could be made by standardization and less generous allowances for safety factors. Some of the methods by which it is proposed to reduce costs generally are described later. Sufficient information has already been given to show that the moving process is not only an economic proposition, but also shows a considerable saving over the alternative of demolition and new construction. Before the war, the cost was being reduced year by year ; in 1936-7 the average cost of moving per cubic foot of building was 2 roubles (1s. 3½d.) ; in 1938-9 it was 1·5 roubles (11¾d.). The aim of Soviet Engineers in 1940-1 was to reduce the cost to 30-35 per cent. of the cost of construction of a new building.

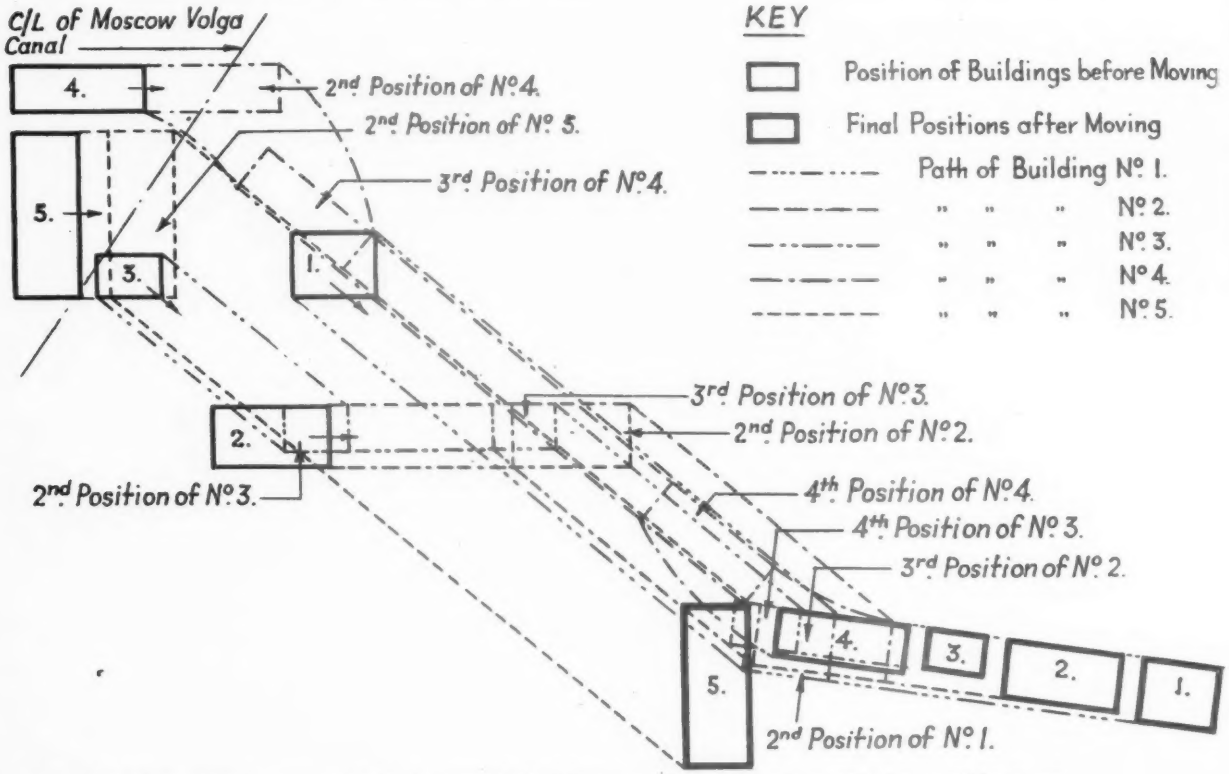


Fig. 3. Plan of operations, in numerical order, for a group of buildings moved during construction of the Moscow-Volga Canal.

Fig. 4. A block of flats moved in 1937 to make way for the new approach to Kvarnholm Bridge. The building was moved 144 feet through an angle of 19°. The curved railway tracks on which it was moved can be seen in the foreground.

Fig. 5. An apartment house in Serafimovich Street after the move.

MOSCOW ON THE MOVE

The possibilities of the moving process were appreciated while the Moscow Plan was being drafted. Early in 1934, Kagonovitch, People's Commissar for Building, requested members of the building industry to investigate the technique in preparation for the adoption of the Plan the following year. In April 1936, on the initiative of N. C. Hueschev, a Bureau for moving buildings was created; it is now called the Trust for Moving and Demolishing Buildings. Its original personnel was drawn from former Metro builders who were, in fact, the first exponents of the process: in the Autumn of 1935 a small electric sub-station standing in the way of the Metro construction was moved in 35 working days, inclusive of preparation of plans, etc., during which time it continued to function uninterruptedly.

Since then the number of buildings moved has increased year by year. In 1936 several large stone buildings were moved during the construction of the Moscow-Volga Canal (Fig. 3), and two large five-storey blocks of flats were moved. The way in which the Bureau juggled with the buildings which stood on the line of the Moscow-Volga Canal reforming them into a new street frontage, indicates the boldness with which these jobs were tackled. These were followed in 1937 by a five-storey block over 200 feet long, which obstructed the approaches to Kvarnholm Bridge (Fig. 4). This block weighed 9,000 tons, and measured 242,000 cubic feet. It was moved 144 feet, and turned through an angle of 19 degrees on curved railway tracks. Later in the same year, this technique was used for the first section of the Gorky Street widening. The building, No. 24 Gorky Street, weighing 23,000 tons, and measuring 1,724,000 cubic feet was moved 150 feet in a straight direction. Such large buildings had not been moved before even in America—the home of house moving—where the record is 11,000 tons. This move gave a road width of 154 feet as compared with the original 50 feet width.

At first, the occupants of these buildings were scared of remaining during the actual move;

Fig. 6. A building at the Kim factory in Moscow moved in 23 days inclusive of preparatory works. A crowd of spectators watch in the distance.

in one block of flats on Serafimovich Street (Fig. 5), on being told that their building was to be moved the next day, they arranged to move to relations and friends during the operation. But the house-movers were too quick for them. They started the move during the night, and when, next morning, the occupants found that they had already moved 65 feet without being aware of it, they lost all fear. They were most impressed by the continued functioning of all the services—gas, electricity, radio, telephone, central heating, water and sanitation. This was done by means of temporary connections—in the case of gas, water and drainage, by flexible rubber piping sufficiently long to allow the move; the hot water and central heating boiler was temporarily shifted to the ground floor, reconnected, and carried along with the building as it was moved (see Figs. 10-11). One can imagine the occupants' delight at finding these services still functioning, and the pride with which they were able to ring up their friends and families to give them a running commentary on the progress of their home on its journey to a new site.

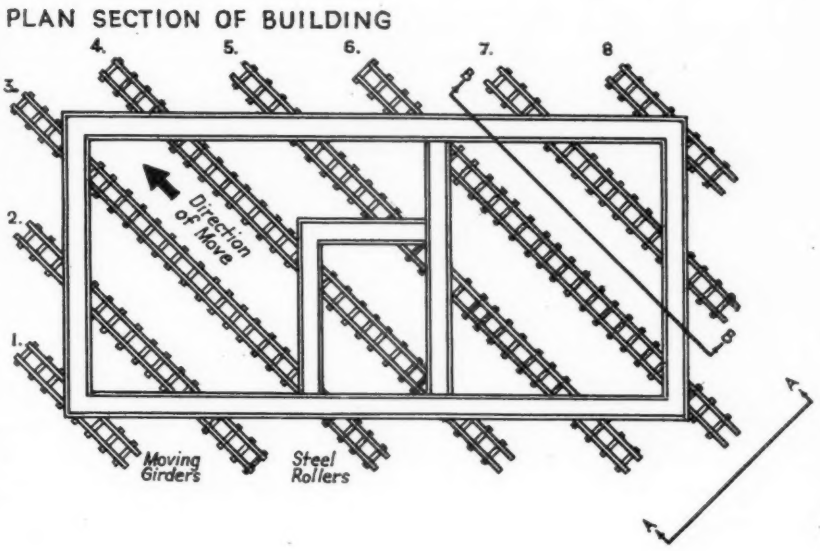
More recently, in 1940, the Eye Hospital in Gorky Street was moved. Throughout the move the hospital continued to function, the patients remaining in their beds, and the doctors continuing to carry out operations.

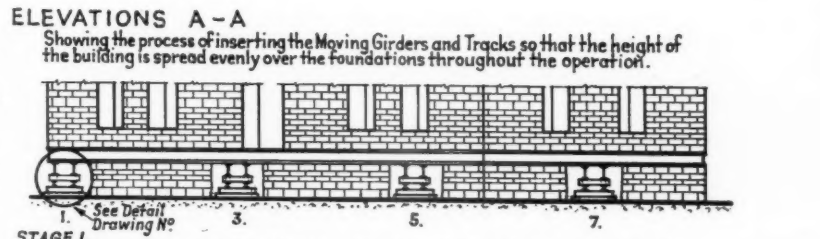
The moving day had developed into a great event for the Muscovites, who turned out to watch as if it were a football cup final (Fig. 6). Whenever possible, the moves were scheduled for completion on an important anniversary or holiday as part of the celebrations. For the 21st Anniversary of the Revolution, the Trust straightened out the curve of a reinforced concrete grain-elevator. A *Moscow News* correspondent, reporting the 1941 May Day Celebrations, told how the workers on their way home along Gorky Street the evening before, were disappointed to find that one building on the south-west side still remained on its old site, which meant that the formation of the procession to the Red Square would be spoilt. But the next morning, to their surprise and delight, they found no obstruction—the offending building had been moved back overnight and the road made up specially for the procession.

During the years 1937-9, eleven stone and brick buildings, twenty-three wooden structures and four pavilions in the All-Union Agricultural Exhibition were moved. Many more buildings are scheduled by the Moscow Soviet to be rolled back on to new sites, including their own Head Offices, the Museum of the Representative Arts, the British Embassy on the bank of the Moscow River, and many others. Moscow, before the war, was literally on the move.

THE MOVING PROCESS

The method of moving is described by Engineer Guendel in an article published in *Moscow Construction* entitled *Three Years' Experience of Rolling Back Buildings in Moscow*. It is a simple process, and in essence, only a magnification of that used for moving pianos or heavy pieces of furniture.





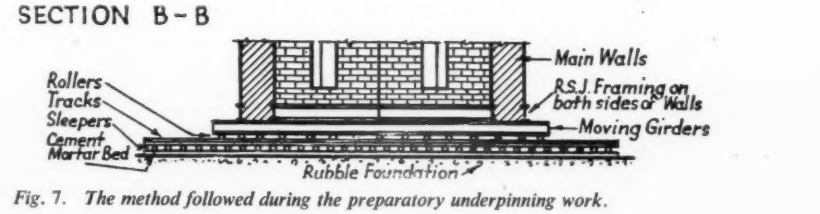


Fig. 7. The method followed during the preparatory underpinning work.

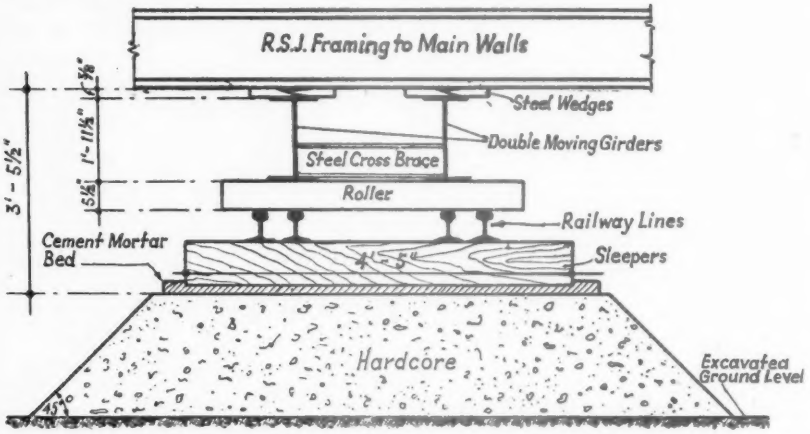


Fig. 8. Detail drawing, referred to in Fig. 7, showing cross-section of moving girders, railway tracks, etc., on which the building is moved.

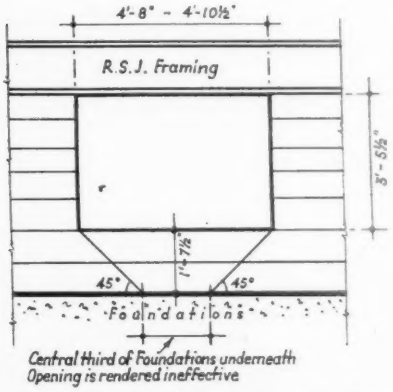


Fig. 9. Diagram showing distribution of load on foundations after openings in main walls, to receive moving girders, have been made.

The following description should be read in conjunction with the accompanying diagrams. The preparatory work is shown in Fig. 7.

Horizontal chases are first cut into both sides of all the main walls of the building at the level at which the building is to be cut; this is usually just below ground-floor level, although in some cases the basements are moved too. Into these chases are placed R.S.J.'s which are bolted together at long intervals through the reduced wall thickness, and welded together at the corners and junctions of the main walls. The cavities left between these joists and the brick- or stone-work are then filled with concrete inserted through a space of 2 in. left between the upper flange of the joists and the brick-work above. This filling is rammed into position by inserting a plank edgeways and hammering on its edge, so pushing the concrete over the edge of the top flanges and into the cavities behind. Finally, the 2 in. space is filled with half-dry concrete. Thus a horizontal steel frame firmly connected to the main walls is provided, below which an underpinning construction can be inserted.

Openings approximately 3 ft. 5½ in. high and 4 ft. 8 in.—4 ft. 10½ in. wide are then cut into the walls below this frame in line with the direction in which the building is to be moved. The exact height is determined by the height of the "moving girders" which varies with the weight of the building. The width is fixed by the length of the railway sleepers, 4 ft. 5 in. plus an allowance for working space (Fig. 8). Railway sleepers and lines are then laid through these openings on a made-up rubble foundation. These are carefully tested with a spirit level to make sure that they are perfectly level. The spacing of the sleepers is determined by the weight of the building to be moved and the load-bearing capacity of the made-up ground. The sleepers are set in a bed of cement mortar. The formation of these openings increases the tension in the walls, but as the normal permissible stress includes a generous safety factor, this does not affect the building detrimentally. A height of wall not less than 1 ft. 7½ in. from the bottom of the opening to the top of the foundation is always left in order to maintain the maximum spread of weight of the building on to the foundations, while the underpinning operation takes place. The foundation beneath the opening is by this means only rendered ineffective for the central third of its length (Fig. 9). Experience has shown that with continuous foundations, the formation of openings for the introduction of the even numbered tracks reduces the area of wall, transmitting load to the foundations, by 14 per cent. This has had very little effect on most of the buildings moved.

The number of railway tracks required is determined by the weight of the building, the disposition of the main walls and the nature of the ground over which the building is to be moved. When these tracks are fixed, moving girders on rollers are dragged into the openings along the railway lines until they are immediately under the building, and the small space, approximately ½ in., left between them and the underside of the steel-joist framing is filled with steel wedges, so that they take the weight of the building immediately above them. The moving girders are usually made up of two R.S.J.s approximately 2 ft. 0 in. in height, spaced at 2 ft. 0 in.—3 ft. 0 in. centres, and bolted and braced together. The rollers are of solid forged steel, 5½ in. in diameter and 4 ft. 0 in. long. The distance between rollers, and therefore their number, is determined so that no roller carries a greater load than 9 tons.

Systematically, the whole weight of the building is transferred to a series of these girders on rollers and railway lines, the process being arranged in two stages—alternate odd numbered railway tracks are laid first, so that half-way through the operation the building is still supported by more than half of its walls evenly distributed over the ground plan; then more openings in the walls are made, and the even numbered tracks and moving girders inserted. The remaining portion of wall between the adjoining tracks is finally demolished, so that the entire building is then resting on the moving girders.

While this work is in progress, new foundations are constructed on the new site, and the ground in between is made up or excavated to the same level as the railway tracks under the building. This is well consolidated by steam rollers. The railway tracks are then extended from the old site in the same direction to just beyond the further edge of the new site. When this work is complete, the building is rolled back by means of electric winches and a system of pulleys and cables, or by electric horizontal screw jacks. The latter method is used chiefly when the path of the move is curved or when the building is very heavy; use of the winch and pulley method in such cases would either require frequent stops to change the direction of the pull, or would fail to function.

The unloading of the building on its new site is the reverse process of the loading. Brick or stone piers with toothed sides are built up in the spaces between the railway tracks from the new foundations to the underside of the R.S.J. framing. When the mortar of these walls is set firmly, the steel wedges between the odd numbered moving girders and R.S.J. framing are removed, and the moving girders are pulled out on rollers back on the same tracks on which they moved the building. Then the railway lines and sleepers under the building are taken up. The new walls between foundations and the R.S.J. frame are then extended. The same process is followed for the even numbered tracks and moving girders, care being taken to see that the mortar on each section of new wall is allowed to set hard before the adjoining girder is removed.

THE ACTUAL MOVE

The actual moving operation is only a matter of hours. The moving of a four-storey building, No. 12 Great Pioneer Street (Figs. 10-11), in 1938 was noteworthy for the record speed of 20 ft. 0 in. an hour attained: previously, it had not exceeded 3 ft. 0 in. an hour. This increase was due to the use of a new type of electric winch mechanism.

Fig. 10. No. 12 Great Pioneer Street being moved. The flexible rubber connection maintains the drainage system during the move.

Fig. 11. Close-up of the same building showing the underpinning steel framework and rollers travelling on double railway lines. Temporary access way, to allow continued occupation, is provided.

The theoretical hauling force required to move a building is contained within the limit of 1-1.5 per cent. of the total weight of a building, but frictional forces caused by dust and debris falling under the rollers, inaccurate placing of rollers, irregularities in the rollers and moving girders, etc., call for a considerable increase above these limits. The tractive effort required to move a building is therefore normally calculated to be 2.5-3.5 per cent. of its weight. In the case of No. 12 Great Pioneer Street, the building weighed 2,430 tons, and was moved by means of a 10-ton winch, with the load reduced by a system of 15 pulleys, and a steel hawser of 26 mm. diameter (approximately 1 in.) (Fig. 12). The main winch was mounted on the flanges of the moving girders on tracks Nos. 7 and 8; pulleys were fastened to the ends nearest the new site of the moving girders on tracks Nos. 3, 4, 6 and 7. Beyond the new site, pulleys were fastened to the ends nearest the new site of the moving girders on tracks Nos. 3, 4, 6 and 7. Beyond the new site pulleys were fastened to the rails of tracks Nos. 2, 3, 4, 6, and 7.

On the top flanges of moving girders Nos. 1 and 2 was fixed a reserve winch, to the drum of which was anchored the other end of the hawser. The winches used were hand ones adapted to revolve by means of electric motors. The building was to be moved 204 feet, requiring a total length of 2,600 feet of hawser. The ordinary cylindrical winch drums which had previously been used only took 975 feet of hawser; this was sufficient for a short move, but for long ones such as this, it would have meant protracted halts for rewinding the hawser, and cutting off lengths of 975 feet when the drum was wound to capacity. To overcome these difficulties, the cylindrical drum was adapted so that it had a spindle of rapidly increasing diameter made up of a series of parabolic metal rods (Fig. 13). With this shape, the hawser turning on the spindle gradually moved to the section of the drum which had the smallest diameter, and in this way, a much greater length of hawser could be wound.

With this improvement, the building was moved 204 feet in 10 hours 14 minutes, at a record speed of 20 feet an hour. With two winches working together at the commencement of the move, a temporary speed of 49 feet an hour was obtained.

This building was moved in December, 1938. In the spring of the following year, the building was raised 8 ft. 4 in. by hydraulic jacks, so that the semi-basement floor became the ground floor. Thirty-eight 200-ton hydraulic jacks were used. In the intervals between the jacks, new courses of brickwork were inserted as the building was raised. When the raising operation was complete, and the mortar had hardened, the jacks were removed and the openings where they had operated were filled with brickwork.

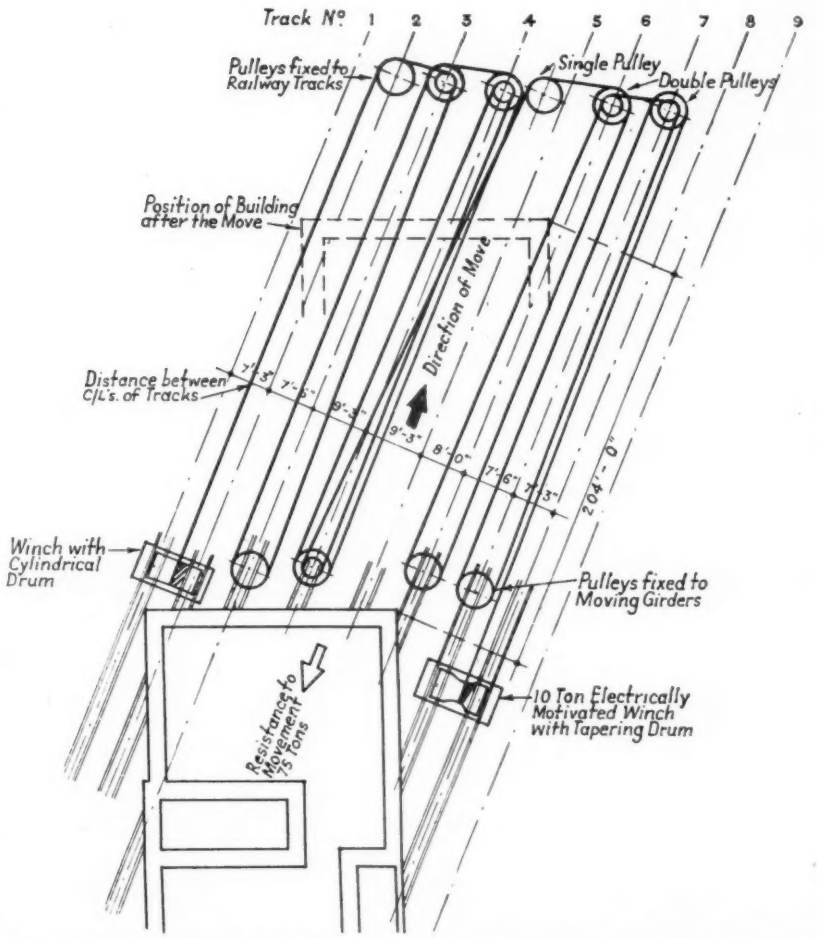


Fig. 12. Layout of the system of winches, pulleys and steel hawsers used for the moving of No. 12 Great Pioneer Street, Moscow.

CIRCULAR MOVEMENT

In many cases, moving a building back in a straight direction, is either impossible or does not satisfy town planning requirements in respect of co-ordinated street design. The Eye Hospital previously in Gorky Street is an example of this. Gorky Street was scheduled for widening to a width of 154 feet, and this three storey building stood 58 feet in front of the new building line. It was erected in the eighteenth century to the designs of a famous architect, Matvei Kazakov, and had its principal façade facing on to Gorky Street with a side façade in Sadovsky Alley (Fig. 14). A straight move leaving the building facing on to a reconstructed Gorky Street was considered unsatisfactory; a three-storey building would have been out of place on such a main thoroughfare, which was for the greater part to be flanked with 7-8 storey buildings. To increase the height by the addition of several more floors would have ruined the work of a famous architect, and necessitated extra constructional work of an uneconomical nature. If the building was to be saved, therefore, it had to be moved well back so as to leave room for a new building site. A moving distance of 260 feet was necessary.

Several other factors complicated the problem. Adjoining the Eye Hospital was the inhabited quarters of the Commissariat of the Timber Industry, part of which extended to the rear of the Hospital. It was first necessary, therefore to move the building towards Sadovsky Alley, so as to clear these buildings. But if then, the building had been moved back in a straight direction, its main façade would have looked on to the back yard of the proposed new building on its old site; also

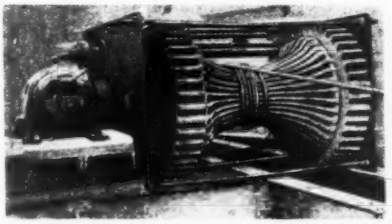


Fig. 13. Electrically driven winch, with parabolic drum, used for winding the long lengths of steel hawser in the moving of 12 Great Pioneer Street.

Fig. 14. Gorky Street before widening and reconstruction. On the left, indicated by a white arrow, is the Eye Hospital, which has been moved round the corner into the side street.

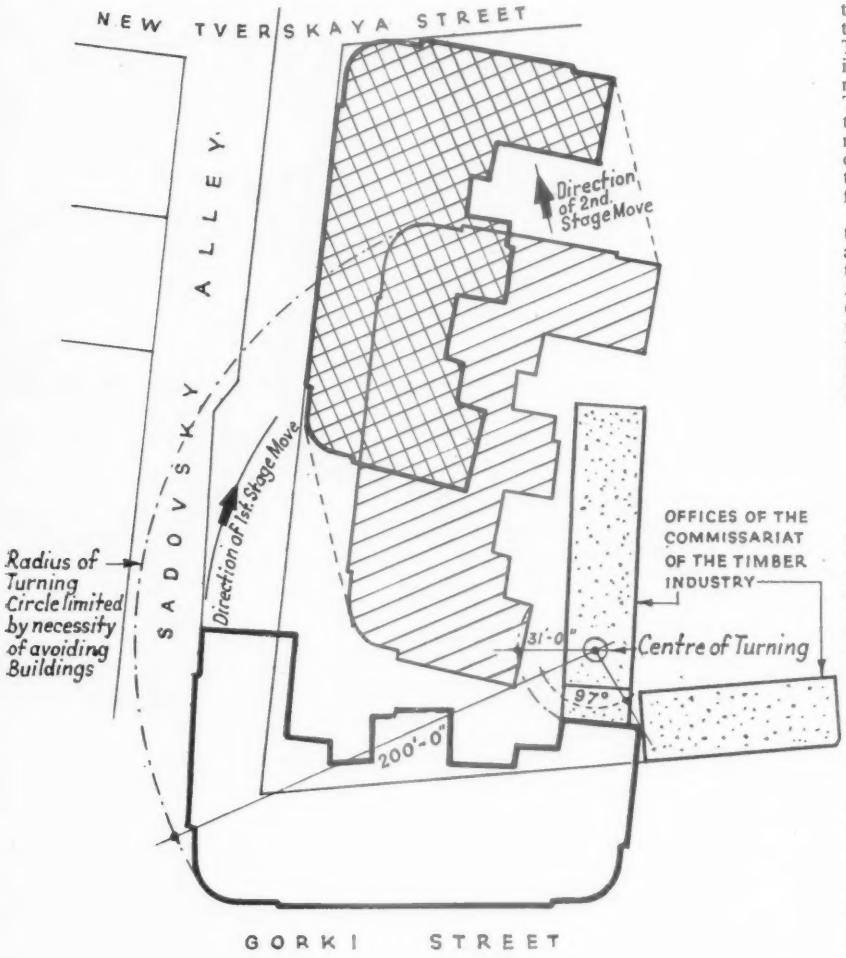


Fig. 15. Diagram showing the method adopted for moving the Eye Hospital. It was first turned through an angle of 97° and then moved obliquely to its new site on the side street.

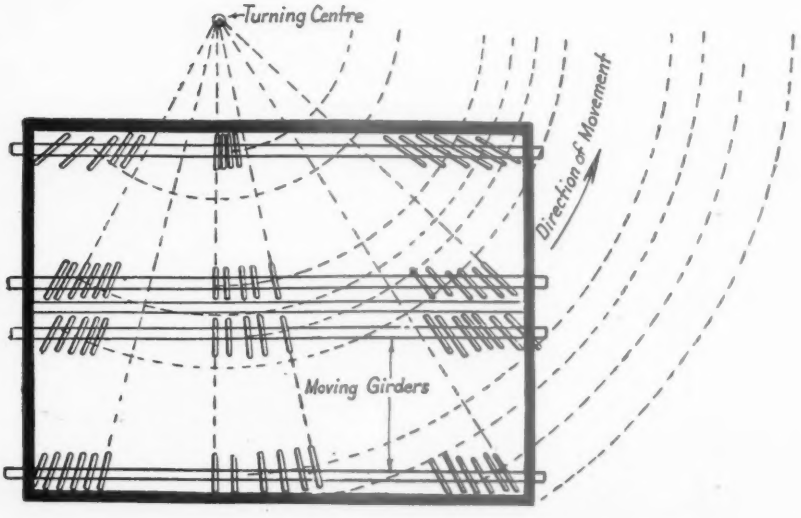


Fig. 16. Diagrammatic layout of rollers for moving a building in a circular direction.

the rear of the hospital would have faced on to the new Tverskaya Street, which was planned to run parallel to Gorky Street (see page 146). To meet all these circumstances and conditions, it was decided to move the building so that its main fa ade would look on to Sadovsky Alley. This meant that the building had first to be turned through an angle of 97 degrees 16 minutes, and then moved in an oblique direction, so that its side façade faced on to the new Tverskaya Street, and its main façade faced on to a widened Sadovsky Alley.

The centre around which the building was turned, had to ensure a clearance firstly of the adjoining Commissariat offices, and secondly of the buildings on the other side of Sadovsky Alley. These requirements fixed the centre of turning at a distance of 31 feet from the nearest point of the building. The area on which the building moved was thus contained by arcs of a radius of 31-200 feet. Never before in the USSR had a building been turned on so small a radius (Fig. 15).

PREPARATORY CONSTRUCTIONAL WORK ON THE HOSPITAL

To effect a turn of this nature, the rollers under the moving girders are arranged radially to the turning centre (Fig. 16). As the building is moved, the rollers move in a circular direction, their speed and distance of movement being dependent on their distance from the turning centre. The rails on which they move are circular on plan, with a radius varying according to their distance from the turning centre. During such a move, it is essential that the rollers do not shift from their radial positions, for a slight deviation causes a large increase in hauling force required. The operation becomes more difficult, as the turning radius decreases, for with a small radius the rollers have to turn round and change their direction more rapidly, and the chances of their deviation are greater. In such cases, it is necessary to move the building by a series of short distances of 6-8 inches at a time, so that between each move, the positions of the rollers can be tested.

In a simple movement of a building in one direction, only one set of moving girders is required, and in all cases prior to the moving of the Eye Hospital, this method was adopted even where the building was turned through an angle. But previously, the turning angles had been relatively small, and the radius of turning relatively large; the differences between the curved line of movement and the straight line of the moving girders was sufficiently small to give a good bearing of the girders on to the rollers. If only one set of straight-moving girders had been used in the case of the Eye Hospital, the small radius of turning would have meant that the rollers would take the weight of the building only for small sections of the move, and very unevenly. To overcome this, a double set of moving girders were inserted—the normal box type for the second stage, arranged so that they would correspond with the direction of the second move after the building had been turned, and underneath these, for the first stage, a series of separate short rails similar to the rails on which the rollers move, but turned sole upwards. These first-stage shoes, as they are called, were curved to conform with the circumference of the turning circle. To save the cost of curved rails, the ones farthest from the turning centre consisted of short straight sections; the flatness of the turning circle arc at this distance made this possible, but those nearer the centre where the building would turn rapidly, had to be curved in order to give a good bearing on to the rollers (Fig. 17).

Rigidity between the various members of the underpinning steelwork was ensured by (*a*) bolts in threaded tubes welded on to the sole of the rails joining the two pairs of rails forming the shoes, (*b*) steel clips securing these shoes to the second stage moving girders, (*c*) diagonal ties and horizontal framing between adjacent moving girders, and

(*d*) strengthening ribs welded to the sides of the moving girders. The type of stiffener used was determined by the structural conditions, and the nature and weight of loading at each point (Fig. 18).

MOVING THE HOSPITAL

The main hospital building measured 826,000 cubic feet, covered an area of 20,200 square yards, and weighed 13,300 tons. Its layout was somewhat complicated, and in some places necessitated cross girders between the moving girders and the R.S.J. framing in order to pick up the weight of the main walls. Before moving, there were two small sections of basement. The main walls were of brick varying in thickness from 4 ft. at ground level to 2 ft. 6 in. at roof level.

The first stage of the move—the turning process—was carried out on 19 curved railway tracks ; the second stage on 14 straight tracks arranged at an angle of 19 degrees 35 minutes to the façade. These tracks were laid on sleepers spaced at 1 ft. 6 in. centres bedded on rubble foundations varying from 1 ft. 4 in. to 3 ft. 3 in. in depth according to the slope of the ground. In view of the complicated nature of the move, the hauling forces were calculated at above the normal for the first stage of the move, at 5 per cent. of the weight of the building, i.e., 650 tons, and for the second at 4 per cent., i.e. 532 tons. The moving operation was carried out by means of electric horizontal screw-jacks, known as house-movers ; the use of the winch, hawser and pulley system for the circular movement of the first stage would have necessitated frequent shiftings of tackle in order to change the directions of the hauling force.

With a circular move, that part of the building furthest from the centre of turning must travel a greater distance in the same time than the part of the building nearest the turning centre. This is achieved by varying the thread of the screws of the horizontal jacks, so that those nearest the turning centre have a much greater number of threads per driving inch than those set furthest away. In between, the number of threads is proportional to the two extremes. The electric motors are separate, and have equal driving power. For the turning process of the Eye Hospital, thirty-three 20-ton house-movers were used ; for the second stage, 27 similarly powered ones were used, giving hauling forces of 660 and 540 tons respectively. In each case, they were arranged in groups of three.

After the building had reached its intermediate position, the changeover of the series of straight tracks and the removal of the first stage shoes, took approximately 10 days ; the process of building new foundations, and of unloading the building followed normal procedure. In its final position, the building allowed a widening of Sadovsky Alley as well as Gorky Street. Throughout the move, the hospital continued to function without interruption. Patients were admitted and operations carried out. Access during the preparatory work was provided through the main Gorky Street entrance, and during the move, through a specially constructed entrance in the side wing approached from the building of the Commissariat of the Timber Industry. A wooden bridge gave access to Gorky Street when the building was swung round, while kitchen supplies and goods were delivered from Sadovsky Alley. All the services, including water, sewage, electricity, radio and telephone continued to function by means of flexible rubber pipe connections, and overhead wires.

The building now stands in its new position as solidly as if it had been built there in the first place. In future, visitors to Moscow who look for familiar buildings without success are advised to look also in adjoining streets.

FACTORS AFFECTING COST

In comparing the cost of moving with demolition and construction of a new building, the cost of preliminary repairs must be taken into account ; if the condition of the building is very bad, the high costs of such repairs may make the moving process uneconomical. A building to be moved need not, however, be in a perfect state of repair ; many defects, even cracks caused by settling can be remedied by inserting new brickwork, etc., and the move has been found to have negligible harmful effect structurally. For instance, in 1937, No. 77 Sadovinchesky Street was moved 144 feet in a curved direction ; this 5-6 storey building had several hundred cracks varying from ¾-1½ in. wide chiefly owing to the weak mortar of the brickwork. For a length of 293 feet the building had no cross walls, the floor bearers being supported in the centre on independent brick columns. But no new deformations were caused by the moving.

There are several other factors which determine the economically ideal type of building and moving procedure. Firstly, the height of a building has a direct effect on the cost of moving ; generally, the greater the number of storeys, the cheaper the cost as compared with new construction. It has been found that the moving of buildings of three or more storeys is nearly always economically worth while. Buildings of one or two storeys are usually only worth moving if they are of either architectural or historic value, or are of recent or well prepared construction, and if the distance to be moved is short. The practicability of adding additional storeys after moving must also be taken into consideration. As a general rule, the smaller the area and the greater the height of a building, the more worth while is its move. The ground plan also affects the cost of moving ; the simpler it is, the cheaper is the cost of the underpinning construction. A rectangular ground plan gives the most economical results.

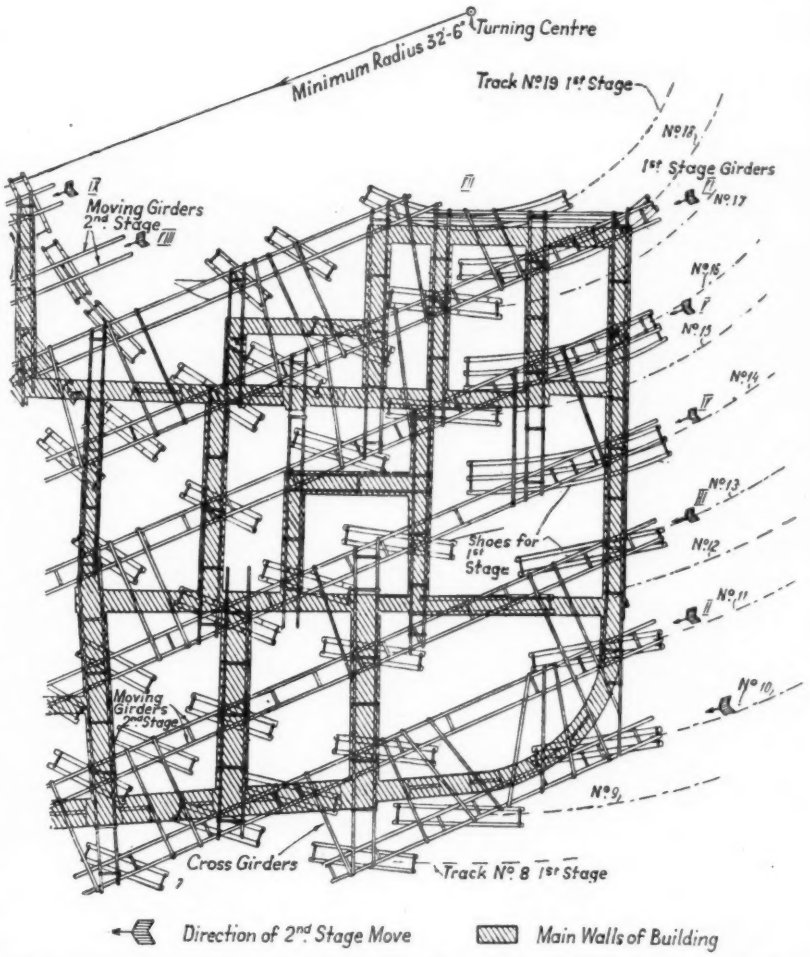


Fig. 17. Plan of part of the Eye Hospital, with layout of the underpinning construction for the circular and oblique moves.

The nature of the ground over which the building is to be moved, is the second most important factor. If it is of poor bearing quality, the top soil must be removed down to a good bearing strata, and an artificial foundation laid for the railway tracks. The level of the horizontal line at which a building is cut is determined (*a*) by the nature of the ground, and (*b*) the necessity for retaining at least 1 ft. 7½ in. of wall underneath the openings made for the insertion of moving girders, etc., measured to the top of the foundations. If the soil has a good bearing capacity, the level is fixed as high as possible, in order to avoid excavation. Wherever possible, the level of excavation should not be deeper than the top of the foundations, otherwise bulging of the soil from underneath the foundations may take place. Where the nature of the sub-soil demands excavation to a level below the foundations, only the section immediately underneath the tracks must be excavated, and care must be taken not to disturb the soil within the area contained by the angles of the natural slope of the ground on either side of the foundations.

From experience, it has been found that a weak, moist strata stands up to a load of approximately 2.8 tons per square foot without soil bulging, while a moist gravel stands up to a considerably greater load.

In deciding whether the basement of a building should be moved as well as the storeys above, the cost of excavations must be

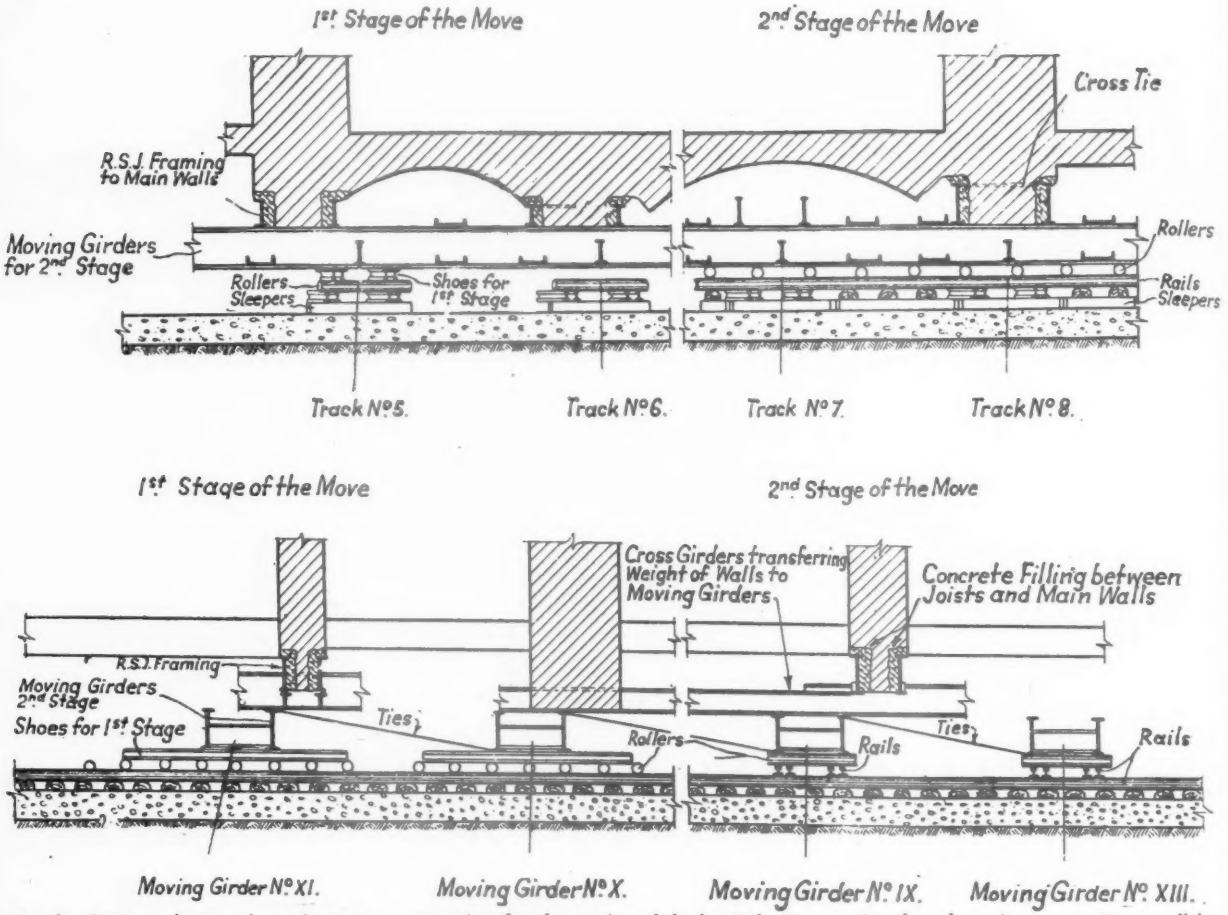


Fig. 18. Sections showing the underpinning construction for the moving of the hospital. Top, section through moving construction parallel to moving girders. Above, section through moving construction at right-angles to moving girders.

weighed against the cost of a new basement. The amount of excavation necessary for moving a basement varies according to the distance of moving, and beyond a certain distance it becomes more economical to leave the old basement behind, and construct another on the new site. If the moving distance is more than 1½ times the dimension of the building, parallel to the direction of the move, the level of the cut of the building should be determined to give the minimum combined expenses of excavation and building work on the new site. In the cases of poor bearing soil, however, excavation is normally necessary irrespective of the question of preserving the old basement and a horizontal cut 1 ft. 7½ in. above foundation level is usually taken, the ground beneath being made up with crushed stone and brick rubble.

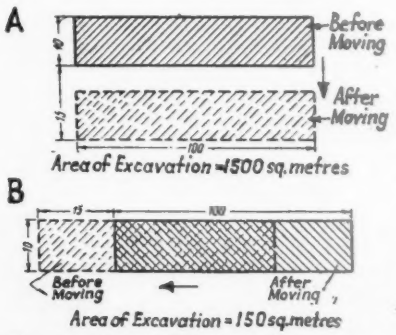


Fig. 19. Diagram illustrating the most economical direction of moving a building to save excavation costs.

Moving can be undertaken on soft ground if the distributed weight does not exceed the maximum safe load. This maximum is considerably higher than that allowed in the construction of new buildings, for a well consolidated soil, may, in the short period during which the building passes over it, bear a larger weight without settling to an extent dangerous to the building. The main reason for this is that the organic content of the soil does not have time to rot in the short time of moving. In the moving of No. 77 Sadovinchesky Street for instance, a load of 1 ton per square foot was taken on a made-up ground, which had been laid 30 years previously. The ground settled only ⅜-½ in. under the weight of the building. In cases like this, it is most important to secure a good distribution of weight over the whole area under the building by an adequate number of sleepers, rollers, and railway tracks.

The third factor to be considered in reducing the costs of moving to a minimum, is the extent of the area over which the building is moved. Obviously, the smaller this is, the lower is the cost of excavation, making up of ground, railway tracks, etc. The area can be reduced to a maximum by (1) keeping the moving distance as short as possible, and (2) moving the building with its longest side parallel to the direction of the move. The greater the difference between the length and breadth of the building, the more important the latter condition becomes (Fig. 19). In this case if the building is moved long side foremost, the area of excavation is ten times as great as that required if it is moved short side foremost for the same distance. The areas are proportionate to the length and breadth of the building.

These conditions are, of course, the ideal ones and the particular circumstances of the building to be moved have to be considered in relation to them.

Apart from economic considerations, moving a building narrow side foremost gives a more proportional distribution of the load on to the ground as the longitudinal main walls are resting on the railway tracks for their full length, while only the shorter transverse ones lie across the rails. Moreover, when the longitudinal walls are resting on the railway tracks, it is possible to arrange these tracks and moving girders with a distance between them diminishing towards the centre and corresponding to the compression on the steel frame introduced into the walls of the building above the cutting line.

This arrangement produces tension in the frame, transmitting a compressive force to the brickwork at the top of the building. This gives the best distribution of forces, as the frame works well in tension, and the brickwork well in compression, and produces the best conditions for counteracting the danger of deformation caused through any settling of the ground.

Lastly, the direction of the move both in the horizontal and the vertical planes affects the cost. In the horizontal plane, a simple straight move in one direction is the cheapest, and should be carried out whenever circumstances allow it. In the vertical plane, it is more economical to move a building horizontally than on an inclined plane, despite the greater tractive effort required. Against the saving in tractive effort must be set the extra work involved in laying the tracks, girders and R.S.J. framework in the inclined plane, and testing them carefully with levels every two or three yards, which more than cancels out the saving. It is generally cheaper to

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TABLE II.—DETAILS OF EXPENDITURE FOR THE REMOVAL OF No. 24 GORKY STREET

Item of Work	Cost of Principal Materials	Wages	Other Expenses	Overhead Expenses	Cost in roubles per cubic meter	Total Cost in Roubles	Total Cost in £.s.d.
1. Planning and preparation of drawings ..	614	—	78,124	27,163	2·27	105,901	3,416
2. Preparatory work—cleaning of basements, felling trees, temporary wooden party walls to Nos. 22 and 26, Gorky Street ..	15,831	14,147	243	10,481	·87	40,702	1,313
3. Temporary Constructions—entrance for inhabitants, paths, smithy's hut and stores	5,952	5,563	568	11,666	·51	23,649	766
4. Excavation underneath tracks	53,711	894	202,030	48,030	6·53	304,665	9,828
5. Construction of tracks, unloading of rubble for foundations, laying of sleepers and rails rollers and travelling girders ..	84,968	96,828	145,596	214,414	11·61	541,806	17,478
6. Construction of R.S.J. framing to main walls and transferring building to moving girders	63,890	207,975	74,565	182,514	11·38	528,944	17,064
7. Construction of rubble foundation and cement mortar bed	19,130	13,510	2,525	22,542	1·23	57,707	1,862
8. Moving of building including cost of working "house-movers"	32,472	3,174	36,850	31,524	2·23	104,020	3,356
9. Transferring building to and construction of new foundations	26,844	44,736	12,454	61,486	3·11	145,520	4,695
10. Removal of girders and tracks	19,750	1,183	22,727	27,658	1·52	71,318	2,301
11. Temporary heating arrangements and re-instatement on new site	8,400	15,641	1,362	13,896	·84	39,299	1,268
12. Ditto for water supply and drainage ..	10,470	13,647	1,760	16,671	·91	42,548	1,373
13. Ditto for electricity supply	3,970	7,428	37	7,213		18,648	602
14. Ditto for telephone	70	—	—	37	·41	107	4
15. Ditto for radio	79	—	—	463		542	18
16. Removal of buildings obstructing the path of the move	29,188	4,514	9,605	15,365	1·25	58,672	1,893
17. Special works necessitated by winter weather	19,175	19,504	—	26,733	1·40	65,412	2,100
18. Construction of basement on new site ..	13,912	1,511	4,731	15,542	.76	35,696	1,152
19. New yard and external works	4,683	6,358	74	10,300	·45	21,415	691
20. Tunnel connecting heating system of No. 24 with boiler-house of No. 26 ..	233	—	—	143	·01	376	12
TOTAL ..	413,342	456,613	593,251	743,841	47·29 (10d. c.ft.)	2,206,947	£71,192

raise or lower the building by means of jacks on the old or new site according to the direction of the slope.

THE IDEAL CONDITIONS

The most favourable conditions for moving a building at a low cost, can be summarized as follows :—

(1) The building should be in a good state of repair.
(2) It should be over three storeys in height.
(3) It should cover a small area and have a simple ground plan, preferably rectangular.
(4) The ground over which the move is to take place should have a good load-bearing capacity.
(5) The building should be moved with its shortest side foremost.
(6) The directions of the move should be parallel to the longest side.
(7) It should be moved in a straight line, and as short a distance as possible.
(8) It should be moved in a horizontal plane.

Very few buildings and sites have been found to conform to all these ideal conditions. Each building has its own peculiarities of siting and construction ; the aim must be to conform to as many of these conditions as possible. The cost of moving may therefore vary considerably between one building and another, according to the extent to which these conditions prove impracticable.

A useful standard of comparison is the cost per cubic foot of building. From experience of moving a considerable number of buildings, the Russians have found that they can move a well-preserved building of not less than four storeys, in a straight line, on a soil strata which does not require much excavation, and for a distance not greater than the smaller dimension of the building, for a cost equivalent to approximately 40 per cent. of the cost of a new building of similar size. Included in this cost is the building of new foundations and basement, and the disconnection and re-connection of services. Additional costs will be incurred if the nature of the building, the site and the move is less favourable.

An example of the detailed costs of moving a building is given in Table II. The building No. 24 Gorky Street has four storeys and a semi-basement ; its volume is 1,724,000 cubic feet ; it weighs 23,000 tons, and it covers an area approximately 195 ft. 0 in. by 130 ft. 0 in. (Fig. 20-21). It was moved long side foremost for a distance of 162 feet ; as has already been shown, a move of this nature is much more costly in excavation than it is if the short side is moved foremost. All the preparatory works were carried out in the winter of 1937-8, and required extra expenditure on that account. The cost, therefore, is slightly above the average.

IMPROVING THE TECHNIQUE

Before the Nazi invasion, Soviet engineers were carrying out considerable research into ways and means of reducing the cost of the moving process. The following notes indicate the lines on which they were working :—

1. *Improvement of Materials*

Experience has proved that building materials will take loads up to definite limits. Usually, an ample safety factor is allowed in design in view of the possible life of a hundred years or more a building. But the materials used in the moving of a building, chiefly steel, have only to take loads over a period of two or three months, often less. A much lower safety factor should therefore be allowed ;

Fig. 20. No. 24 Gorky Street being moved back to allow road widening. The building is shown on the way to its new site.

this would result in less material being used and a lower cost of moving. A scientific investigation of the maximum permissible loads on materials over short periods, and of possible improvement in materials is needed.

2. *Improvement of Haulage Equipment*

The system of hawsers and pulleys works well, but the greater the weight of the building, the greater the number of pulleys and hawsers required, and the less efficiently the system works on account of the increase in frictional forces. The loss in efficiency may reach a point at which this method can no longer justify itself. The use of electric horizontal jacks — house-movers — then becomes more economical, but this method has the disadvantage of frequent halts every 1 ft. 4 in.— 1 ft. 8 in., which for long moving distances draws out the moving time, and increases the cost excessively. In moves with a circular direction, the pulley and hawser method is generally ruled out as frequent changes of direction involving dismantling and refixing of tackle are necessary, except where the radius of turning is large.

Further investigation is needed into the relative efficiencies of different kinds of pulleys and hawsers, and the maximum weight of building for which the pulley and hawser system remains an economic proposition. New methods of moving buildings with the smallest possible number of halts must be invented.

3. *Economy in Cement*

The rubble foundation underneath the tracks is usually laid on a cement base ; the sleepers are laid on a bed of cement mortar. After the move, this foundation is of no further value except on the site of the new building where it may form part of the new foundations. There is room for considerable saving in the use of cement ; concrete should take its place for the rubble base, and a stone bed which can be re-used should be laid under the sleepers.

4. *Improvements in the Steel Underpinning Construction*

All the joints between the various members of the underpinning construction are at present welded, and cut again in the dismantling process. Usually, about two months are spent on the welding work, and 20 to 30 days on the subsequent cutting. This time could be substantially reduced by the use of standardized lengths of joints and girders prepared in the workshops and provided with junction plates or clevices at the ends.

The large travelling girders suffer considerable deformation during a move. The material is sound, but the design of the members is open to considerable improvement. An investigation into the most efficient shape and size of these girders for vertical stability is needed.

5. *Rollers*

A maximum load of 9 tons is allowed on each roller ; this exceeds the theoretical safe load by 40-50 per cent. An increased load could be taken if the rollers were of reinforced concrete, or if the irregularities on the surface of the rails were eliminated.

The rollers weigh 3 cwts. each, and to move 1,000 of them (the approximate number required for moving a heavy building), considerable labour and transport is required. The present transport costs consequently are high. Rollers in the form of thick hollow tubes, requiring a reduction in load of only 15-20 per cent. in comparison with a reduction in weight of 60 per cent. over those used at present, offer the possibility of a 50 per cent. reduction in transport costs.

Fig. 21. The move completed with the railway lines, on which the building has travelled, cleared away. The original position of the building is indicated by the hoarding in the left foreground.

6. *Stakhanovite Methods*

The workers of the *Trust for Moving and Pulling Down Buildings* were actively collaborating with the engineers in their efforts to improve the technique and reduce the costs and time of moving. As on all large building works, there is a Job Committee composed of representatives of building workers, technicians and officials of the Trust which encourages men to beat the time schedule laid down, and to suggest ways and means by which the process can be improved, or time, labour or materials saved. High speed work has been encouraged for ten or more years now, by means of a system of payment similar to the bonus system introduced in the building industry in this country just over a year ago. Either working in gangs or as individuals, according to the nature of the job, the men receive an increasingly higher rate of pay the greater their achievement above the agreed schedule. Shock brigades are formed, and there is keen rivalry between them. Ideas which occur to the men as they work on the job are given serious consideration and test, and those that prove their worth are put into operation. Problems which have confounded the architect or engineer have often been solved in this way.

TYPES OF BUILDINGS MOVED: AMERICAN METHODS AND EXPERIENCE

Nearly all the buildings which the Russians have rolled back to new sites have been either timber framed or of solid stone or brick construction ; some of the latter have in part been of steel frame construction, but I can find no record of wholly steel or reinforced concrete framed buildings being moved. This is probably due to the small scale on which frame construction has been used, firstly, because the severe winters demand a high degree of insulation, and the 2-3 ft. thick brick wall takes a lot of beating on cost and effectiveness ; and secondly, because munitions and weapons of war had been given first place on the steel priority list long before the Nazi invasion.

In dealing with buildings of solid construction the Russians have had to solve the most difficult of the problems involved in the moving process. Framed buildings, with their more even distribution of weight and greater stability, are less liable to deformation and as the panel walls are carried on the frame a considerable reduction in the underpinning construction required to spread the load on the rollers, is possible. In the United States the majority of buildings moved in the last ten years have been of frame construction, so that the combined experience of both countries gives us sufficient data to be able to deal with any type of building. In applying the moving process to street widening in this country there will on the whole be more steel-framed buildings to contend with than in Moscow. The main difference between practice in the United States and the Soviet Union is in its organization. In Moscow for instance a Trust, responsible to the Moscow City Soviet, undertakes all the work involved ; this enables the experience gained on different jobs to be pooled and used to improve the technique

and continuity of research is possible. In the United States, on the other hand, the moving jobs are carried out by individual firms and there is no such co-ordination between them.

Soviet War News of September 1, 1941, bravely reported: "despite the war, Moscow is continuing with its reconstruction plan. . . . In Gorky Street, the removal of a large building 53 yards from its present site is in full swing, and will soon be finished. The building is 923,000 cubic feet in size and weighs 16,300 tons. When it has been moved to its new site in September, the whole of Gorky Street between Mayakovsky Square and the centre of the city will have been widened"—a defiant gesture from the builders of a new civilization. But the grim situation demanded more realistic gestures. The moving building gave way to the leap frog industry but sufficient advance had been made before the work was interrupted by invasion to establish the process as an indispensable part of Soviet reconstruction, and we can be sure that many more buildings will be moved to celebrate victory over the Nazis.

THE MOVING PROCESS AND ITS APPLICATION TO PROBLEMS OF RECONSTRUCTION HERE

We cannot afford to ignore this aid to reconstruction. The existence of valuable buildings along our main roads has for many years deterred and prevented us from undertaking road widenings so as to relieve traffic congestion. In desperation, our planners have been forced to accept the avoidance of these buildings as the main factor in deciding the lines of new traffic routes. Instead of widening existing roads—often the most logical solution—new highways are constructed or planned through so-called back land (actually this is generally where people live) on the grounds that it is cheaper to buy up property in the side streets. The high costs of compensation and the purchase of larger and more costly buildings for demolition where the land values are greatest have frightened and forced our planners and valuers into this back land. The result so far has been a gradual confusion of the roads into a double system of old and new, the traffic using both and for lack of preventive measures, the new slowly, and in some cases rapidly, deteriorating to the standard of the old, through ribbon development and the allowance of shops and business houses alongside. Moreover, what were once quiet residential areas are now cut up by main roads. Many of the routes in Sir Charles Bressey's road plan for London followed this back-land principle, and town-planners are still guided by it to a great extent.

The widening of existing roads has been painfully slow. How long now have we waited for the completion of the Strand widening to a meagre 80 feet? A Borough Engineer has calculated that at the past rate of progress the widening of a main street in his Borough will take at least 2,000 years.

The moving process should at least help us to make better progress than this, and to avoid carving up residential communities quite unnecessarily. It would enable us to use the cheaper back-land immediately to the rear of buildings facing on to a road requiring widening, and to roll back the building on to it. It will not, of course, solve the more fundamental problem of land and property ownership, which in the centres of towns and cities will be overriding, for the cost of buildings there is often negligible in comparison with the value of the land. Technical processes, however numerous or inventive, cannot dispose of this problem. The Soviet people have decided that their land and the main bulk of the property on it shall be under public ownership. I have yet to hear of a better solution.

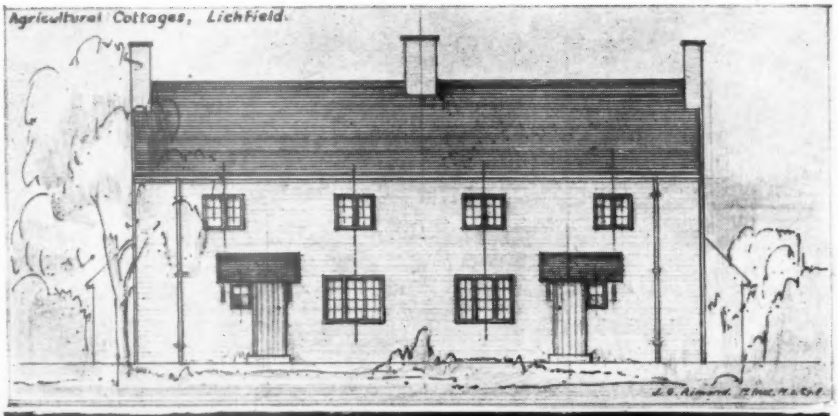
After the war, the extent and pace of our reconstruction will depend a great deal on the available labour, materials and accommodation. For a considerable time there is likely to be a shortage of all three; under such conditions, it would be unrealistic to demolish buildings in a sound state of repair, and use up materials and labour for new buildings only to replace the lost accommodation. The moving process would enable us to maintain all existing sound accommodation, and at the same time carry out street widenings with the minimum unproductive use of labour and materials.

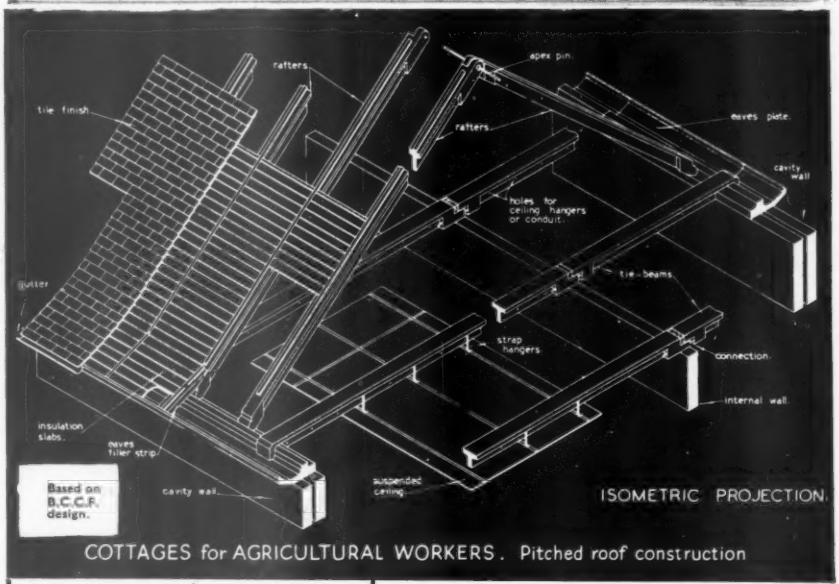
However enthusiastic we may be about reconstruction, we shall never be able to raze our towns to the ground and rebuild overnight. A slow process of change from quantity to quality is inevitable, and the more clearly we realize this the greater will be our progress. A balance has to be struck between economic, social and technical factors, and the first two of these will be, as they always have been in the past, the determining ones.

This does not mean that we should be half-hearted about reconstruction. We must do things on the biggest scale and with the most up-to-date methods possible. We must sweep aside the obstructive vested interests, and be ready to make the necessary changes in our economic and social system, for it is useless to imagine that we can return to pre-war conditions and also have sound planning and bold reconstruction.

The war has revealed the enormous latent power of organized labour and technique. If in war we can produce thousands of ships, guns and aeroplanes, improve their designs at breakneck speed, organize and launch huge overseas invasions calling for minute control and planning, why not reconstruction with the same speed and energy? The frustration of pre-war years has made us sceptical of our power. We need to recapture the adventurous spirit of the Victorian railway builders—but this time, we must build not for a Limited Company, but for that great unlimited company—the people of this country. If we can do this, then such a process as the moving of buildings will no longer be looked upon as an impractical novelty; it will become a valuable part of our reconstruction programme.

The author wishes to acknowledge the assistance given by the Society for Cultural Relations with the USSR and the use of material from articles by the Russian engineers, I. T. Ivanov and E. Guendel in Moscow Construction. *Most of the diagrams are reproduced by courtesy of* Architectura USSR *and* Moscow Construction, *and have been specially redrawn by Eveline Felce.*





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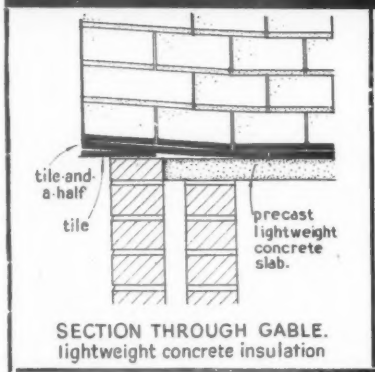

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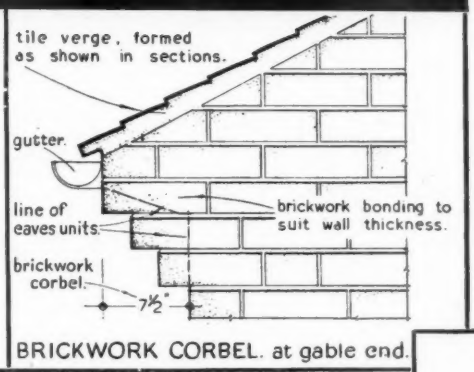
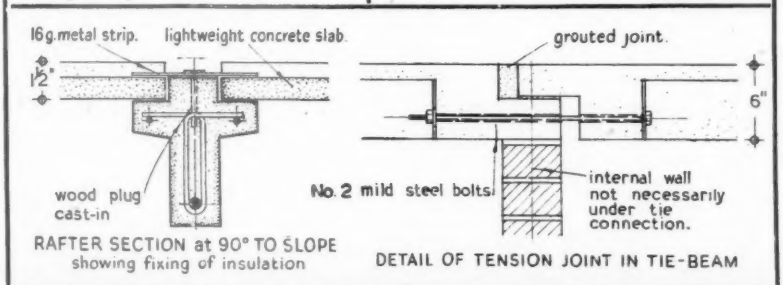
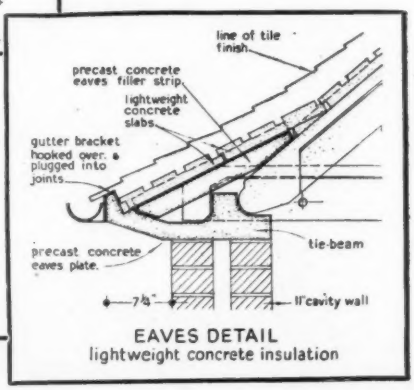


BRICKWORK CORBEL. at gable end.



RAFTER SECTION at 90° TO SLOPE
showing fixing of insulation

DETAIL OF TENSION JOINT IN TIE-BEAM



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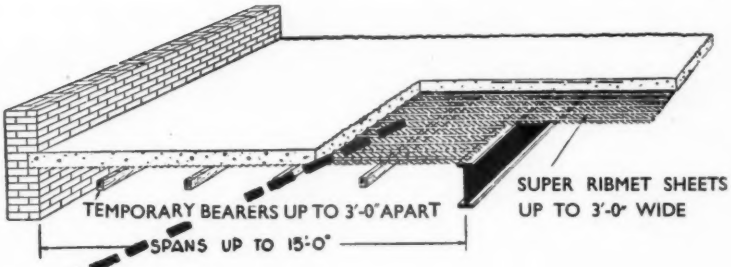

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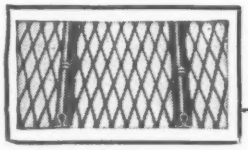

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(*b*) PLANNING ASSISTANT, at a commencing salary of £275 per annum, rising, subject to satisfactory service, by annual increments of £12 10s. to a maximum salary of £300 per annum, plus war bonus of £41 12s. per annum.

(*c*) DRAUGHTSMAN, at a commencing salary of £250 per annum, rising subject to satisfactory service, by annual increments of £12 10s. to a maximum salary of £275 per annum, plus War bonus of £41 12s. per annum.

Applicants for appointment (*a*) should be Associate Members of the Town Planning Institute, by examination, or persons holding the Town Planning Diploma or Certificate of one of the constituent bodies of the Town Planning Joint Examination Board, and must have had experience in a planning office and possess a good knowledge of architecture. Previous experience in the preparation of development schemes for coastal areas will be deemed to be an advantage.

Applicants for appointment (*b*) should have had experience in a regional planning office, and in the preparation of regional surveys and planning proposals.

Applicants for appointment (*c*) must be good colourists and draughtsmen, and be competent to prepare perspective drawings.

Applicants for each of the foregoing appointments must be exempt from Military Service.

The above Officers are required in connection with the preliminary survey work and the preparation of planning schemes for the Joint Committee's area and will work under the direction of the Town and Country Planning Officer.

The appointments will be subject to the terms and conditions of service applying to the administrative, technical and clerical officers of the County Council, and will be terminable by one month's notice on either side. The successful applicants will be required to pass a medical examination.

Applications stating age, qualifications and full details of experience, accompanied by copies of three recent testimonials must be sent to me, the undersigned, and must be endorsed "Planning Assistant (*a*)," "(*b*)" or "Draughtsman," as the case may be, by not later than Monday, the 28th day of February, 1944.

WILLIAM ROBERTS,
Deputy Clerk to the Joint Committee.

County Offices,
Ruthin.
February 7th, 1944. 552

CUMBERLAND COUNTY COUNCIL.

COUNTY SURVEYOR'S DEPARTMENT.

APPOINTMENT OF PLANNING ASSISTANT.

Applications are invited for the position of Planning Assistant, at a salary of £450 per annum, plus war bonus, payment (at present £50 per annum) for extended hours, and a car and subsistence allowance, all in accordance with the County Council's scale.

The appointment is subject to the Local Government Superannuation Act, 1937, and the successful candidate will be required to undergo a medical examination.

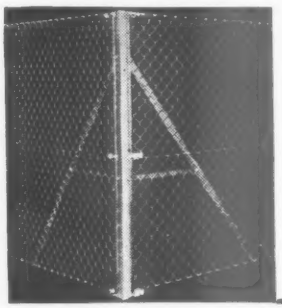
The appointment to be terminable by one month's notice on either side.

Candidates must be fully conversant with the Town and Country Planning Acts and Orders made thereunder, and be thoroughly competent to carry out field work, plotting and the preparation of plans.

Applications, stating qualifications, experience and age, accompanied by copies of three recent testimonials, and endorsed "Planning Assistant," should be received by Mrs. G. O. Lockwood, M.INST.C.E., County Surveyor, Citadel Chambers, Carlisle, not later than Monday, 20th March, 1944.

G. ANDREW WHEATLEY,
Clerk of the County Council.
9th February, 1944. 557

Classified Advertisements continued on page xliv.



**THE POLYTECHNIC,
REGENT STREET, LONDON, W.1.**

SCHOOL OF ARCHITECTURE.

Applications are invited for the post of full-time SENIOR LECTURER in CONSTRUCTIONAL SUBJECTS.

Candidates must be Fellows or Associates of the Royal Institute of British Architects. Previous teaching experience essential. The Degree or Diploma of a fully recognised School of Architecture will be a recommendation for the post.

Salary in accordance with the Burnham Technical Scale for London (plus war-time bonus), subject to the usual 5 per cent. deduction for superannuation. Commencing salary according to previous teaching and professional experience. There will be a special responsibility allowance of at least £24 per annum.

Forms of Application, which must be returned not later than 1st April, 1944, and further particulars of the post, can be obtained by sending a stamped, addressed foolscap envelope to the Director of Education, The Polytechnic, 309, Regent Street, W.1. 547

Architectural Appointments Vacant

Draughtsmen seeking positions in Architects' offices will be printed in "The Architects' Journal" free of charge until further notice. Other "Appointments Vacant" and "Wanted" will be found under later headings, and are subject to the charges given under each heading.

Wherever possible prospective employers are urged o give in their advertisement full information about the duty and responsibilities involved, the location of the office, and the salary offered. The inclusion of the Advertiser's name in lieu of a box number is welcomed.

ARCHITECTURAL ASSISTANTS required. State age, experience and salary required, with copies of references, etc., to Ernest A. Newton, Chartered Architect 28, Kennedy Street, Manchester 2. [Architect and Consultant] 251

EXPERIENCED CAPABLE ARCHITECTURAL ASSISTANT required. Apply, with particulars, qualifications, salary, etc., to Hadfield & Cawkwell, 279, Glossop Road, Sheffield 10. [Architects and Consultants.] 261

SENIOR ASSISTANT required in Architect's Office near Birmingham. Must be competent with good qualifications. State age, experience with references. [Architects and Consultants.] Box 262.

Architectural Appointments Wanted

ARCH. DRAUGHTSMAN (30), Inter. R.I.B.A., requires position. Plans, details, surveys, etc., all types of buildings. Box 250.

ARCHITECT - ENGINEER, qualified, American citizen, desires new appointment, varied experience. Box 257.

ARCHITECTURAL ASSISTANT, qualified, exempt, seeks position; wide experience of all kinds of work, including setel and R.C. framed buildings. Knowledge of quantities and surveying. Salary by arrangement. Box 258.

ARCHITECT experienced in carrying through works complete, requires position with prospects. Box 259.

ASSISTANT, 6½ years' practical experience in industrial and domestic architecture, studying for Final RIBA, seeks position in London or Provinces. Exempt from military service. Box 260

Other Appointments Vacant

Four lines or under, 4s.; each additional line, 1s.

ASSISTANT EDITOR wanted for Architectural Paper. Write, with full particulars of qualifications, salary required, &c., to Box 51.

PRIVATE TUTOR wanted to coach student for second part R.I.B.A. Special Final Exam. during evening hours. London N.W.8 district. Box 548.

CEMENT WATERPROOFING MANUFACTURERS of high repute wish contact gentleman with ability to write articles of a technical nature concerning waterproofing problems, on basis of data supplied. Please write Box 554.

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Miscellaneous

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FOR SALE.—THREE DOUBLE DOORS, 8 ft. by 4 ft. from Adam mansion, original condition, and furniture, solid mahogany with figured panels. Tweedie, 32, Cranmore Street, Dunfermline, Fife. 550

BUCKLAND TILES. Concrete Roofing Tiles and Fittings—also Air Bricks, Paving Slabs and other concrete products for sale. Large or small quantities—keen prices ex works or delivered. Apply Buckland Tile Co. (Reigate) Ltd., Reigate Heath, Surrey. Phone Reigate 2202. 556

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Telephone: Euston 3305 and 3906.

R.I.B.A. AND T.P. INST. EXAMS. Private Courses of tuition by correspondence arranged by Mr. L. Stuart Stanley, M.A., F.R.I.B.A., M.T.P.I. Tutor, St. Catherine's College, Cambridge. 231