



In the beginning, God said
"Let there be light."

MODERN HOUSING

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A REVIEW OF PRESENT HOUSING REQUIREMENTS IN GT. BRITAIN,
A RESUMÉ OF POST-WAR HOUSING AT HOME AND ABROAD,
AND SOME PRACTICAL SUGGESTIONS FOR FUTURE HOUSING.

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WITH A PREFACE BY

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LONDON:

JOHN TIRANTI & CO., ARCHITECTURAL PUBLISHERS
13, MAPLE STREET, TOTTENHAM COURT ROAD.



728.1
(41)
M22

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First Impression . . . May, 1931.
Second Impression . . June, 1931.
Third Impression . . . October, 1931.

PRINTED BY CARSON & NICOL, LTD., 12-14 BATH STREET, GLASGOW.
1931.

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MAR 5 1943 Transf. FROM FWA LIB.

APR 1 1936

PREFACE

BY

Sir WILLIAM E. WHYTE.

I AM one of those who think that the subject of the "Housing of the People" is not yet by any means exhausted or solved. I do not mean by that, simply that many thousands of houses are still required throughout the country in order to provide decent accommodation for the people. I rather mean that there are still a great many questions that should and must engage interest in this all important subject connected with, for example, methods of construction and design; layout; location; transport arrangements and the like, as well as, of course, the great questions of finance and economics. In the great rush that has taken place to provide working-class houses in practically every community since the completion of the War, many matters of unquestionable interest and importance have been overlooked and neglected. The needs were so great and so urgent that other considerations than those of "running up" the houses at the greatest possible speed on any likely site and by the application of most of the recognised methods of building, were almost of necessity shut out. But no one will deny that there is room for new thought and new ideas—our very experience of the past twelve or fifteen years has taught us many lessons, and those who contribute those new ideas are to be commended for the great public service which they are rendering.

Mr. M'Donald's book, therefore, is both opportune and welcome. It is evident that Mr. M'Donald has made a close study of the subject and that he has profited greatly not only by his visits to Continental Countries, but by his communings with some of the best known and most successful Architects in those countries. He has shown that those Continental Countries have secured the maximum facilities for health in the designs they have adopted for working-class houses, while at the same time attaining definite economy in construction. He has shown that by proper designing we can get more sunshine into our dwellings, and in his advocacy for making more use of the tops of our houses he certainly makes out a good case for the Flat Roof; his arguments also in favour of "cavity walls" are clearly based on sound scientific reasoning. While we must, of course, have regard to the differing conditions of Continental Countries and to the fact that every country has its own specialties, we may yet learn much from such a masterly enquiry as the Author has undertaken in connection with the methods employed in those other countries.

There is not, so far as I know, any other publication that has attempted such an informative survey of the housing conditions in the more important countries of Europe. The Book is admirably written. The Author has not expressed himself at any time in such technical language or style as to make the production uninteresting for even the layman. There is a wealth of the most valuable information throughout its pages, and it is a very special feature of the work that there is included in it an exceptionally fine collection of photographs of dwellings in various countries. And what I liked particularly about the narrative—for it is really a narrative, its various chapters being drawn in excellent sequence—is the broad human touch which Mr. M'Donald so often introduces. His concern for the health and well-being of the people, especially the children, and the emphasis he lays upon the great social gains that must inevitably result from the provision of good healthy homes for the people are commendable in the extreme. I feel sure that his Book will reach a wide circle of interested people not only in this country but in many other countries as well, and that it will serve to many—Architects, Builders, Local Government representatives and others—as a most useful work of reference.

May, 1931.

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WILLIAM EDWARD WHYTE.

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GENESIS : AN INTRODUCTION.

PROBABLY one of the first things Adam did in the Garden of Eden was to build himself some form of shelter, and thus he initiated man's oldest calling—The Building Industry. As Pierre Jeanneret of France puts it—"Dwelling is a biological phenomenon." By this he means that the provision of shelter is always premised as a biological necessity for the human species, and when Adam became the first Building Trades' Operative he doubtless instituted the traditions of the builder's craft, which his descendants practised for thousands of years almost more as a habit than as a science.

As in other crafts which are handed down from generation to generation, methods of building have been regulated too much by tradition and usage, and too little by reason and logic. Instead of thinking out its own solutions to its own requirements, combining the experiences of the past with the possibilities of the present, each succeeding generation has been too inclined to accept the dictum of its predecessors. True, after a period of some four thousand years, architecture had attained in Athens a state of beauty and magnificence in the use of the materials that lay to its hand. But in the succeeding centuries builders and architects did little more than copy and ornament the classic architecture, neglecting the newer materials and the altered conditions of their day. They were borrowers, servants of other men's minds, imitative professionals.

Not until the nineteenth century was almost closed did the profession and the trade awaken to the possibility of more logical methods, less blatant plagiarism; traditionalism was succeeded to some extent by an eclecticism,—which can only be regarded as a half-way stage on the way to design and construction on a basis of reason and sense. Already this latter aim is almost attained in the design of large buildings which are being built primarily to fulfil the functions for which they are required; this does not mean that they must needs be awkward ugly constructions, with no æsthetic value, but on the contrary lends a purity of line and honesty of conception that is refreshing after the over-ornamented falsity of those who had forgotten that 'Truth is beauty.'



OLYMPIA BY DAY.



OLYMPIA BY NIGHT.

Architects Journal

Mr. Emberton, in his design for the New Olympia in London, exemplified this development by providing a building first and foremost suitable for an exhibition hall; yet he attained an æsthetic

value by the adoption of pleasing proportions and by incorporating the very functionings of his building in his design—as when he included the outlines of the large ventilating ducts in the deliberate lines of his planning.

But while this rationalism or functionalism has developed considerably in the design of large buildings, yet in this country the provision of dwelling houses—which was undoubtedly the original, and is still the most important aspect of the building industry—has remained to some extent bound by tradition and convention, or as the Secretary of the International Congress of Modern Architects more bluntly described it—"prejudice."

And it is that aspect of building with which this book proposes to deal—the provision of dwelling houses for the people, designed primarily for the maximum facilities for that health which is the Golden Fleece sought after by labourers, millionaires, and kings. Let us adopt only the best materials of the past and combine them with all the most recent improvements and devices that can economically be included, and let us not be side-tracked from our logical purpose because our results vary somewhat from the results in 'the bad old days.' Healthy housing is the fundamental necessity for the physical and mental welfare of our people, while bad and unhealthy housing conditions are not only the worst of all social evils in themselves, but also the direct cause of many others.

The philosophers tell us that that the Home is the University of the Soul; and if we want something more definite and more contemporary than the philosophers' opinion, let us review the Report of an architect in Vienna's Municipal Building Department only last year:—"The provision of 64,000 dwellings of healthy and sanitary design to re-house some quarter of a million of the city's population has had a tremendous effect on the social well-being of the city; physical health is improved, as witness the 33 per cent. decrease in the returns for deaths from infectious diseases; mental soundness is increased, as testified by the 25 per cent. reduction in the figures for cases of idiocy. As well as those expected improvements in public health, the effect of better housing is reflected in the falling off in the reported cases of crime of violence to almost 70 per cent. of the former number, while the revolutionary unrest of the lower classes is giving way to happier conditions of peace and industry."

Vienna has only done what we can do in this country, and it is from considerations of results such as these that Major Clark writes in his 1930 Book, *The Housing of The Working Classes of Scotland* that "continued housing reform is vital The State will save a considerable sum of money annually from that presently being spent on the ever increasing number of institutions necessary to cope with those infirmities, those diseases of body and mind which result largely from over-crowded conditions, and as an additional asset will have a healthier and more settled race."

Housing is the Keystone of Civilisation. Houses that provide the maximum facilities for the development and maintenance of the sound physical and mental condition of our people are the solution not only of the housing problem, but of the public health problem, the problem of the care of mental defectives, the problem of traffic congestion of the streets by those unfortunates who find the streets less dismal than their present homes, the problems of crime and unrest, indeed all the social problems that beset us to-day.

In a subject of such proven importance, therefore, there is surely sufficient interest to warrant the reader continuing over the succeeding pages, of which we now give a brief synopsis. We do this to clarify in his mind the trend of argument that is running through the whole book and to show the correlation of points which, because some of them are new and others only insufficiently appreciated, might seem not too obviously related or connected with each other.

SYNOPSIS.

WE shall start off by considering the magnitude of the post-war housing requirements, and the extent to which the housing needs of this country still exist. We compare Scotland with England from a consideration of the figures available at the time of writing—before the results of the 1931 Census are available. We are forced to the conclusion that there is still required in Scotland a number of new houses well over the 100,000 requirement noted in the 1929 Report of the Scottish Board of Health, who are apparently accepting the unsatisfactory over-crowding standard of "Not over 3 per room"; the real economic as well as humanitarian requirements are more nearly represented by the figure of 265,000 houses shown as necessary in Major Clark's recently published volume to which we have already referred.

We show over-crowding to be not only the worst of all social evils in itself, but the direct cause of many others. We demonstrate also that the continuance of the Housing Programme as promised by the Government in 1924, would reduce the two million unemployment figure by 25 per cent., which might very easily be enough in itself to start us on the way back to prosperity.

Being convinced then, that the continuance of the housing programme is not only desirable but necessary, and in the long run profitable, we turn from the statistics and reasons that should convince the legislators, to the scientific and practical considerations that should have the attention of architects and housing engineers.

We note a few points from the experience of the last ten or twelve years at home, but since they are well known and accepted, we spend only a short time on them before investigating conditions abroad, to enquire if we can find any desirable features that have developed there, but have been missed here in our own country.

We find that every country in Europe, and even America has its post-war housing problem, and we take an illustrated tour round the civic housing developments in the United States, France, Belgium, Holland, Germany and Vienna, with a brief glance at the other countries in Europe; and then we make some comparisons with developments at home.

We note the use of draught-proof and vermin-proof solid floors with seamless coverings, rather than the joist and boarding construction used in this country; the growing adoption of steel windows with larger panes to admit the maximum of light; and the brightening of housing colonies by the use of coloured rough-cast. But there are two most important constructional principles adopted; in every foreign country we find the most thoughtful design to have incorporated two salient features in the popular housing schemes—flat roofs and cavity walls, the former being almost neglected in this country, and the latter not universally adopted. We investigate these tendencies and find not only are both of them advantageous for reasons of health, usefulness and economy, but they are indeed correlated the one to the other.

By research and experiment there have been evolved perfectly satisfactory materials and methods of constructing buildings with flat roofs and cavity walls, and we show how these buildings have indeed nearly a score of separate and distinct advantages which have led to their adoption on the Continent. These advantages include a number from the health point of view, as many more from the economic aspect, and still more from the structural and architectural view-point.

We summarise these advantages and find that as well as these, the adoption of flat roofs affords to the housing architect the means of escape from the inevitable monotony imposed upon him by the old-fashioned pitched roofs. We see how this adoption has only been retarded by prejudice and timidity; and we conclude by urging the adoption of flat-roofed cavity wall construction for schools and hospitals as well as for housing.

I.—A REVIEW OF POST-WAR HOUSING REQUIREMENTS AND CONDITIONS TO-DAY.

IN 1917 the Royal Commission on Housing in Scotland reported, "To our amazement we found that even if we took over-crowding to mean more than three persons per room, some 121,000 houses are required, and if an improved standard (reducing number of one-room and two-room houses) is adopted, as we recommend, the total number of new houses required would approach 236,000."



HOMELESS FAMILIES EVICTED WITH ALL THEIR BELONGINGS.

Even this latter standard proposed by the Royal Commission was not as good a standard as has been adopted, and now practically attained, for England—namely: that over-crowding should not extend to more than two people per room—a standard evidently considered too good for Scotland, where at the last Census over two million people were living in worse conditions.

But even accepting for the moment the figure of 236,000 required houses, as dictated by the Royal Commission in 1917, and adding the 10,000 houses normally required each year to cope with wastage of old houses and those additional houses required for the normal increase of the population, we see that, to-day, in 1931, the position is as follows:—

Required in 1917, - - - - -	236,000
Add number required during 1917-1931, - - - - -	140,000
	<hr/>
	376,000
Less estimated number completed to date, - - - - -	123,000
	<hr/>
Giving total still required, - - - - -	253,000

a figure definitely approaching the figure of 265,000 so eloquently and reasonably pleaded for by Major Clark—the authority we have quoted so often in this connection because his book is the most up-to-date and authoritative compilation of Scottish Housing Statistics. It is this book of which Sir William E. Whyte, the Lanarkshire housing and town-planning authority, writes—"There is not only sound reason, but good sense, in such a statement of the position."

Either the figure of 253,000 houses at which we ourselves have arrived, or Major Clark's figure of 265,000 houses serves to show that there is still a tremendous need for continued, and even increased, output of houses.

Truly one half of the world does not know how the other half lives. For instance, how many of our readers realise that nearly a million people in Scotland are still living in conditions of over-crowding to the extent of more than 3 persons per room (rooms including kitchens, living rooms and bedrooms)? Or how many realise that half the population of the whole country is living more than two per room?



AN IMPRESSION OF THE SLUMS.

With acknowledgments.

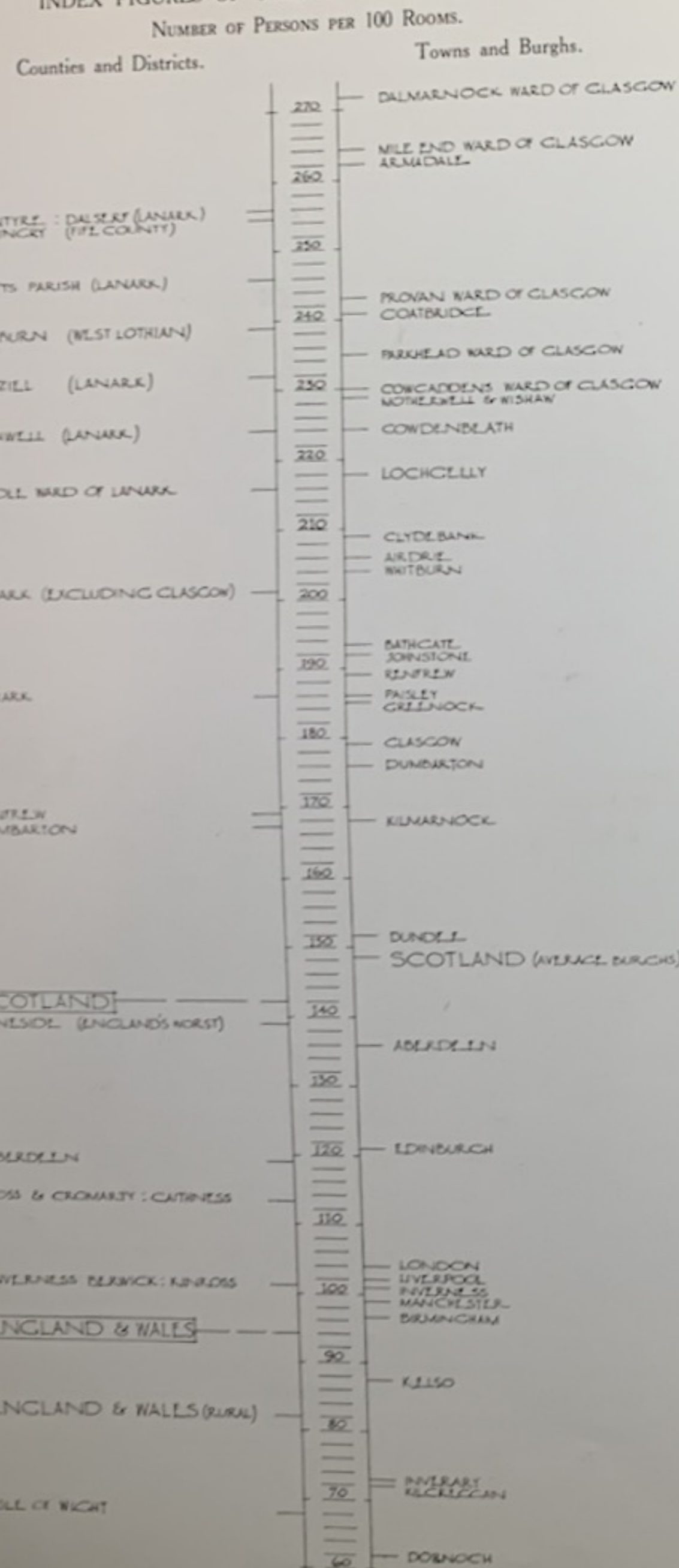
Or to look at the disgrace of over-crowding in another way, how many realise that more than half of Scotland's population is living in one-roomed or two-roomed houses? Over half a million children under ten are being reared in two-roomed houses, and probably some quarter of a million in single-roomed houses. This in the country which professes to revere the words of Him who said "Suffer little children to come unto Me."

There are other gauges by which we may measure over-crowding, as well as the two we have outlined so far, namely: 'Persons per room' and 'number of houses of one-room, two-rooms, etc.' We might elect to base our estimates of the extent of over-crowding on considerations such as have been adopted in Manchester, *i.e.*, by considering the number of persons per bedroom. Or again we might consider any house overcrowded which did not provide for the proper separation of the sexes; *i.e.*, as Mr. E. D. Simon expresses it—"houses which enable the parents to have one room, and the boys and girls over 10 years of age to be separated." But whichever gauge we adopt, we find that over-crowding measured on any humane, reasonable standard does still exist in Scotland to a degree that will "amaze" and "alarm" us, even as it did the Royal Commission which reported in 1917.



OLD HOUSES CLOSE TOGETHER ON EACH SIDE OF A NARROW ALLEY; NARROW STREETS, HIGH ROOFS, PROJECTING EAVES AND SMALL WINDOWS—COMPLETE DISREGARD OF THE DESIRABILITY OF ADMITTING SUNLIGHT AND AIR.

INDEX FIGURES OF OVER-CROWDING CONDITIONS.



With acknowledgments to 'The Housing of the Working Classes of Scotland' by G. W. Clark.

II.—A COMPARISON BETWEEN OVER-CROWDING IN ENGLAND AND SCOTLAND.

LET us turn for a few moments to the comparison between conditions in Scotland and England :— England, where the successfully adopted standard is to ensure conditions of over-crowding not worse than are represented by 'not more than two persons per room' in any household ; and Scotland, where nearly half the population is still living under such conditions.

This comparison is perhaps most graphically effected by comparing first the figures for what is known as the 'occupation density' of the various districts ; *i.e.*, the number of persons per 100 rooms, including kitchens, living rooms and bedrooms in that district. This is an *average* figure assuming all the people in each particular area evenly distributed between all the rooms in that area ; and so, though an occupational density of 200 would mean that there are 200 persons for every 100 rooms in the area, it does not mean that there are no more than two people in any one room ; for there are in every large district some better-class houses of 5 or 6 rooms with only 3 or 4 inhabitants, which serve to counter-balance cases at the other end of the social ladder, where there are one or two-roomed houses with 8 or 9 inhabitants. This occupation density figure, however, serves as a fair basis of comparison as between different large areas, especially when the comparison is amplified, as we propose to amplify it, by afterwards considering the relative proportions of the population existing under varying intensities of over-crowding.

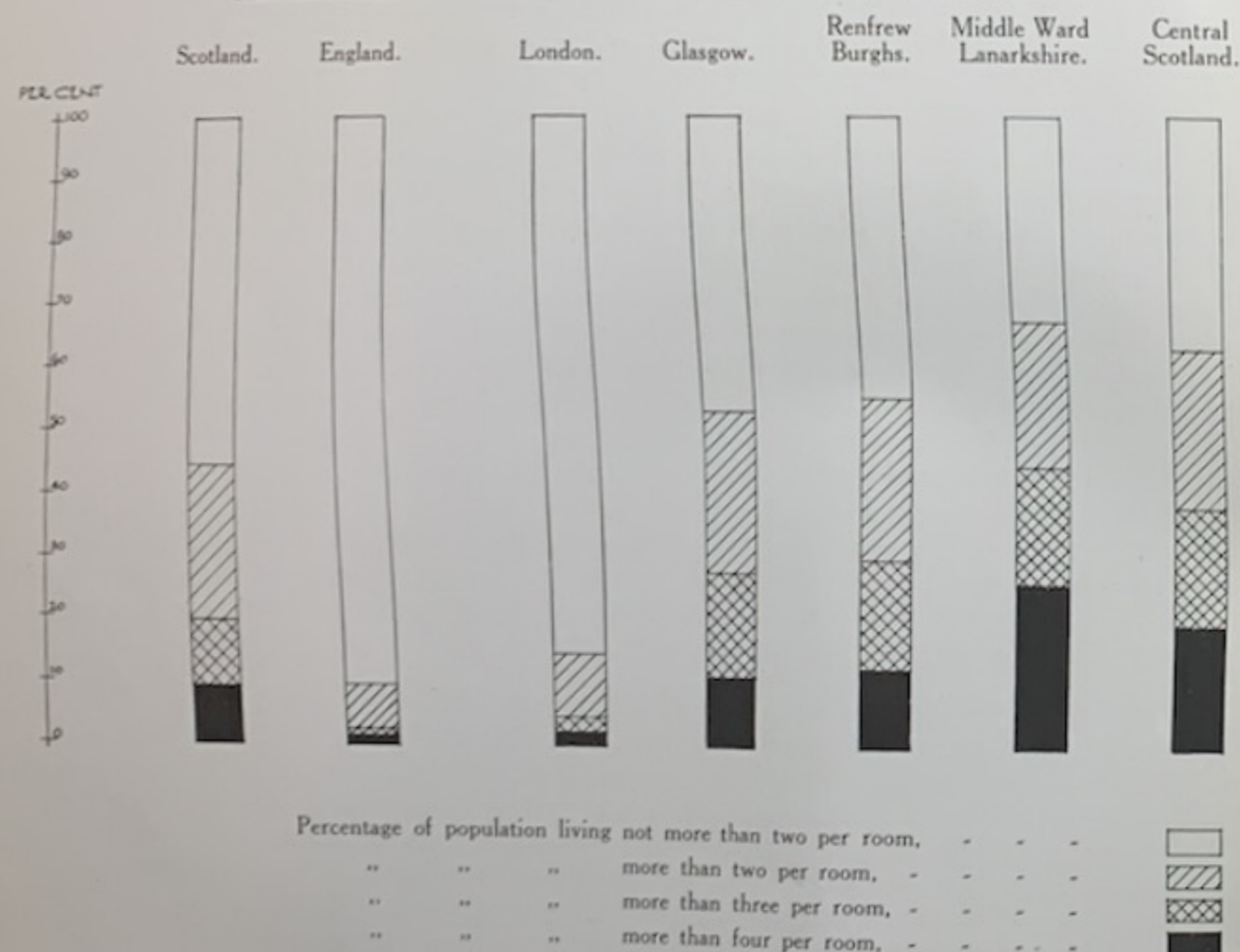
The table opposite this page shows the index figure of the number of persons per 100 rooms not only for the average of all England and the average of all Scotland, but also for a number of towns and burghs in each country. From it we see that, whereas the average figure for England is at the reasonable level of 94, the average for Scotland is at the abnormally high level of 142—more than 50 per cent. higher than the English figure—and it should be remembered that the once whispered excuse that some Scottish rooms were bigger than those in England, has been discountenanced once and for all by Major Clark, whose quotations and statistics go to show that indeed English rooms are more frequently provided with unreported accessories, such as sculleries, larders and private closets, which, although not returned in the Census figures, definitely relieve congestion on the main rooms of the house.

To return to our table, we see that the average over-crowding in Scotland is worse than the worst conditions in England, which exist on Tyneside, the figures being 142 and 139 respectively. All the highest places in this race for the greatest misery of over-crowding conditions, are taken by Scottish burghs and the municipal wards of Glasgow with their appalling figures of as high as 272—three times as bad as the average for all England with the slums of London, Manchester and Birmingham all included in the English figure.

From this rather depressing review of statistics that show our once proud country of Scotland so appallingly inferior to industrial England in the matter of occupation density indices, let us turn to consider the proportions of the population living under various degrees of undesirable over-crowding.

The diagram on this page shows the comparison between Scotland as a whole and England as a whole from this view-point: also the conditions in London are shown as compared with Glasgow, as compared with four burghs in Renfrewshire, as compared with the Middle Ward of Lanarkshire, and lastly, as compared with five burghs of Central Scotland.

PERCENTAGES OF OVER-CROWDING. COMPARATIVE FIGURES.



In each case the total height of the column represents the total population in the area, while that part shown as single-line shaded represents the proportion over-crowded to the extent of more than 2 but less than 3 persons per room, the double cross-lined part shows the proportion in conditions of more than 3 per room, and the solid black parts—and black blots they are indeed—show the proportion huddled together more than 4 persons to each room.

The diagrams need but little explanation. They only corroborate the desperate conditions in Scotland that were indicated by the index figures. Her position is shown as no less than nine times as bad as England with regard to the "black" proportion—those living more than four persons per room. Again, even with the city taken as a whole, Glasgow's black proportion is five times that of London; Renfrewshire burghs is between six and seven times as bad as London, Central Scotland Burghs is no less than eight times as bad, while the Middle Ward's black proportion is twelve times that of the city that contains Limehouse and Whitechapel.

And yet let us read what is reported even of conditions in England.

The British Medical Association says, "The sunless, airless, overcrowded areas of our towns and cities are the very breeding grounds of our worst diseases."

Lt.-Col. Fremantle shows how the death-rate rises from 12 per 1,000 per annum in fairly good housing to 21 per 1,000 per annum in bad housing areas—an increase of 75 per cent. more deaths per year.

Lord Passfield, who was Mr. Sidney Webb, has conclusively proved that the death rate from tuberculosis varies almost exactly with the amount of over-crowding in our big cities, the figure being three times as high in slum areas as under reasonably fair conditions.

If these results of bad housing conditions are reported from England, they are manifestly only on a smaller and less desperate scale than the evil results of bad housing in Scotland, where we have shown conditions to be so much worse.

III.—BAD HOUSING—THE CAUSE OF MANY OTHER SOCIAL EVILS— UNPROFITABLE AS WELL AS UNDESIRABLE.

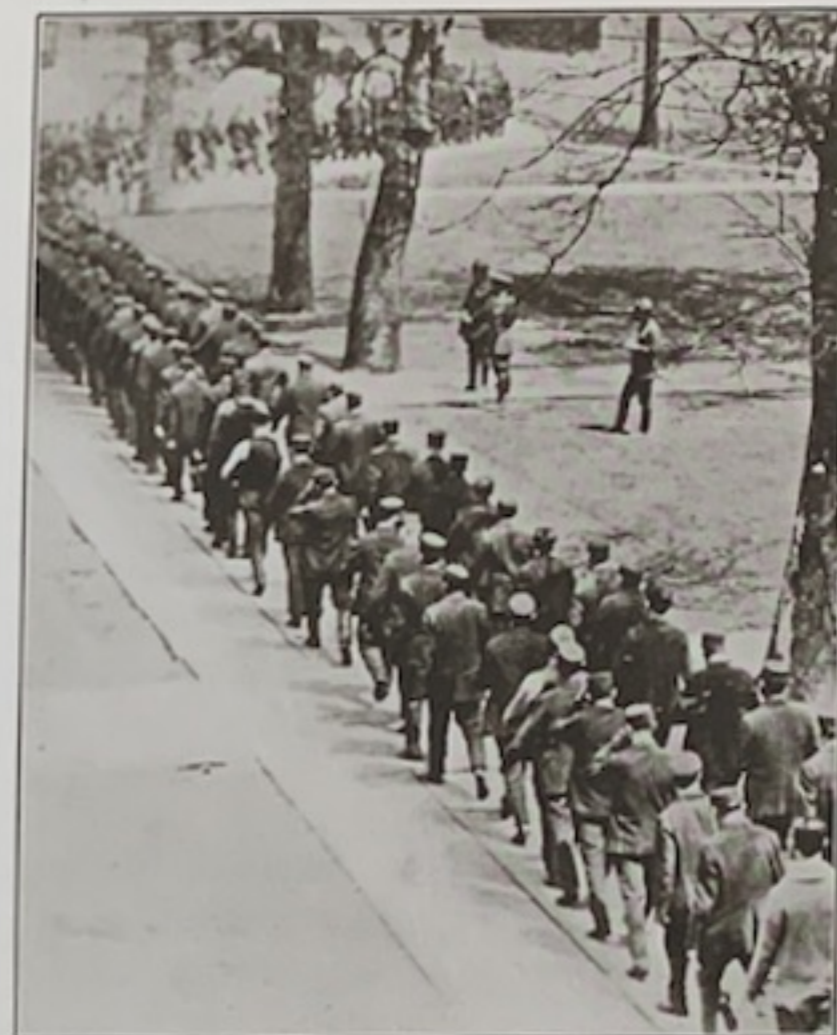
Nobody will question the fact that bad housing is in itself the worst of all social evils, but perhaps we do not all fully realise that as well as this, it is also the direct cause of many others. Housing is indeed the Keystone of Civilisation. We have shown that decreased health and increased death rates are directly due to bad housing conditions; not only is this the case, but general debility, social deterioration, moral and sexual depravity, revolutionary unrest, crime and lunacy are all to a large extent merely by-products of bad housing conditions.



A PHOTOGRAPH OF A RELATIVELY QUIET DEMONSTRATION SIGNIFICANT OF THE 'DEEP-SEATED UNREST' REFERRED TO IN THE TEXT.

A Royal Commission reports "The general deterioration in the health of the people is a worse feature of over-crowding even than the encouragement by it of infectious diseases." The Board of Health Report for 1929 describes bad housing conditions as "the causes not only of ill health but of social deterioration and deep-seated unrest." The same authority which, like all government bodies, is by no means given to the use of extravagant terms but is restrained even in its emphasis, reports with regard to two-roomed houses—"much of the crime that springs from early and unnatural sex depravity, will not be eradicated until the conditions are altered."

Page 4 of 'The Housing of the Nation' tells us how bad housing breeds "Socialism and discontent which, deaf to all other reason, preaches the duty, if need be by violence, to demand some measure of equalisation and redress, if only in the interest of the rising generation. What humanity, what patriotism is proof against the natural urgent appeal of such an argument?"



THE TERRIBLE YEARS OF IMPRISONMENT ARE FREQUENTLY THE RESULT OF CONDITIONS AT HOME.



A PHOTOGRAPH TAKEN IN LONDON RECENTLY, ILLUSTRATIVE OF THE QUOTED WARNING FROM LT.-COL. FREMANTLE'S BOOK 'THE HOUSING OF THE NATION.'

These many evil results of bad housing are not only the reports of the authorities we have quoted, but they are evils which are actually proved to be due to bad housing conditions by the fact that they are greatly lessened by the bettering of conditions. As an example of this we have the testimony of the Municipal Building Department in Vienna—"The provision of 64,000 dwellings of healthy and sanitary design to re-house some quarter of a million of the city's population has had a tremendous effect on the social well-being of the city: physical health is improved, as witness the 33 per cent. decrease in the returns for deaths from infectious diseases; mental soundness is increased, as testified by the 25 per cent. reduction in the figures for cases of idiocy. As well as those expected improvements in public health, the effect of better housing is reflected in the falling off in the reported cases of crimes of violence to almost 70 per cent. of the former number, while the revolutionary unrest of the lower classes is giving way to happier conditions of peace and industry."

Vienna has only done what we can and must do in this country, for the only permanent cure of the various social evils due to bad housing is by the removal of the root cause and the provision of new, healthy houses to replace those giving rise to the old bad conditions. These are the considerations that lead Major Clark to write in his book 'The Housing of the Working Classes of Scotland'—"Continued Housing Reform is vital The State will save a considerable sum of money annually from that presently being spent on the ever increasing number of institutions necessary to cope with those infirmities, those diseases of body and mind, which result largely from overcrowded conditions, and as an additional asset will have a healthier and more settled race."

Dr. Tomson in his book on the relation of the Housing Problem to the prevalence of Tuberculosis points out the futility of spending four million pounds yearly on the temporary, though expensive cure of tuberculous patients, only to send them back to the slum conditions where the disease was born, and where it will rapidly be resuscitated "probably with a still greater intensity." Mr. Tom Johnston, then Under Secretary of State for Scotland, now Lord Privy Seal, shows in an article on Scottish Slums how "each new housing scheme on a complete balance sheet yielded an annual money profit to the community. One slum in the Cowcaddens area of Glasgow cost the ratepayers for Tuberculosis, infectious diseases and the economic loss of excessive mortality among adult lives, more than £1 per head per annum over and above the average costs for the city."

We have, therefore, the testimony of a member of the Cabinet to the actual economy and profit, over and above arguments of humanity and social reason, that accrue from the re-housing which is so vital to the community. And he shows that the futility, of which Dr. Tomson complains with regard to the four million pounds per annum being spent on temporary cure of Tuberculosis rather than permanent prevention, applies generally to the twelve million pounds being spent annually on infectious diseases, and other health services, and also to the further twelve million pounds expended on lunacy and mental deficiency.

IV.—HOUSING CONDITIONS AND NEEDS IN GLASGOW.

CONSIDER, for instance, the position of Glasgow, which proudly claims the title "The Second City of the Empire." To what extent does all this uneconomic, as well as undesirable lack of good healthy housing exist in Glasgow? The last Census showed two-thirds of its inhabitants living in dwellings of one and two rooms, 132,000 of them in the 40,000 single rooms of the city.

Dr. Childe, ex-President of the British Medical Association, said "Is it a sound, economic position to equip and maintain at the cost of millions of the tax-payers' money, sanatoria for the so-called tuberculous, while we guard intact the very preserve of this disease—in over-crowding." Does the same reasoning not apply to the several million pounds proposed to be spent on a Home for Mental Defectives, to be erected by the City of Glasgow at Lennoxton?

Has Glasgow forgotten the diatribe of Dr. Russell, her ex-Medical Officer of Health:—

"Let us ask ourselves what life in one room can be, taken at its best. Return to those men, women and children whose house is one apartment, and consider whether, since the world began, man or angel ever had such a task set before them as this—the creation of the elements of a home, or the conduct of family life within four bare walls.

You mistresses of houses with bedrooms and parlours, dining-room and drawing-rooms, kitchens and washing-houses, pantries and sculleries, how could you put one room to the uses of all? You mothers with your cooks and housemaids, your nurses and general servants, how would you in your own persons act all those parts in one room? Where, too, you must eat and sleep and find your lying-in room and make your sick-bed? You fathers, with your billiard-rooms, your libraries and parlours, your dinner parties, your evening hours undisturbed by washing-days, your children brought to you when they can amuse you, and far removed when they become troublesome, how long would you continue to be that pattern husband which you are—in one room?

You children, with your nurseries and nurses, your toys and your picture-books, your space to play in without being trodden upon, your children's parties and your daily airings, your prattle which does not disturb your sick mamma, your special table spread with a special meal, your seclusion from contact with the dead and still worse familiarity with the living, where would you find your innocence, and how would you preserve the dew and freshness of your infancy—in one room? You grown-up sons, with all the resources of your fathers for in-door amusements, with your cricket fields and football clubs and skating pond, with your own bed-room, with space which makes self-restraint easy and decency natural, how could you wash and dress, and sleep and eat, and spend your leisure hours—in a house of one room? You grown-up daughters, with your bed-rooms and your bath-rooms, your piano and your drawing-room, your little brothers and sisters to toy with when you have a mind to, and send out of the way when you cannot be troubled, your every want supplied without sharing in menial household work, your society regulated, and no rude rabble of lodgers to sully the purity of your surroundings, how could you live and preserve 'the white flower of a blameless life'—in one room?

You sick ones, in your hushed seclusion, how could you deport yourselves in the racket and thoughtless noise of your nursery, in the heat and smells of your kitchen, in the steam and disturbance of your washing house, for you would find all these combined—in a house of one room."



"beneath the vehicle which conveys your scanty company to the distant and cheerless cemetery, where the acrid and deadly air of the city in which you lived will still blow over you and prevent even a blade of grass from growing on your grave."

Since then, certainly, some improvements have taken place, but similar conditions, if not quite to the same numerical extent, still do exist in houses frequently far worse than the two we illustrate.



TWO PICTURES OF PROPERTIES WHICH ARE NOT BY FAR THE MOST DILAPIDATED OF THE HOUSES STILL INHABITED IN GLASGOW.

He continues this vivid picture of life in a single room:—

"Last of all when you die, you shall have a room to yourself, where in decency you may be washed and dressed, and laid out for burial. If that one room were your house what a ghastly intrusion you would be. The bed on which you lie is wanted for the accommodation of the living. The table at which your children ought to sit, must bear your coffin, and they must keep your unwelcome company. Day and night you lie there until with difficulty those who carry you out thread their tortuous way along the dark lobby and down the narrow stair, through a crowd of women and children. You are driven along the busy and unsympathetic streets, lumbering

In his Report issued in 1927, the Medical Officer of Health tells us that there are still in Glasgow 13,000 houses that should definitely be closed; while the following year we learn there are over 3,000 houses with more than 5 people per room, 1,600 one-roomed houses with 7 to 9 persons in each, and even 62 single-roomed houses with 10 to 12 people huddled within the one room.



WITH HOMES LIKE THOSE IN THE BACKGROUND, IT IS LITTLE WONDER THAT THE PEOPLE CROWD TOGETHER IN THE SQUALID COURTYARDS TO DISCUSS "SOCIALISM IN OUR TIME."

In Camlachie are reported several cases of 13 people in one-roomed houses, and one case of 29 people in a two-roomed house.

Then the report issued in 1929 shows that infant mortality in slum areas is four times as high as in the reasonably good areas; this report also gives the following table:—

Number living	4 to 6 persons per room,	- 14,131
" "	7 " 9 " "	- 21,239
" "	10 " 12 " "	- 4,268
" "	over 12 " "	- 284
		39,922

a total of nearly 40,000 people still living under miserable conditions of the most desperate over-crowding.

Even in Glasgow's new housing schemes, statistics of this year show that some 400 houses are already badly overcrowded to the extent of 4 persons and over per room—conditions which cannot be corrected, or even criticised, till there is ample provision of good housing accommodation for everyone. As the author of 'How to Abolish the Slums' has put it—"There is only one way of dealing effectively with our slum areas—to demolish them." This can only be done by providing more new houses.



FLOODING NOT INFREQUENTLY ADDS TO THE DISCOMFORT AND UNHEALTHY CONDITIONS OF SLUM PROPERTIES.

Economic reason and common humanity both dictate the building of new and healthier houses to replace the "drab, dreary, dirty and depressing" slums, in which we have shown that even in only one of our cities, forty thousand people are still forced to continue their miserable and demoralising existence.



V.—UNEMPLOYMENT EXISTING IN THE BUILDING INDUSTRY.

As well as the economic, moral and humane reasons for a continued programme of providing better houses, there is another almost equally potent reason on both economic and moral grounds. This reason is that a vigorous programme of Housing would materially reduce the unemployment figures which are now swollen to the appalling total of over two millions; it is a moral reason because for hundreds of thousands of men it would obviate the admittedly demoralising conditions of months and years of idleness; it is an additional economic reason because these men would be earning wages for work done, not drawing relief from the already bankrupt Unemployment Insurance Fund.

In 1924 the Government made a bargain with the Building Trade, which is summarised in Memorandum Cmd. 2151, Housing (Financial Provisions). The industry agreed to "augment their resources" up to an inflated capacity of 225,000 houses per annum by 1934, in return for an undertaking that two and a half million houses should be built in that time, and that the increased labour supply demanded should not, therefore, result in eventual unemployment in the Building Industry. And we find, now that three-quarters of the stipulated time has passed since 1924, that there has only been built little over half the guaranteed number, and unemployment has risen in the Building Industry to the figure of 225,000, as reported in the Ministry of Labour Gazette at the time of writing (February, 1931).

If the Government had kept its promise to the Building Industry, not only would another million houses have been nearing completion to mitigate the conditions of overcrowding of which we have written in the last few sections, but this quarter million men in the Building Industry, and probably an equal number of men indirectly employed in the manufacture and transport of materials to the industry—half a million men altogether would then be taken off "the dole."

Think what this means—half a million more men employed, the total unemployment figure reduced by 25 per cent. It might quite easily be sufficient to reverse the wheels which have been turning in vicious circles of "more unemployment—less purchasing power—more unemployment." In Glasgow alone with its 100,000 unemployed the proportionate 25 per cent. would mean 25,000 more men employed in this one city—surely a result worthy of achievement, even in the absence of all the factors enumerated in the previous pages.



UNEMPLOYMENT
IN THE TOWN—



—AND IN THE COUNTRY.



TWO VIEWS OF CROWDS THAT ARE ONLY TINY FRACTIONS OF THE
TWO MILLION UNEMPLOYED.

VI.—A FEW POINTS FROM POST-WAR EXPERIENCE AT HOME.

Now let us consider a few of the more salient points in our practical experience of the last ten or twelve years at home, before passing on to review developments abroad, particularly in the various countries of Europe, each of which had its post war housing problem exactly as we have ours. And we must make it clear at the outset that we are dealing with general and constructional matters both in theory and in practice, rather than particular points such as the selection of various types of internal fittings and equipment.

In the latter respect—the provision of the most efficient first-quality internal fittings and fittings—it is our considered opinion from careful and widespread observation, that we at home here in Britain have, if anything, done better than most countries abroad. Many of the Local Authority Architects have devoted much time to the matter and have ensured the inclusion of the finest and most suitable equipment that could economically be included.

Further to the fact that we are dealing only with constructional and general principles of design, and these particularly as related to the maximum facilities for the inhabitants' good health, we should perhaps repeat that throughout our work the methods and materials which we advocate are primarily advanced for housing and other buildings for the general body of the people. This is no catalogue of luxury methods of ensuring the rich man's health and comfort, but a brief exposition of the most modern and sane means of providing houses, schools, hospitals and other buildings for the people which will afford them the maximum facilities for the maintenance of good health, and will at the same time allow a strict economy and speed of construction. A few notes then on home experiences before passing on to Continental methods and theoretical considerations.

The 'Review of Operations' issued by the Housing Department of the Glasgow Corporation at the beginning of 1928, notes, in referring to experiments with various forms of wall construction—"houses built of brick and roughcast, or with concrete hollow walls, are better and cheaper in the long run and give a more substantial structure for the occupancy of the tenants." With this opinion of the Director of Housing of the city which had at that time built some 20,000 houses, we are in entire agreement. Indeed, several of the 1924 solutions to the problem of alternative materials and methods of construction—raised because of the shortage of bricks and other usual materials at that time—took the form of houses of this type.

A FLAT-ROOFED HOUSE REVIEWED BY THE GOVERNMENT COMMITTEE ON NEW METHODS OF CONSTRUCTION IN 1924. THIS IS A BLOCK OF ONE HOUSE, BUT THE TYPE OF CONSTRUCTION WAS ADAPTABLE TO TWO, FOUR OR SIX HOUSES IN A BLOCK.



One of these was of pre-cast concrete blocks and brick rough-cast, having also the added advantages provided by a flat roof, which advantages will be fully explained and illustrated in the subsequent sections.

This house, of which we publish a photograph, aroused considerable interest at the time of its review by Government and local Housing Authorities, and Sir Ernest Moir's Committee on new methods of house construction. Amongst these Authorities, the then Minister of Health, the Chairman Sir Ernest Moir, the late Sir Charles Ruthen and Sir William E. Whyte were so favourably impressed, that the proposers were encouraged to carry out further tests and experiments in evolving a type of building which should have all the advantages of the flat roof and the cavity wall, and yet at prices enabling Local Authorities to adopt it for healthy housing, schools and hospitals.



A PHOTOGRAPH TAKEN IN 1924 AT THE HOUSE PICTURED ABOVE.

L. TO R.

THE LATE MR. JAMES STEWART,
THEN UNDER-SECRETARY OF STATE FOR
SCOTLAND;

THE MINISTER OF HEALTH,
THE LATE RT. HON. JOHN WHEATLEY;
AND

MR. JOHN M'DONALD,
HEAD OF THE FIRM OF BUILDERS
RESPONSIBLE FOR THE CONSTRUCTION.

VII.—RECENT DEVELOPMENTS IN THE UNITED STATES OF AMERICA.

AND now we may consider the recent developments in popular housing in other countries. Let us take a brief glance at the United States before travelling eastwards across the various countries in Europe.

There is not a great deal of civic housing in America, except by certain philanthropical organisations in the older cities; the reason is that whereas every country in Europe had her housing development totally arrested by the War, the United States was not affected to the same extent. This means therefore, that in the case of the United States, we cannot deal purely with Municipal Housing; but we may trace the modern tendencies there by noting new examples of middle-class houses.

Too long was America—essentially the land of the new—bound to traditions of the old. But before the end of the last century, first Richardson and then Sullivan who built many of America's most famous buildings, had broken away from the classic conventionalities which Sullivan's still more famous pupil, Frank Lloyd Wright, describes as—"a legacy of so-called styles which have become only yard-sticks for the blind, crutches for the lame, the recourse of the impotent." Frank Lloyd Wright it was, who designed the Imperial Hotel, Tokyo, which only gained its present popularity after it had been the only building in the centre of Tokyo to withstand the gigantic earthquake of 1923.

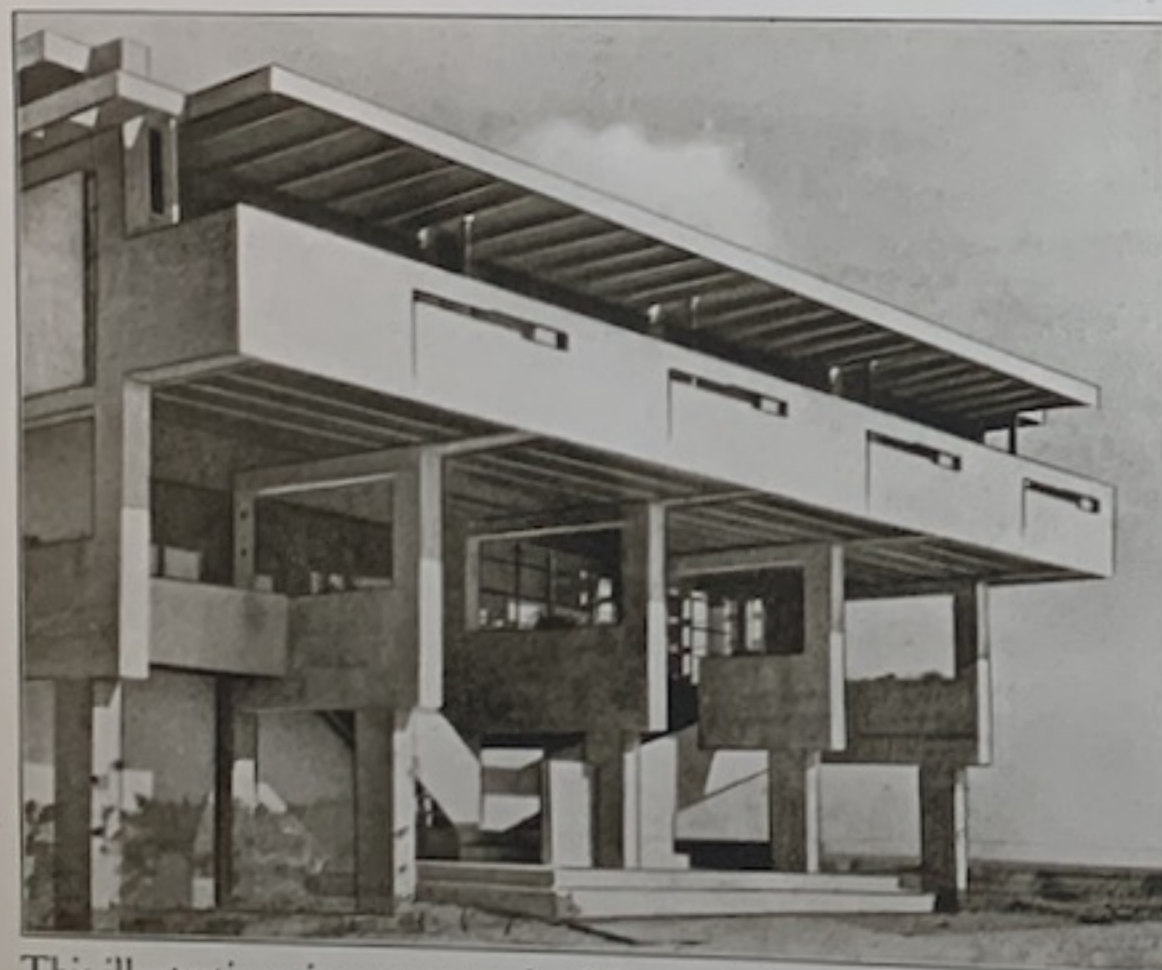
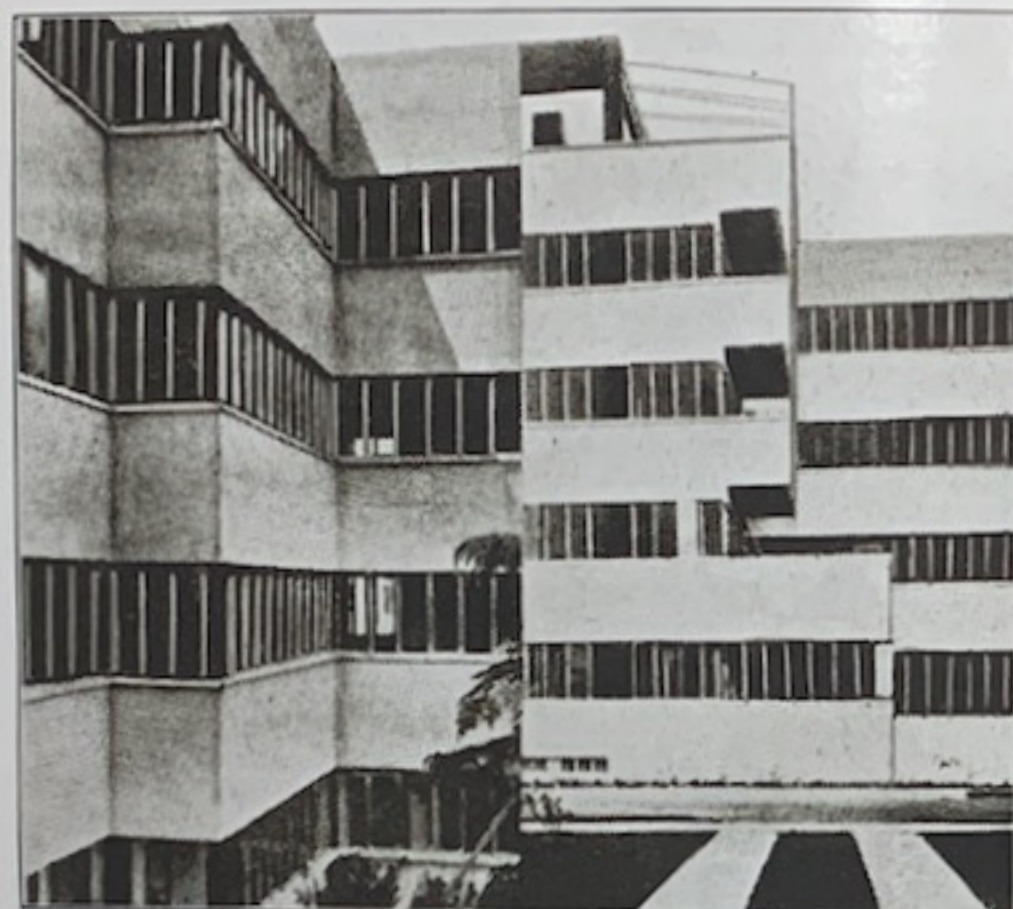
It is this architect Wright, whose 'honesty' of design has so strongly attracted his admirers. One of these was Richard J. Neutra who designed the building in the picture herewith; observe the honest unadorned use of the materials of to-day—glass, concrete and steel; note also how the strong rigid lines of the design agree with massive bareness of the hillside on which the building is constructed.



AN EXAMPLE OF THE WORK OF RICHARD J. NEUTRA, A FOLLOWER OF FRANK LLOYD WRIGHT. IT DEMONSTRATES 'HONESTY' IN THE UNHIDDEN USE OF MODERN MATERIALS—GLASS, CONCRETE AND STEEL.

The next picture shows an unusual view of a block of flats in Los Angeles—again the uncovered honesty of the design with its complete lack of redundant subterfuges of ornamentation is particularly striking. Notable features are the flat roofs of the building and the continuous bands of windows to admit the maximum of sunlight and daylight.

RESIDENTIAL FLATS IN
LOS ANGELES, U.S.A.
NOTE THE CONTINUOUS
BANDS OF WINDOWS.



A MODERN HOUSE
IN CALIFORNIA:
R. M. SCHINDLER.

This illustration gives an example of the work of a group of modern architects in California; it is built with cavity walls to insulate the house and keep the interior cool in the hot summer, just as we in this country advocate cavity walls to insulate the house and keep it warm during the colder northern winters.

While some of these examples, for the reason we have given, are of individual rather than municipal housing, our next photograph shows anew slum clearance housing block in New York.



GRAND STREET RE-HOUSING DEVELOPMENT, NEW YORK;
ARCHITECTS: SPRINGSTEEN AND GOLDHAMMER.

The six storey building may look rather high to us here, but of course it is not high in comparison with the towering skyscrapers of down-town New York. In this case there is no suggestion of philanthropy in this civic development. Its results therefore have a greater value, as the results of a self-supporting, businesslike venture, economically as well as humanistically sound. It represents a landmark in the housing development of New York City and, as the reviewer in the 'New York Times' phrases it—"the houses are designed for air and sunlight . . . with a recreation roof-garden for adults, another for children."

On the roof is one of the most interesting features of the whole building—a drinking-fountain to increase the enjoyment of the one-time slum dwellers in their new delight of the accessible roof-garden, built by an Italian bricklayer who had been engaged on the general work of construction, but who refused any payment for this voluntary contribution to the future tenants' health and pleasure.

VIII.—NEW HOUSES IN FRANCE—MALLET-STEVENSON AND LE CORBUSIER.

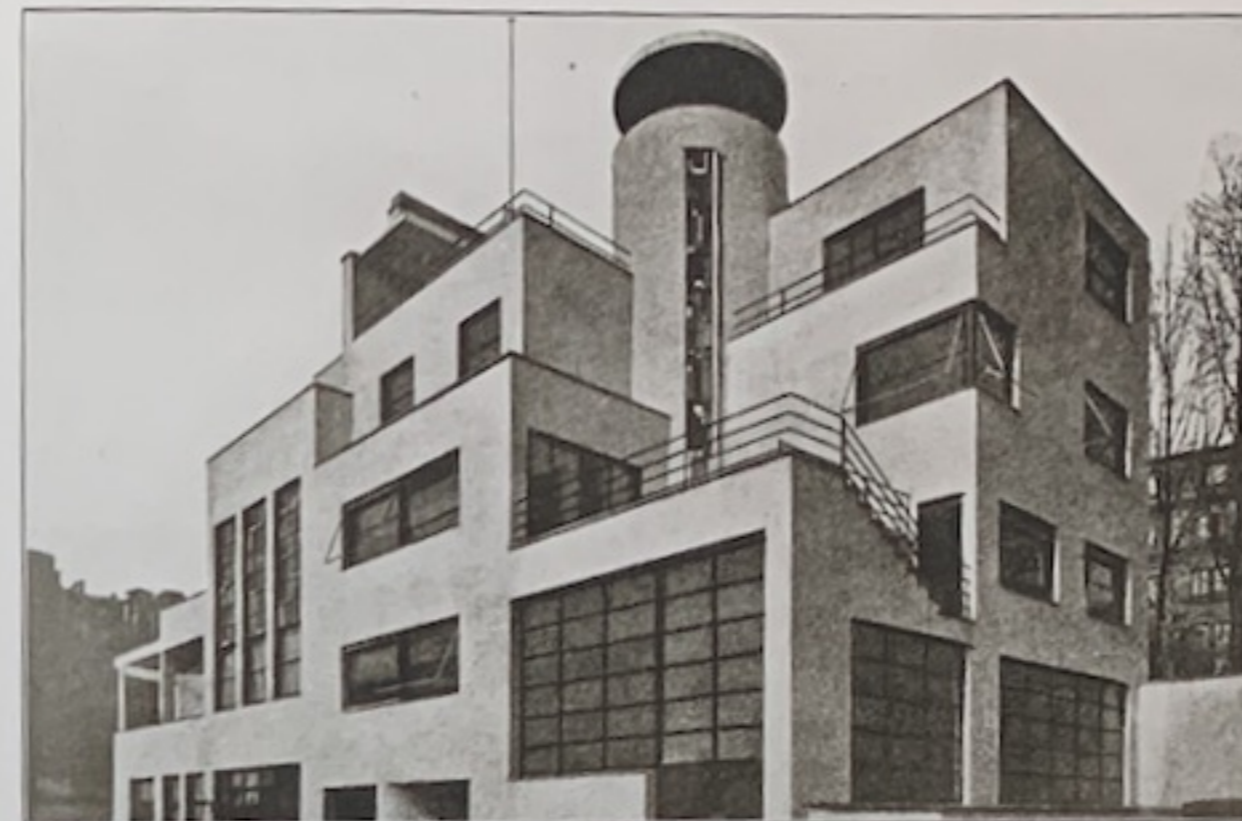
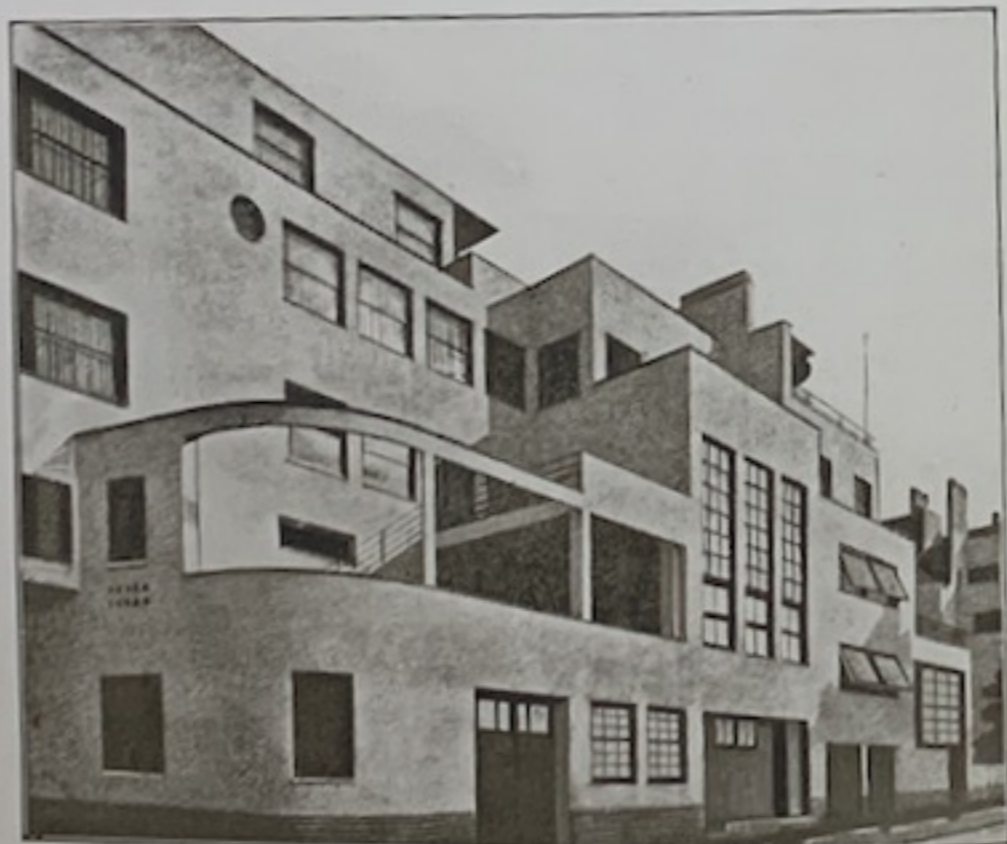
Now let us move eastward across the Atlantic to France, of which Mr. Howard Robertson, the well-known London architect, writes—"France is daring in experiments with form, and is attacking the problem of an architecture of our age, economical, hygienic, simple and practical, on lines of logical experiment. The new cubist houses are ultra-modern as regards light and airspace they mark a great advance, and much is to be learnt from them."



A VIEW OF A SHIP'S DECKS: COMPARE WITH THE ACCOMPANYING PICTURE OF A HOUSE IN PARIS.

cessive floors of the house gives the effect of the decks of a ship.

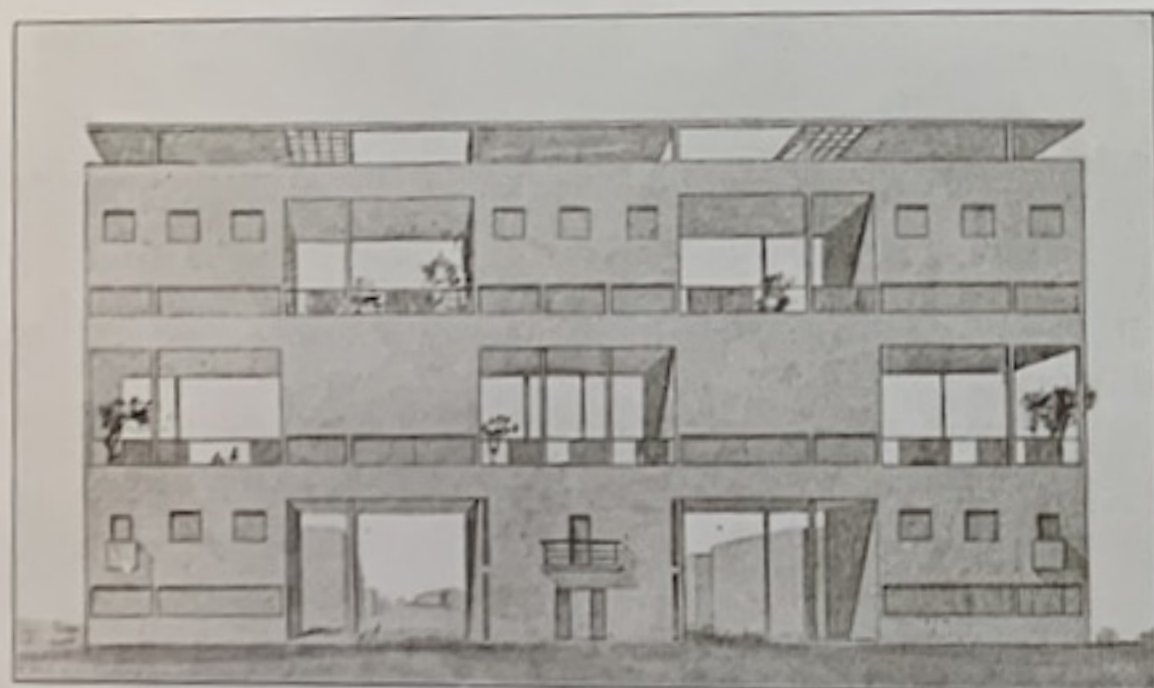
The house is designed by Robert Mallet-Stevens, who has given his name to a street in Paris, the Rue Mallet Stevens running through the district where most of his designs have been erected. The other two pictures opposite are also of his work in the French capital; in each case we note the flat roofs and the decks, the object being to provide sun-terraces and roof gardens on which the fortunate inhabitants may take their ease.



HOUSES IN PARIS BY ROBERT MALLET STEVENS



Then here are some pictures of municipality houses built by Le Corbusier, probably the most outstanding architect of to-day. As author of his books 'Vers Une Architecture' and 'Urbanisme' he has startled the interested world by his revolutionary ideas in town-planning and architectural design. Lady Ross writes of this architect that he is "the pioneer in the only domestic architecture of our day that can be called original and practical as well as beautiful."

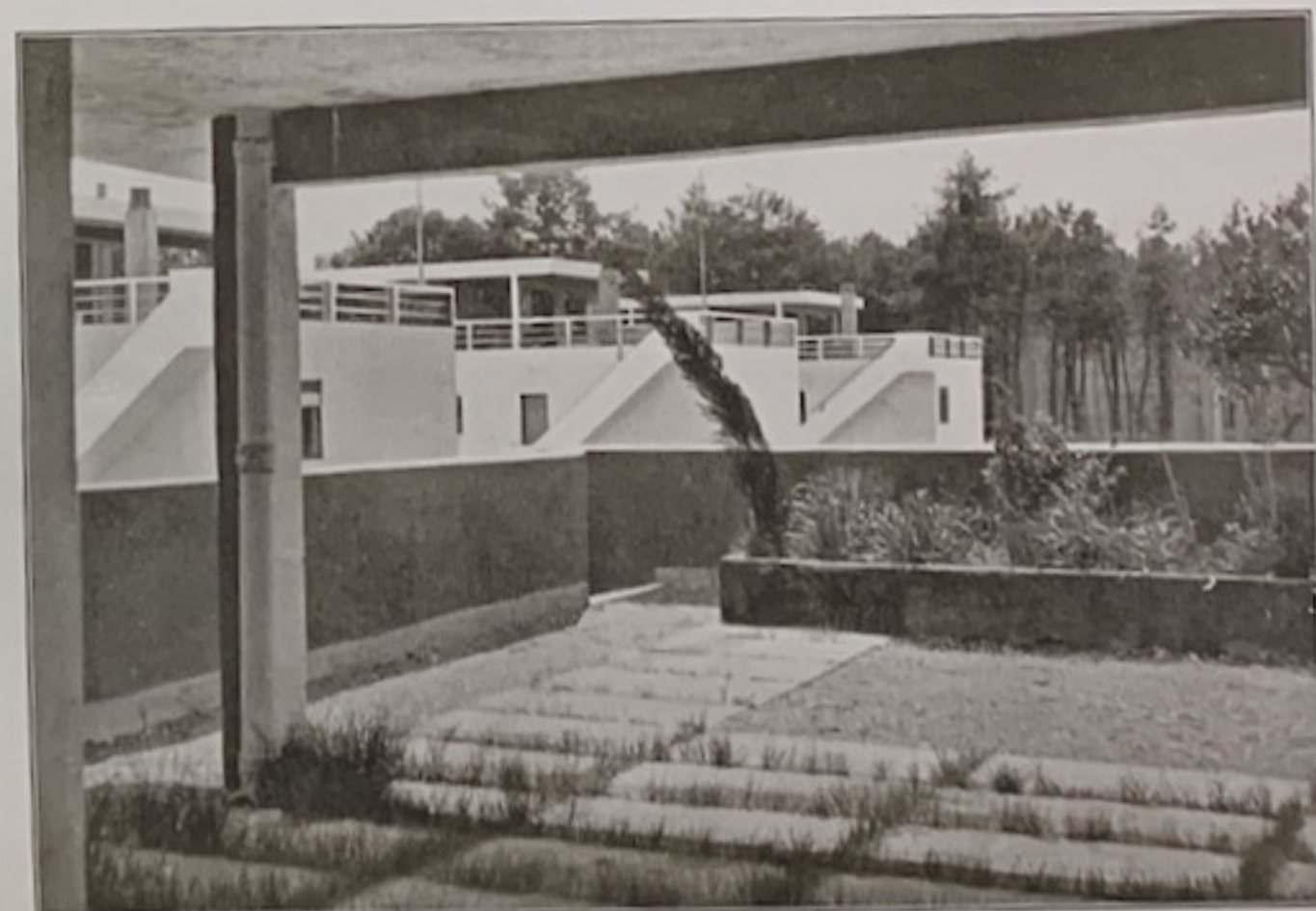


LE CORBUSIER'S TYPE DESIGN FOR A GARDEN HOUSING SCHEME
ADOPTED AT BORDEAUX.

We reproduce his drawing for a garden-city housing scheme on the cellular or 'honey-comb' principle, each house having its open air sheltered porches or its roof-terraces. The two pictures opposite show that already in Bordeaux his ideas have been put into practice to a considerable extent, the second of the two photographs being a view from one of the sun-terraces showing the delightful facilities afforded to the tenants by their inclusion.



A MUNICIPAL HOUSING SCHEME IN BORDEAUX DESIGNED BY LE CORBUSIER IN
THE TYPICAL VIGOROUS STYLE OF THIS MODERN OF THE MODERNS.



A VIEW FROM THE ROOF GARDEN OF ONE OF THESE MUNICIPAL HOUSES, GIVING
SOME IDEA OF THE PLEASURE WHICH ROOF GARDENS BRING TO THEIR INHABITANTS.

IX.—BELGIUM: LA CITÉ MODERNE AND—A DIVERSION.

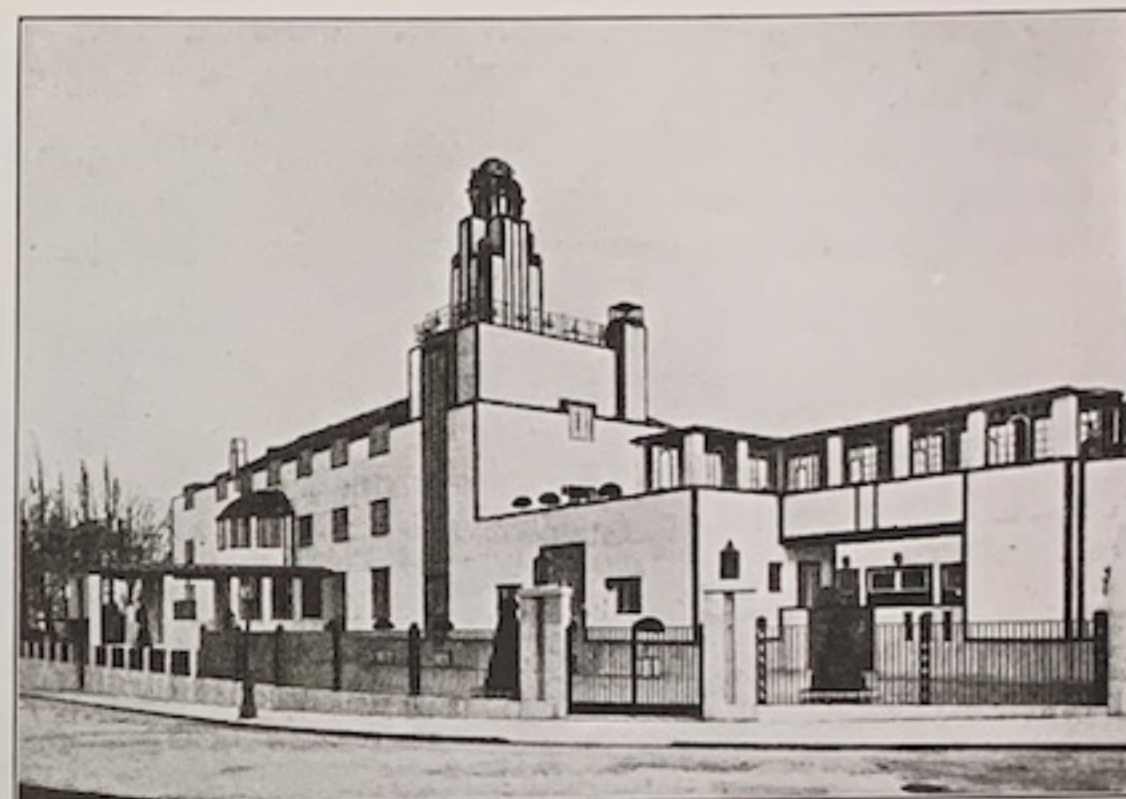
Now let us glance at Belgium. Probably the two most interesting personalities in post-war architectural circles in Belgium were Bourgeois and Van de Velde. The latter, Van de Velde, is the Director of the School of Applied Art in Brussels and it was to this architect and to Peter Behrens of Berlin that Bruno Taut refers as "the Dioscuri of Art in Industry." We presume he uses the simile to emphasise their deeds of intellectual valour in post-war architectural spheres, but does not extend the allegory to include the penalty meted out to the classical Dioscuri—that only one of them could attain immortality.



LA CITÉ MODERNE—A MODERN SUBURB OF BRUSSELS. DJO BOURGEOIS.

As regards the other Belgian architect we have mentioned, Djo Bourgeois, it was he who built the suburb of Brussels named 'La Cité Moderne,' of which we show a photograph. It shows houses of a type more nearly resembling our own types than the more advanced French houses which we have just reviewed. But the most noticeable difference is again the flat roof. In this Cité Moderne still enjoy their many other advantages which we shall review later.

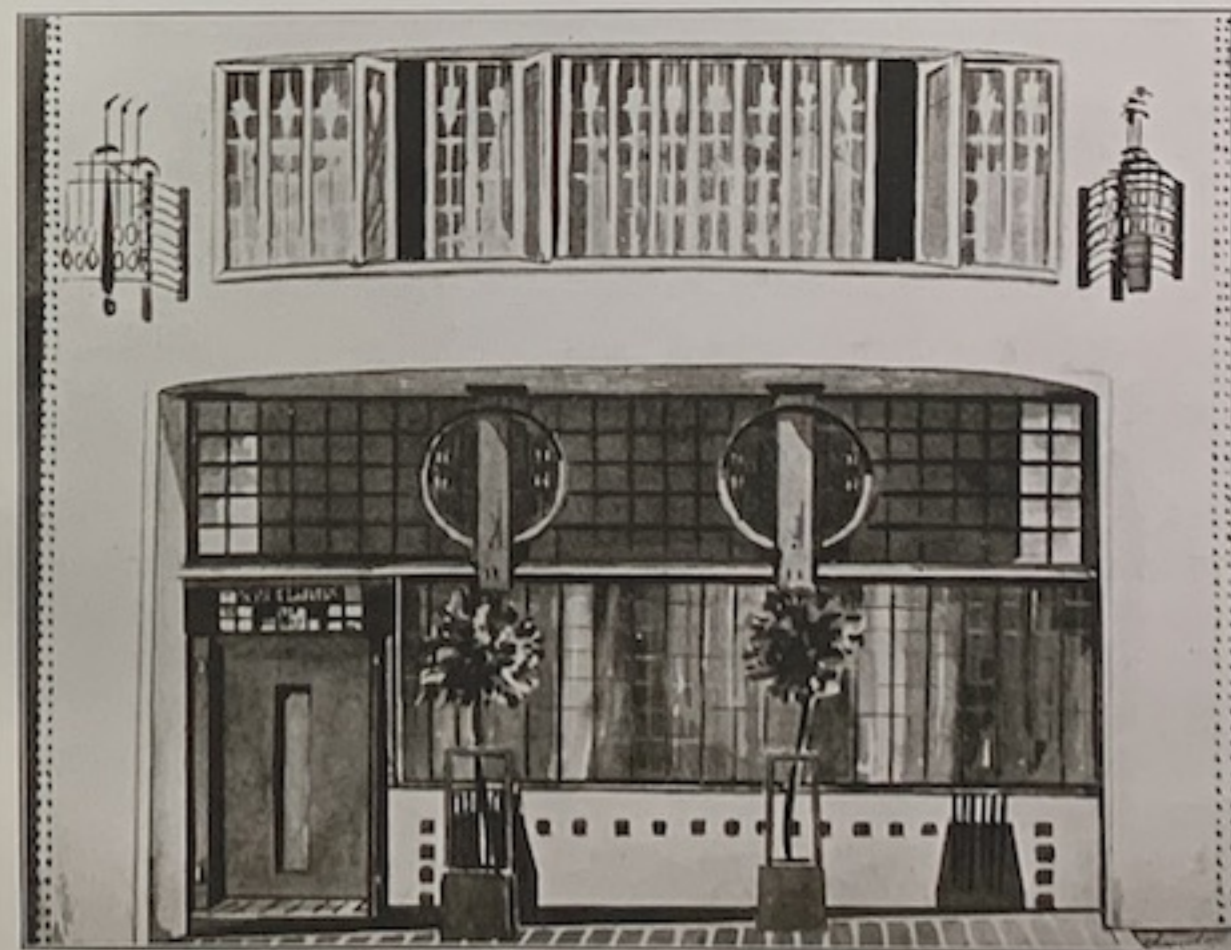
Our other photograph is of a house in Brussels. Most of the foreign houses which we are illustrating are working-class post-war houses corresponding to our housing scheme and slum clearance types, for it is with houses for the masses that we are primarily concerned; but this house is perhaps worthy of mention, as it illustrates a point of particular interest to us here in Scotland.



THE STOCLET HOUSE IN BRUSSELS, DESIGNED BY THE VIENNESE ARCHITECT HOFFMAN. NOTE THE RESEMBLANCE IN THE STYLE TO THE TEA-ROOM IN THE OTHER PICTURE.

It was designed to the order of a Brussels gentleman, by the Austrian architect Hoffman, who had evolved a delicate modernist style from the work of a Glasgow architect, the late Charles R. Mackintosh. It was Mackintosh who designed the Art School in Glasgow, but indeed his work was better known and more appreciated in Vienna than it was in his own city. Anyone who has noticed the face of the building that used

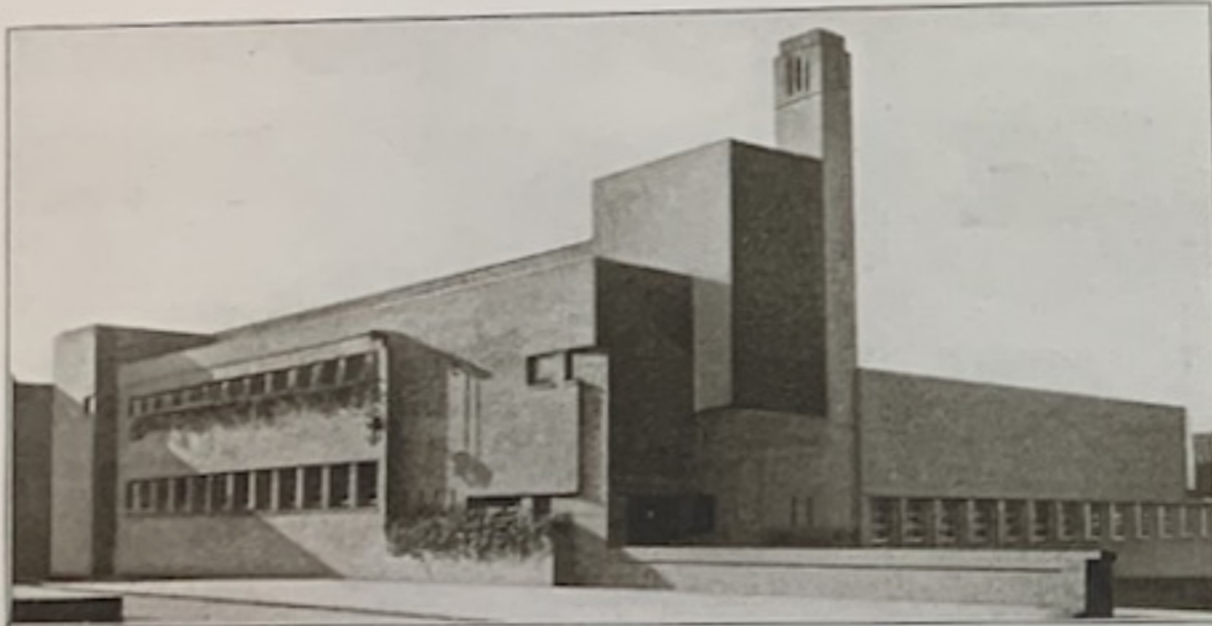
to be Miss Cranston's Kensington Tea Rooms in Sauchiehall Street, Glasgow (which we picture here), will see the resemblance which the house in Brussels bears to it. It is of interest to notice in passing, the oddness of the circumstances that led a citizen of Brussels to order from an architect in Vienna a design based on the work of a Scottish architect in Glasgow.



A TEA-ROOM IN GLASGOW DESIGNED BY CHARLES R. MACKINTOSH SHORTLY AFTER 1900. NOTE THE RESEMBLANCE TO THE STYLE OF THE ABOVE PICTURE.

**X.—HOLLAND. A NATIONAL STYLE.
AND A FEW WORDS ON "FUNCTIONALISM."**

Now we may return from this brief diversion, to the consideration of houses designed and constructed for the general population. Let us pass from Belgium to the neighbouring country of Holland and review what has been done there.



A MODERN BUILDING IN HOLLAND. COMPARE WITH THE REPRODUCTION OF EGYPTIAN ARCHITECTURE ON THIS PAGE.

Holland, as a neutral country in the Great War, was the first European nation to tackle its housing problem after the War. And the Housing Commissioner of Holland decided to place the work of housing the people, in the hands of the younger and more progressive of the Dutch architects—De Klerck, Oud and Dudok, all pupils of de Bazel and adherents of Berlage. These architects evolved a real national style, with restful horizontal lines that contrast so vividly with the vertical emphasis in New York, and which remind the American reviewer, Wood, so forcibly of Egypt that she says "the brown-skinned architects of Karnak and Luxor dreamed the same dreams three thousand years ago."

This is no fancied resemblance, as our illustrations comparing buildings in Holland and Egypt will show.



A REPRODUCTION OF EGYPTIAN BUILDINGS. COMPARE WITH THE PICTURE OF A BUILDING RECENTLY ERECTED AT HILVERSUM, HOLLAND.

Headed by the late de Klerck in Amsterdam, these architects initiated a policy which has been given the high-sounding name of 'Functionalism.' This simply means that they determined to build houses primarily designed to fulfil their functions in the most efficient and economic manner, and not as a mere background for an antique architecture. They planned rooms to the most useful shapes and sizes, arranged them in the most reasonable way and then built up their walls round these plans, instead of the old idea of designing a pseudo-Georgian or semi-Roman facade and fitting in the rooms as well as might be behind.



BLOCK OF FLATS IN AMSTERDAM THE LATE DE KLERCK.

Thus the Amsterdam flats illustrated have circular stairs and the shape of those stairs shows to the outside because it suits the plan of the block; cantilevered pulley brackets for raising furniture also show, because they are the necessary and economic method of installing the massive heirlooms that the Dutch folk have not yet learnt to replace by more efficient furniture.

But though the elevation is thus made of secondary importance to the plan of the building, the resulting elevation with its honesty of purpose is far from unpleasing. And surely it is eminently sensible to regard architecture as these architects have done, as does Herr Schinkel who defines it—"the convergence of purpose and material"—the art of using materials most efficiently to fulfil our purpose.

XI.—GERMANY—AN ENCYCLOPÆDIA FOR THE STUDENT OF MODERN HOUSING.

MENTION of Herr Schinkel brings us to Germany, which with Vienna contains the most noticeable developments of modern housing.

Hamburg, Berlin and Frankfurt probably contain the most imposing examples of post-war housing developments in any European city.

Many other German cities also—Magdeburg, Nürnberg, the industrial yet amazingly smokeless cities of Essen, Düsseldorf and Köln, all have their modern developments of dwellings for the people, fundamentally designed to provide optimum conditions for health and comfort, with efficiency and economy.

Stuttgart with its intriguing and admirable experimental colony, we shall consider separately in a later section.

But let us first glance at Hamburg, Berlin and Frankfurt, as typical of progress in Germany, which has so ably applied her scientific knowledge and her zeal for physical fitness to the problem of providing houses.

Here are two photographs of houses in Hamburg, and again, as in the other countries we have reviewed, the flat roofs are adapted and utilised for roof-gardens or sun-lounges. Hamburg is not so very far south of us even in the cities of Scotland; indeed it is farther North than Manchester; and so to the sceptic who might ask how much sunshine is available in our climate, we can answer—as much as in Hamburg, where full use is successfully being made of all there is. The less sunlight we have, the more religiously should we avail ourselves of the full benefits of it all; and in any case we have the assurance of the famous doctor, Sir Herbert Barker—"even though the sun may be obscured, the daylight rays have the same beneficial properties and can be employed to advantage."



HAMBURG HOUSING. THE ROOF TERRACES AND THE WIDE WINDOWS ARE EVEN MORE NOTICEABLE ON THE OTHER ELEVATION.



HOUSE IN HAMBURG . . . KARL SCHNEIDER, ARCHITECT.



FLATS DESIGNED BY MIES VAN DER ROHE, BERLIN. NOTE THE SUN-LOUNGES ON THE FLAT ROOFS, AND THE ALMOST CONTINUOUS BANDS OF WINDOWS, BOTH FEATURES TO ALLOW THE MAXIMUM FACILITIES FOR SUNLIGHT.



BERLIN HOUSING. FLATS DESIGNED BY BRUNO TAUT.

Then in Berlin, which Dr. Heigenthal, the City Engineer, tells us used to be a city of "barrack-like flats" we find the same march of progress, the same desire for the maximum admission of sunlight within the houses and the fullest use of it outside.

The top picture opposite is of a block of flats designed by Mies van der Rohe of Berlin, with their wide windows and their sun-traps on the flat roofs.

The lower picture opposite is of flat roofs in Grellestrasse, by Bruno Taut, who has given the benefit of his architectural ability to so many of Berlin's housing schemes. In that picture, note how the balconies are projected from the building line to get as much sun as possible.

The other photograph below shows flats at Lichtenberg, Berlin-Ost, again designed for the maximum of sunlight by having sun porches, and flat roofs which do not obstruct so much sun from the windows, as do the unnecessarily higher pitched roofs—a point which is fully explained and evaluated on page 79.



FLATS OF THE 'BAUGESSELLESCHAFT' BERLIN-OST.

Next we come to Frankfurt, the city where has been probably the most progressive of all the continental civic administrations. The Städt Hochbauamt built 32,000 houses in the five years 1925-1930, and this during a period when the city was in straits no less difficult than those obtaining in other German municipalities.

The fact is that this splendid programme for a city of less than half a million inhabitants was largely due to the dominant personality of the City Architect, Herr Ernst May. By reason of the strict economy that was necessary, May had to standardise the interior fittings of all the houses and arrange for cheap and efficient production of all the units of his construction. But this did not mean that he covered the suburbs of Frankfurt with houses of monotonous uniformity. Our selection of half-a-dozen photographs, each illustrating some points that have received May's particular attention, is sufficient to show the amazing variety of design that he did manage to evolve while working with standardised units. As regards furnishing, he has largely adopted steel windows with their slim steel astragals which obstruct less light than the usual wooden astragals; and he has adopted concrete floors with a jointless mastic covering, thus providing a vermin-proof, draught-proof floor as compared with the wooden joist and boarding method still in use for houses in this country.

As regards general plans, each site was considered separately to discover the best possible lay-outs and types to conform with the ever-present need for economy and the no less important demand for health facilities.

And here are some of the results.



FRANKFURT MUNICIPAL HOUSING.
NOTE SPACES ON EACH ROOF WHICH CAN BE PRIVATELY SCREENED OFF.

This picture shows a back view of a terrace of municipal houses, each with its own sun-trap on the flat roof, provision being made for screening off to afford the privacy that can never be attained by a ground garden.

The picture opposite shows another type adopted in Frankfurt, not unlike the preceding one in its provision of sun-trap roof-gardens on one half of the roof.

Then the lower picture on that page taken from the steps of the Municipal Kindergarten of the Colony, illustrates several interesting points, to find all of which exemplified in the one block is almost unique.

In the first place, note the 'saw-tooth' design of the building with the windows pushed out as far as possible into the sunlight. Secondly, notice the individual roof gardens on all the roofs, even although there are common gardens in the area enclosed by the block. Thirdly, notice the relief of any monotony that might be threatened by such a large block constructed of standardised units; this is accomplished by the use of coloured roughcasts. The wall to first floor height is blue and above that white; this colour scheme is further varied by the brown wing walls in the background, and the whole effect, with the enclosed green space, is most charming—and all obtained for very little more cost than the monotonous uniformity of grey walls.



FRANKFURT MUNICIPAL HOUSING. SUN-TRAPS ON EACH ROOF.

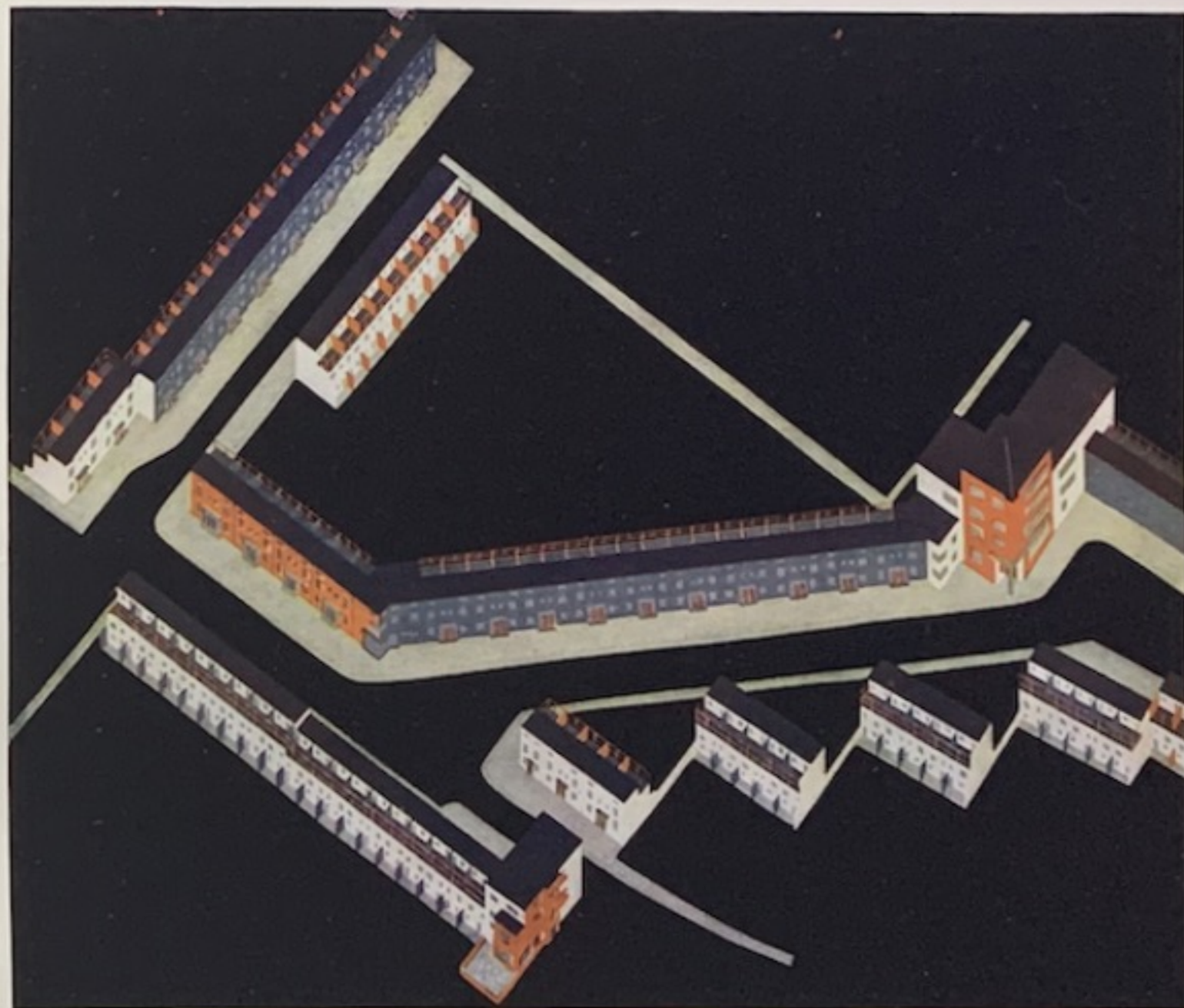


WORKMEN'S DWELLINGS IN FRANKFURT: . . . ERNST MAY.

This picture also is illustrative of Mr. May's use of coloured wall-finishes, the porches, general walls and the central bridged portion making a pleasant picture of green, brown and pale cream, introducing a colourful liveliness into bare expanses of walls which could easily have been left in a gloomy grey.



FRANKFURT HOUSING ; RELATIVELY BARE EXPANSES OF WALLS ARE SAVED FROM MONOTONY BY TINTING THE ROUGH-CAST WITH CHEERY COLOURS. IN THE BLOCK PICTURED ABOVE, THE PORCHES ARE GREEN, THE MAIN WALLS A BUFF BROWN AND THE CENTRAL BRIDGED PORTION CREAM-COLOURED.



The coloured block above is an artist's reproduction of a section of Praunheim Colony and, while the artist's colours are perhaps brighter than the rough-cast originals, the relief of what might otherwise be monotonous regularity is forcibly illustrated ; note again the private sun-trap spaces on the roofs.

Then this next picture demonstrates the versatility of May's design. He finds a site with a curved frontage, so he does not lacerate his layout to retain his usual vigorous rectilinear designs, but he arranges a bold sweeping curved facade that loses nothing of its modernism because of its curvature. In fact the illustration shows that modernism does not always mean straight lines—



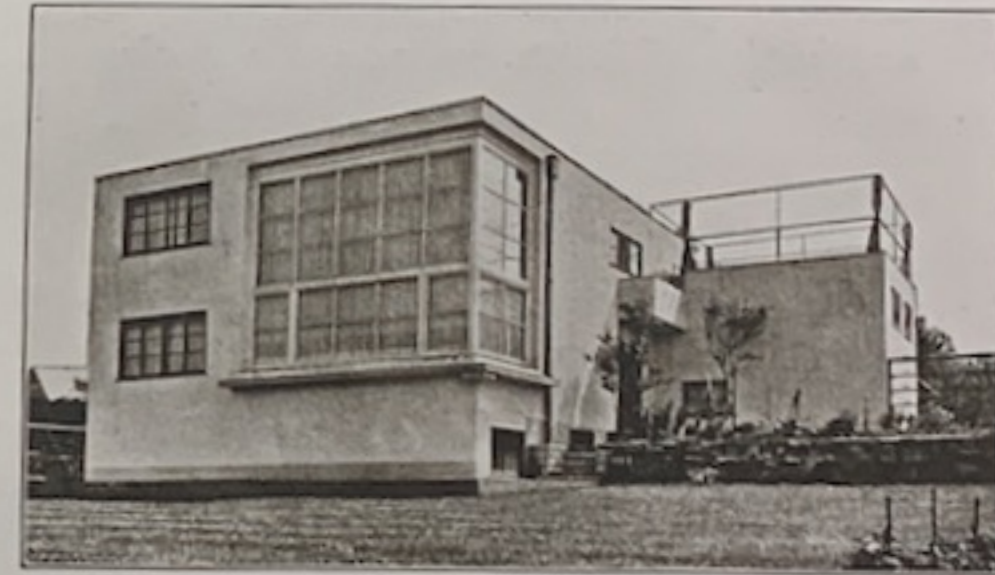
MODERNISM DOES NOT NECESSARILY MEAN STRAIGHT LINES. A FUNDAMENTALLY MODERN BLOCK OF FLATS IN FRANKFURT.

here we have a wide curve in plan, and the circular stair lights introduce relieving curves in the elevation. But there is no departure from the flat roofs, sun terraces, wide steel windows and cavity walls that characterise up-to-date housing everywhere.

Mr. May has designed for the people houses which are only economical editions of what he has built for himself, a fact which is clearly demonstrated by our picture opposite: the architect's own house where the present writer was so hospitably received. Now that the city of Frankfurt is well on her way to solving the problem which was so graphically illustrated in her housing report by



this little silhouette of couples left out in the rain for lack of houses. Herr May has gone to Russia to be first architect to the Soviet Union, and whatever our fears may be for Russia's political future, we are confident that Herr May will do much to ensure the health and efficiency of her future housing developments.



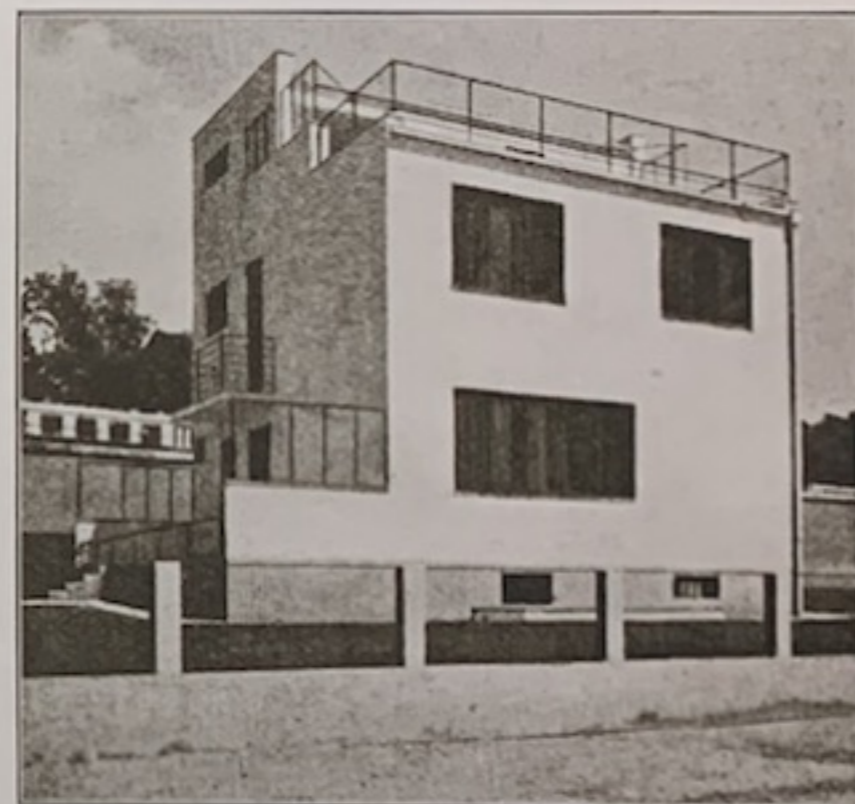
THE HOUSE OF HERR ERNST MAY, LATE CITY ARCHITECT OF FRANKFURT, NOW FIRST ARCHITECT OF THE SOVIET UNION OF REPUBLICS.

For a student of healthy and efficient modern housing design, Germany is a very encyclopædia of interest, and we trust that our review of developments in Hamburg, Berlin and Frankfurt has given some indication of this.

Yet it is not only in these relatively large centres of population that the development is noticeable. Here for instance are other three photographs illustrating three more types of modern German homes for her industrial population. Contemptuously avoiding any unnecessary ornamentation, any policy of endeavouring to reproduce Tudor mansions in ridiculous miniature, with over-hanging eaves "hanging in the eye of the sun," these post-war municipal architects of Germany have used all the available finance in providing efficient equipment and the maximum facilities for the inhabitants' health. And their resulting elevations have not suffered in the eyes of those who can see truth as beauty. The appeal of simplicity, the strength of bold sharp lines, the logic of placing our children's all-important health above the commemoration of our fathers' oft-mistaken architecture; all these argue the sound judgment of those who direct affairs in Germany's splendid housing programme, being attained under difficulties much greater than those of any other country after the War.



THREE MORE HOUSING TYPES IN GERMANY;
EACH WITH SUN-SPACES ON THE FLAT ROOFS,
AND INSULATING CAVITIES IN THE WALLS.



XII.—VIENNA. COMMUNAL HOUSING, THE CARE OF THE CHILDREN, AND ART IN THE WORKERS' LIVES.

AND now to Austria, or what is most essentially Austrian—Vienna, the capital.

A city of musicians and luxuriants; despite all the glory of its world-famed opera and the splendour of its magnificent court, pre-war Vienna had its sordid slumdom, its horrid hovels making a miserable mockery of the city's reputation for brilliance and affluence. But after the War the social democrats in control of Vienna's municipal affairs launched an impressive housing programme to overtake her existing shortage of 40,000 dwellings and provide for annually increasing requirements. This was done by means of a housing tax—a severe imposition on an already poverty-stricken populace, but a most desirable alternative to suicidal inaction on the key problem of healthy housing.



A LARGE HOUSING BLOCK IN VIENNA, WITH ITS ECONOMICALLY BARE WALLS RELIEVED BY A SCULPTURED FOUNTAIN IN THE COURTYARD. IT SHOWS THE MOTHER BEAR CARRYING HER YOUNGSTER ON HER BACK, AND IS THE WORK OF THE SCULPTRESS HANNA GAERTNER. THE BAS-RELIEFS ON THE SIDE OF THE FOUNTAIN ARE THE SIGNS OF THE ZODIAC.

In Vienna, as the City Architect whom we have quoted on page 16 said, the Council was not insensible to the advantages of cottage types—two or four houses in a block, but this was economically impossible, and so they proceeded to make a splendid job of the alternative—large housing blocks.

The Viennese wife in the working-class family frequently goes out to daily work as well as the husband; and so we have the fundamental conditions that led to the most marked development in Vienna's Housing—the extension of communal services, group nurseries, laundries, baths and kitchens. Each colony of any size has its community kindergarten, its common laundry which supplies central heating to all the houses, and indeed all the services that the absent housewife cannot render to the family, are taken over more economically and more efficiently even, if also more impersonally.



A COMMUNAL NURSERY IN A VIENNA MUNICIPAL HOUSING BLOCK.

While we in this country are happily able to have our own separate houses and live our own family lives, we must admit that in Vienna, where conditions made this impossible, a splendid achievement has been made of the alternative. The communal nurseries are models of cleanliness and good sense, where the little ones are occupied happily and healthily till their mothers call for them after the day's work. One point that shows just how carefully thought out these municipal kindergartens are: this is the adoption of pictures instead of names to differentiate the belongings of the little ones who are too young to read. Thus, one child will have the picture of, say, a stork on its coat-hook, its tooth-brush and everything it uses during its hours of rest and play; while another has a pictured lamb or a river on any other little thing that the kiddie can recognise before it is old enough to read its name or a number. This is, of course, a minor point, but it goes to show that real thoughtful care is being exercised over those little ones, and that the Viennese have not forgotten their own proverb "He who erects palaces for the children to-day, breaks down the prison walls of to-morrow."

Another most laudable feature of to-day's housing in Vienna is the idea of providing some work of art, painting or sculpture, at all the municipal workmen's colonies.

XIII.—A GLANCE AT OTHER COUNTRIES—AND THE STUTTGART EXHIBITION OF 1927.

WE have now reviewed the varying and yet similar developments in U.S.A., France, Belgium, Holland, Germany and Austria, the foreign countries where have been carried through the largest housing programmes of post-war years. But before we sum up the tendencies which can be observed in modern housing in all progressive communities seeking to incorporate the maximum facilities for health in their designs, while necessarily attaining economy in the construction, let us glance at a few of the minor nationalities. The other countries of Europe have not perhaps progressed to the same extent as those we have noted, but each has its modern architects, working along not dissimilar lines—Gaudi, in Spain; Moser, in Switzerland; Nyrop, in Denmark; and Saarinen who designed in Finland before emigrating to America.



MODERN HOUSES IN STOCKHOLM, SWEDEN, WITH THE FLAT ROOFS, ROOF-TERRACES AND LARGE WINDOWS THAT ARE TYPICAL OF MODERN HOUSING.

NOTE.—THE HOUSES ON THE RIGHT WERE JUST FINISHED AT THE TIME OF THE PHOTOGRAPH, AND THE GLASS HAD STILL TO BE SET IN SOME OF THE WINDOWS.



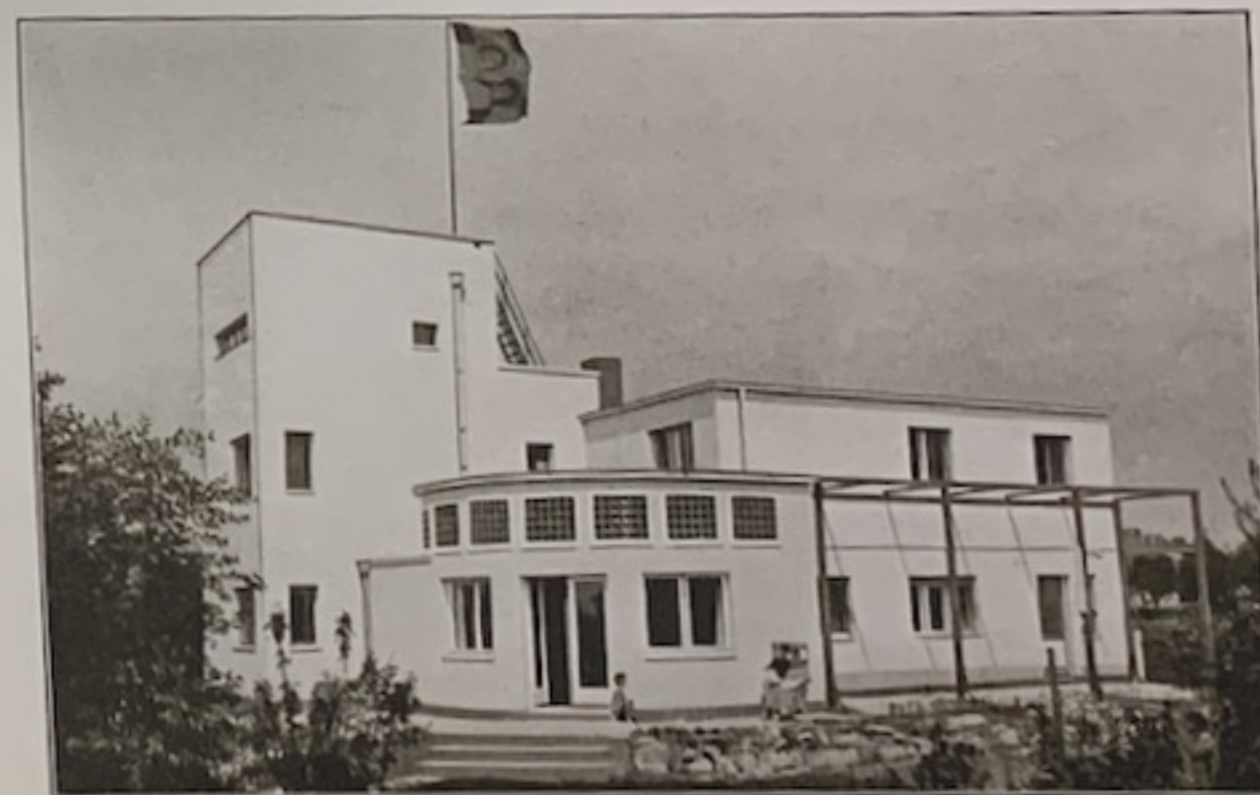
Italy is returning to her solarium on the roofs and terraces as in the days of the glorious splendour that was Rome.

Russia, which lagged so far behind in decent working-class housing under Czardom, is already showing signs of a tremendous impetus under the Soviet Regime; in the Soviet countries already in industrial and office buildings, there is a development of logical rationalism, or as one writer has it "Russian Architecture is being Americanised without the absurd appendages with which America once tried to imitate so-called 'culture.'"

In Hungary the "verticality" of Béla Lajta and Malnai Béla is gaining adherents, while our pictures from Stockholm, Prague and Warsaw show the similar tendencies of housing developments in Sweden, Czecho-Slovakia and Poland.



A PHOTOGRAPH FROM PRAGUE, THE CAPITAL OF THE REPUBLIC OF CZECHO-SLOVAKIA.
ARCHITECT, F. A. LIBRA.



ANOTHER PICTURE FROM THE CONTINENT.

Now let us return as we promised to Stuttgart, where in 1927 many of the foremost post-war housing architects on the Continent gathered together, and each contributed the healthiest and most economical of his designs to a colony of municipal dwelling houses erected on land set aside for the purpose by the Municipality. We are happily able to publish some photographs of these results: flat roofs and roof gardens, large windows and cavity walls.



TWO HOUSES IN THE STUTTGART COLONY.
NOTE THE USE OF THE FLAT ROOFS FOR SUN-LOUNGES IN EACH CASE.



ANOTHER HOUSE IN THE COLONY: BY A FRENCH ARCHITECT.



HOUSES IN STUTTGART: BY WALTER GROPIUS, OF GERMANY.



THE CONTRIBUTION OF LE CORBUSIER, THE FRENCH ARCHITECT, TO STUTTGART'S INTERNATIONALLY-DESIGNED HOUSING SCHEME.



A VIEW OF THE HOUSING COLONY ERECTED IN STUTTGART, 1927, TO THE DESIGNS OF ARCHITECTS FROM ALL COUNTRIES. NOTE THE SUN-SPACE ON THE ROOF IN THE FOREGROUND.



NOTE HOW THE FLAT ROOFS OF THE HOUSES IN THE CENTRE OF THE PICTURE ALLOW THE SUNSHINE AND DAYLIGHT TO SHINE DIRECTLY ON THE HOUSES AT THE BACK, WHEREAS PITCHED ROOFS WOULD HAVE OBSTRUCTED THE LIGHT FROM THE WINDOWS OF THE BACK HOUSES.

Here then in concrete form is our summary of post-war housing on the Continent. Not a sloping roof or a badly-lit room in the whole suburb, and yet all built economically, at costs that allow them to be let to working-class people. The Weissenhof Suburb of Stuttgart, with its houses by Corbusier from France, Frank from Vienna, Oud from Holland, and others, as well as the German architects—Behrens, Taut, Gropius and Poelzig, shows how in these countries architects have logically evolved a style of which the American architect-author, Sheldon Cheney, writes "There is the peace of simplicity here decks, terraces, sun-traps, air-baths, spaces half garden half sitting room on the flat roofs, that indicate a conviction that we should make more of the tops of our houses."

XIV.—COMPARISON WITH DEVELOPMENTS IN BRITAIN.

Now for Britain and a few comparisons between home and abroad.

There are very few modernist houses in England and practically none in Scotland; the few that have been built are privately-owned houses built by people whose knowledge of the requirements of health have led them to insist on the most up-to-date construction.

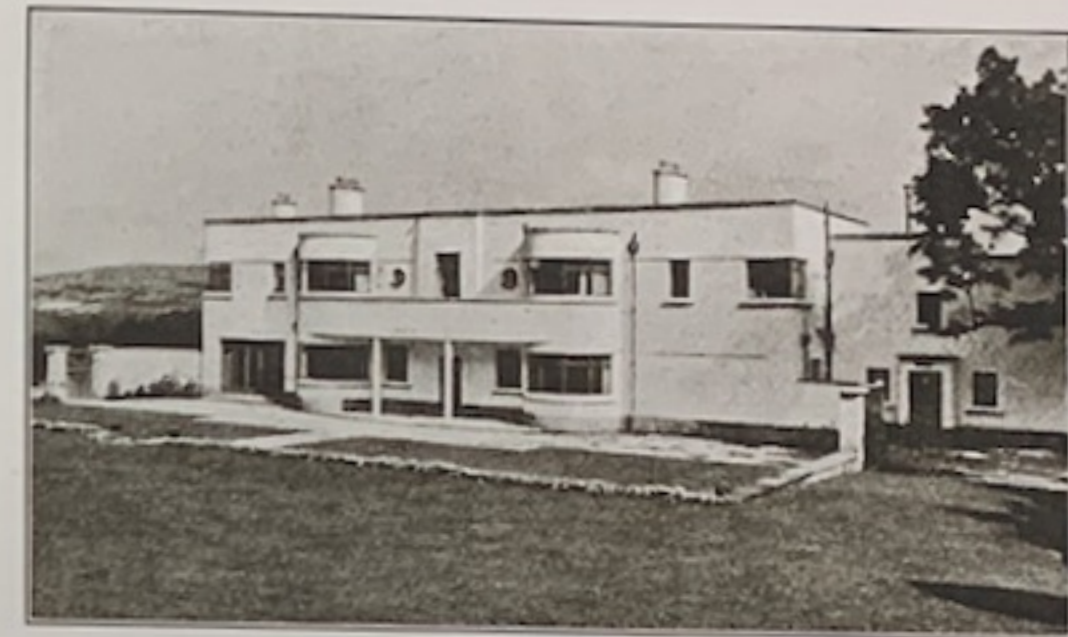
Here we illustrate some such houses :—

First, the home of Mr. Bassett Lowke, of model railways fame, designed by a Continental architect.



AN ENGLISHMAN'S HOUSE AT NORTHAMPTON DESIGNED BY A GERMAN ARCHITECT.

Our other two pictures are of modern homes in Yorkshire and Berkshire, each with flat roofs and the other essentials of modern design.



A MODERN HOUSE IN YORKSHIRE, ENGLAND.



A MODERN HOME IN BERKSHIRE. MR. THOMAS S. TAIT, F.R.I.B.A.

But these are houses designed and built for wealthier owners. Modern housing in the sense that the Continental architects and engineers have reasoned it out, has not yet arrived in the housing schemes of England and Scotland. Yet why should our working classes be deprived of the numerous advantages which accrue from the adoption of the flat roofs—advantages which we have fully explained and corroborated in the third part of this book, pages 79 onwards.



A PHOTOGRAPH OF ONE OF THE CRITTALL HOUSES MENTIONED ON THIS PAGE.

The only case within our knowledge where this has been done for even a middle class population in England, is at the Crittall Cottages near Braintree, Essex, designed by one of England's foremost architectural firms, Sir John Burnet & Partners, and Mr. James S. Tait, F.R.I.B.A., who has dispensed with "frilly gables, nooks, and pretty-pretty roofwork, and gone out for the simple beauty of utility."

And in Scotland there is the contract for the Glasgow Corporation at Carntyne, near Glasgow, one block of which is illustrated on page 78 and which is more fully mentioned and illustrated in Section XXIII.

These experiences at home only corroborate the evidence from abroad—the evidence in favour of flat roofs and cavity walls. After all, the fact that there is not a single pitched roof in some fifty illustrations of housing in twelve different countries, that we have included in the last few sections, is no mere coincidence. This feature, and that of cavity walls—which do not, of course, show in photographs—recur so steadily that they cannot be accepted as coincidences, as mere whims of their designers. These two features—the very frequent provision of cavity walls and the universal adoption of flat roofs—are those to which we are devoting the next seven sections, demonstrating that they are the definite results of thoughtful design in all these countries, each faced with the same problem—the necessity for the economical provision of healthy houses.

We are not of the number, like Tolstoy's character, who try to find all treasure abroad and despise the good things that exist at home. In this respect we should point out at once that the limitation of buildings to two storeys for cottage and flatted types and three storeys for re-housing types is an excellent principle which we in this country have been fortunately able to maintain in many of our towns. It is in accordance with the papers read by Gropius of Germany, and Neutra of America at the International Congress of Modern Architects in Brussels, 1930; a Congress attended for the most part by the very architects whose work we have seen pictured in our photographs of the Stuttgart Colony. These architects appreciate that the lower houses are most desirable, though they have not always been able to adopt them in the crowded cities of the Continent.

But while they envy the finances that allow us in Britain to erect two and three storey buildings, they marvel at the inconsistency that leads us to nullify the benefits by using up the height of another storey with the unnecessary projection of an old-fashioned pitched roof. All very quaint and suitable for old-world cottages in the country, say they, but how stupid to stick to the less advantageous though more conventional slated or tiled roofs in built-up areas where every such roof is an obstruction to the all too scarce sunlight that brings health and happiness.

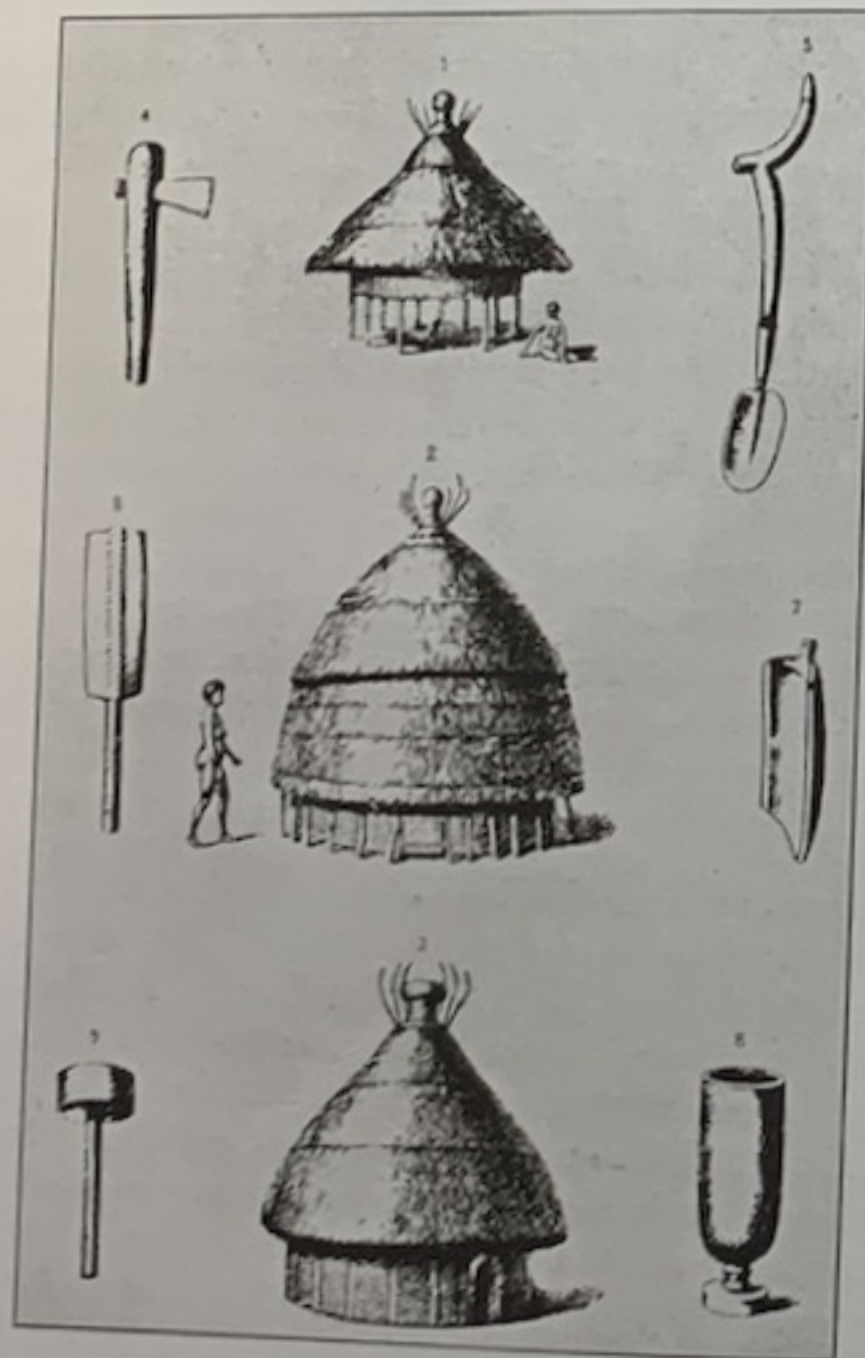
Yes, some features of our home housing are good, such as the limitation of the number of storeys, the use of brick and rough-cast walls, and some excellent internal arrangements of rooms and fittings such as have been designed by the Housing Director of Glasgow and some other local authority architects. But let us keep the good things we have and yet adopt the good things we can learn from others. And chief of these latter are the adoption of flat roofs together with cavity walls for our housing schemes. These two features may sound quite different and separate ideas, but we shall show that they are twin results of a common reasoning, and as well as each being of very definite value in itself, they add to each other's value.

So much for our review of the methods adopted at home and abroad, and now let us pass on to the theoretical and, no less, the practical advantages of the two features we are discussing.

The next seven sections are devoted to the discussion of nearly a score of such advantages, each with the corroboration of experts—medical men, scientists and housing authorities; and to the reader who has followed us, first through the statistical evidence of the need for new houses, and then through the pictorial evidence of the trends in housing abroad, we would commend the pages that follow. In them we have explained and confirmed the reasons that have led these European architects individually and universally to the adoption of the features which we advocate—flat roofs and cavity walls. We further show that these reasons hold good for this country which is faced still with the same problem of providing economic but healthy housing, in climatic conditions no more severe than those of Stockholm or Hamburg, no less favourable than those of Vienna or Frankfurt.

XV.—THE QUALITIES OF A SUCCESSFUL FLAT ROOF.

BEFORE we proceed to the enumeration of the direct and indirect advantages of the type of construction which embodies these two principles of the flat roof and the cavity wall, let us glance briefly over the history of flat roofs—or rather, roofs with a very flat slope—in this country. The flat roof has not previously been adopted simply because we had not the materials to make it thoroughly satisfactory.



EARLY DAYS OF PITCHED ROOFS; IN FORM THESE ARE THE SAME AS MANY ROOFS BEING BUILT EVEN STILL. SURELY SOME FUNDAMENTAL IMPROVEMENT IS POSSIBLE IN THIS AGE OF INVENTION.

Thatch was first used because the primitive people used the only materials which lay to their hands and which they had the intellect to visualise as useful; and the thatch was laid at an angle because otherwise the rain would come through. But surely the methods and results of our stone-age ancestors pictured on this page, should by now be replaced by more up-to-date arrangements. It is as much an anachronism to put pitched roofs on our houses to-day as it would be to put a slated roof on a motor car.

In the past, flat roofs have not always been successful, just as the motor car or any other development had its early days of only partial success before it eventually reached a state of practical

perfection. And, just as in the case of any other development, the only requirements to make flat roofs really successful were experience and experiment. That is why the flat-roofing must be carried out by a firm that has not only the theoretical knowledge but practical experience of the construction of efficient flat roofs.

Of course, sheet lead and sheet zinc have been successfully used for many years as roof coverings; but in addition to other disadvantages, these are so expensive as to be quite outwith the possibility of use for popular housing. Really efficient materials for an economical flat roof have only been evolved in comparatively recent years. Partly this has come about from the modern developments of oil refining processes in connection with petroleum oils, partly from research and experiment in the use of bitumen and asphaltic compounds for road surfaces; but largely from the realisation of the benefits of flat roof construction, and the zealous efforts of certain health and housing enthusiasts to evolve a really efficient roofing surface at costs that would bring these advantages within the reach of the great body of the people.

A study has been made, not only of the materials and methods of laying the roof surface itself, but also of the points which must be observed in the construction of the timber work of the roofs, underneath the impervious and indestructible surfacing. The degree and arrangement of the slight gradients necessary to run off rain water have also been studied, and the most efficient method of obtaining these gradients has been discovered. Each roof plan should be considered separately, and the taper pieces to be laid on top of the joists designed to achieve the required gradients in the best possible way. Not only that, but consideration must be given to the most suitable type of boarding to be laid under the surfacing coats to ensure a really successful job. The question of covering concrete roofs—quite a different problem from the covering of timber roofs—must also have attention.

All this apart from the primary necessity of evolving a surfacing that should combine a large number of qualities. It requires in the first place to be absolutely impervious to all climatic conditions, water, snow, dust, or any of the acid impurities in city atmospheres. It has to be durable, have elasticity and expansion without any danger of deterioration; it must further be incombustible and fire-resisting, and it must have an upper surface that can be used as a roof garden or for recreation without any likelihood of damage. Further to these necessary qualities of the timber roof framework and of the roof surfacing itself, there is required considerable thought in the design of the edges and corners of the roof, and the drip boxes for the carrying off of the rain water.

These points are only a resumé of the features that must be embodied in a successful flat roof to which access is to be provided, but they will be sufficient to show that it was by the incomplete consideration of these that our fathers were not always perfectly successful with their flat roofs. These are the points which constitute our answer to the few ultra-conservative critics who would condemn the modern flat roof untried, because they recall a flat roof which once leaked, some forty or fifty years ago. Again we have the parallel to the case of the motor car which had its early enemies because of its early faults; yet by the perseverance of those who realised its advantages it has become a reliable and indispensable adjunct of our every-day lives.

Yet even the very early bitumen or asphalt roofs were not always unsuccessful—as witness the report of the Committee on New Methods of House Construction which speaks of—"Flat roofs of asphalt or similar material, some of them over 110 years old."

The Sunlit Construction Roofs, protected by Patents, now have all the qualities which we have mentioned above as requirements. We could write this whole volume on the details of the methods and materials that have been found most efficient, but we content ourselves with the illustrations we publish and with the following brief description of this roofing.

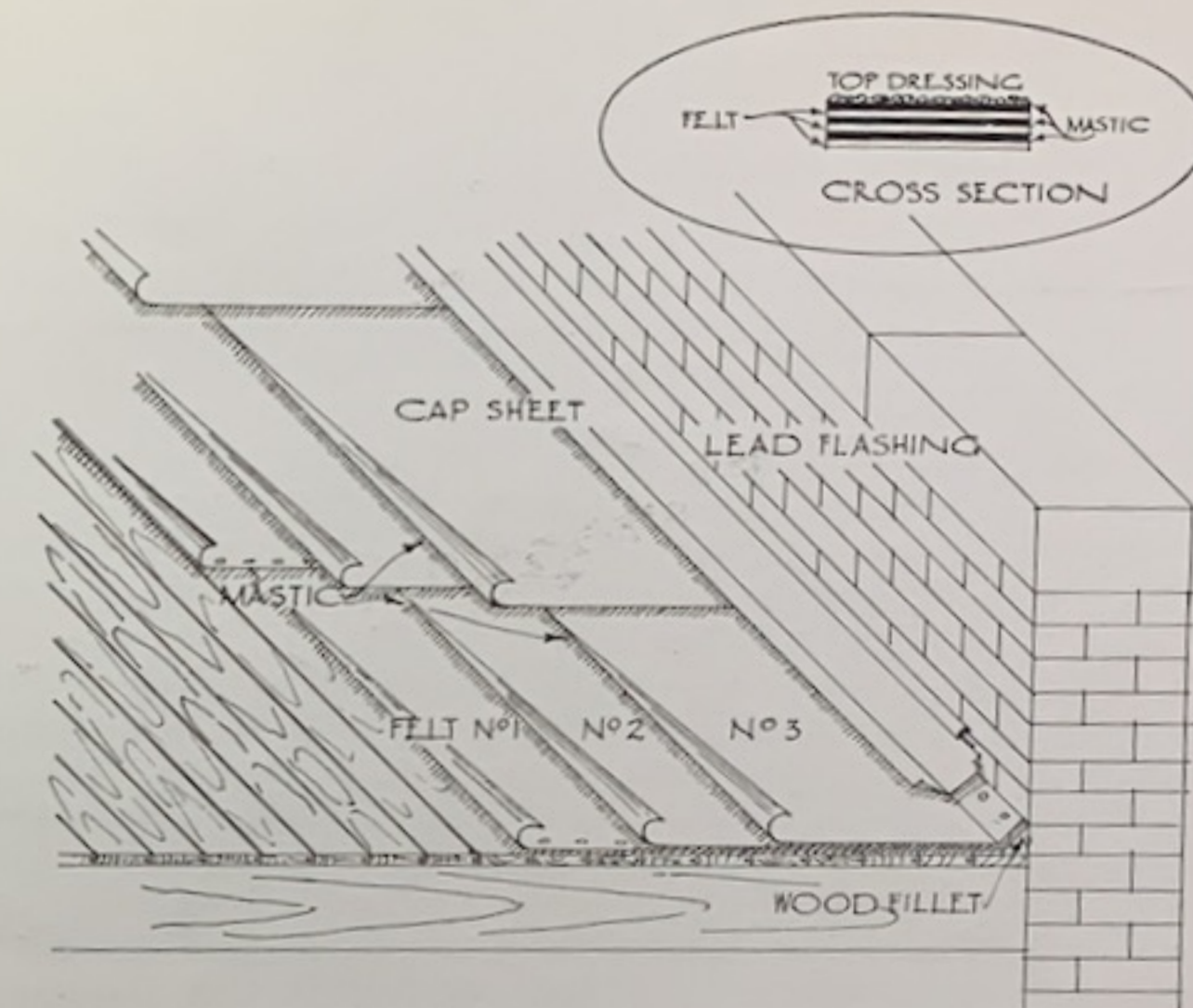
In the case of a timber joisted roof, the taper pieces designed to provide the required gradients are nailed to the ceiling joists, and across them is laid thick specially wrought boarding. In the case of a reinforced concrete roof, the upper surface is formed to the required gradients, and a layer of fibre board is laid to minimise the risk of condensation which might tend to occur with certain solid concrete roofs.

In each case there is then laid the roofing system of sectionally laminated felt interspersed with heavy coatings of bituminous mastic; the layers of felt are laid with over-lapping joints and severally bound together with the hot mastic. This binding agent is quite free from tar and adheres tenaciously to the felt courses; yet the natural stable oils which it carries ensure ample flexibility to allow for reasonable settlement of the building without fear of even the slightest cracking of the roof surface.

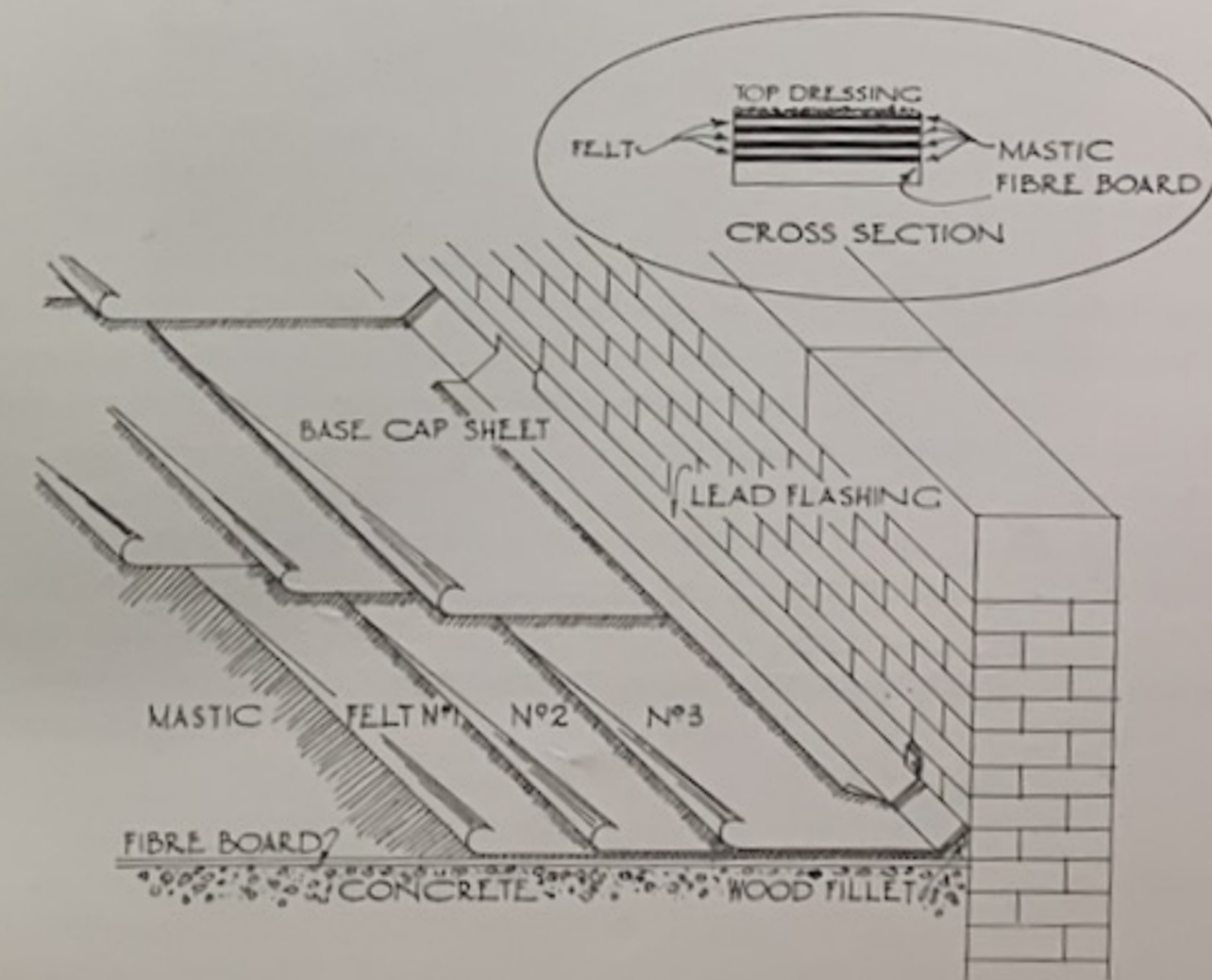
This can be finished in either of two different forms, both of them suitable for standing chairs, tables, flower-pots and so on, to obtain a roof garden effect. One kind of finish gives a smooth hard surface, in appearance not unlike the finished surface of some of our fine new roads; the other is finished with a weathering layer of red blaes or grey granite chips, solidly rolled in and looking very like a garden path, thus also heightening the roof garden effect.

The resulting roof is absolutely impervious and quite indestructible, and possesses the other qualities which we have noted as being necessary for flat roof construction. It is the ideal type of roof to afford the advantages enumerated in Sections XVI.-XXI., both from the health point of view and the practical and economical view-points. With regard to the latter point, we need only say that in place of the usual six months guarantee which goes with tiled or slated roofs, these flat roofs can be built to carry a free maintenance guarantee of as much as fifteen years—a guarantee that no commercial firm would give unless convinced of the efficiency and durability of their product.

Having satisfied ourselves that efficient and yet economical flat roof construction is eminently practicable, provided the firm responsible for the work has the necessary knowledge and experience to carry it out successfully, we can now pass on to discuss the advantages that accrue from flat roof construction, especially when combined with cavity walls, advantages which are applicable to Schools, Hospitals, and other large buildings, as well as to housing construction. There are five main points of advantage from the health aspect, as many again from the view-point of economy, and still more in number from the practical and structural points of view. We shall proceed therefore to consider each of these advantages and then review the splendid appearance of these healthy modern houses, with their increased possibility for varied elevations, noted particularly on pages 121 to 125.



SKETCH OF FLAT ROOFING SYSTEM ON TIMBER JOISTS.



SKETCH OF FLAT ROOFING SYSTEM ON CONCRETE ROOFS.



ONE BLOCK OF GLASGOW'S 500 FLAT-ROOFED HOUSES BEING ERECTED AT CARNTYNE FOR THE GLASGOW CORPORATION BY MESSRS. JOHN M'DONALD (CONTRACTORS), LIMITED.

XVI.—HOW SUNLIGHT BRINGS HEALTH OVER THE FLAT ROOF.



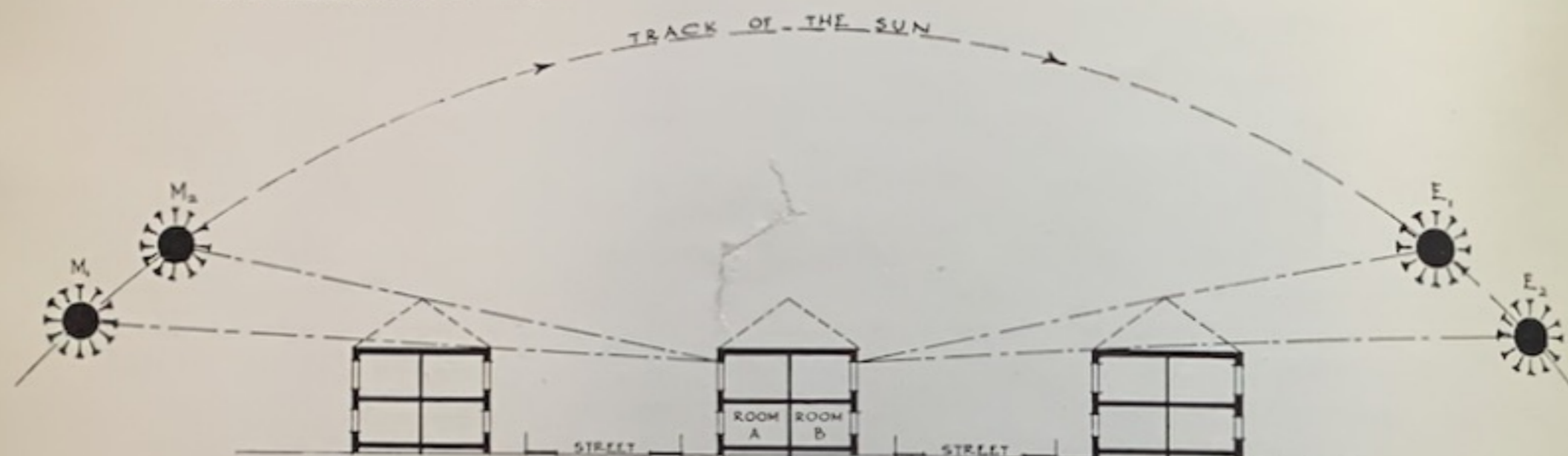
A REMARKABLE PICTURE ILLUSTRATING HOW PITCHED ROOFS OPPOSITE OUR WINDOWS OBSTRUCT SUNSHINE AND DAYLIGHT MUCH MORE THAN DO FLAT ROOFS. NOTE THE FIRST HOUSE ON THE LEFT WITH ITS WINDOWS COMPLETELY IN THE SHADOW OF THE PITCHED ROOF OPPOSITE IT, WHILE AT THE SAME INSTANT THE OTHER THREE HOUSES ON THE LEFT, BEING OPPOSITE FLAT ROOFS, ARE BATHED IN SUNSHINE.

SIR GEORGE NEWMAN has stressed the need for the prevention of disease as distinct from the curing of it, and surely the most effective way of obtaining this object is to give the people the maximum possible facilities for health and fitness in their home lives. So we shall deal first with the health advantages of flat-roofed cavity-wall construction.

The first point in favour of flat roofs is the point which we shall perhaps most clearly express in the words used by Sir William Arbuthnot Lane, the famous Health Authority, who wrote an article on flat-roofed houses in the *Daily Mail* under the title "Secrets of Good Health." He said "The roofs being flat, they do not impede the entry of the sunlight into the rooms of the houses opposite to the same extent as do the higher pitched roofs, and thus the sunlight reaches these rooms for the maximum number of hours every day, the added hours being in the morning and evening when the home is most used." Here in a few words this well-known medical man has put the point that is so graphically illustrated in our picture at the top of this page.

The sun is setting in the evening over to the right of the picture and already the shadow of the pitched roof of the first house to the right has crept above the lintel of the upper floor windows of the house opposite it—the nearest house on the left—both upstairs and downstairs rooms of which are in the shadow. But at the same instant of time, for that same position of the sun, the windows of the other three houses on the left of the street are still bathed in sunshine streaming over the flat roofs of the opposite houses, the shadow of which has not yet risen above the ground floor window sill.

This curtailment of the hours of direct daylight and possible sunshine in our rooms due to the old pitched roofs opposite them takes place not only in the evening but also in the morning, as is illustrated in our diagram.



A DIAGRAMMATIC SECTION THROUGH THREE ROWS OF HOUSES, WITH STREETS BETWEEN RUNNING NORTH TO SOUTH.

This diagram shows a section through three houses at the usual distance apart, and the sun is rising over on our left and travelling to the right. Now if this left-hand house has a flat roof, the sun gets over the top of the roof as soon as it reaches position M_1 , and the sunlight shines directly into the windows of room A in the middle house, whereas if the left-hand house had a pitched roof the sunshine would not get in these windows till the sun had risen to position M_2 .

Then again in the evening, whenever the sun reached position E_1 a pitched roof on the right-hand house would stop its direct light entering the windows of room B of the middle house, but with a flat roof not until the sun had sunk to position E_2 would its direct light be cut off.

Thus both when the sun is rising and when it is setting the flat roof impedes it less than does the slated or tiled roof on a building with the same height of eaves.

Before we proceed to discover the amazing extent to which the old-style pitched roofs cheat our houses of the all too precious sunlight, let us first quote from an article entitled "Sunlight for All" in the *New Health Magazine* of October, 1927—

"Medical men to-day, and indeed the public generally, are much interested in means of using the undoubted beneficial properties of sunlight in curative healing. Owing to the comparatively few hours of sunlight in our climate we have spent much time and ingenuity in the invention of electric lamps which will give us rays possessing the curative properties of natural sunlight; and we have not been unsuccessful in this, several types of lamps having been evolved which are satisfactory, but in every case expensive. We are forced to the conclusion that artificial sunlight in the home is at present a luxury for the rich, and in the case of the large body of the people we must confine ourselves to the utilisation of the natural sunlight we have.

In the housing of the people some attention has been paid to the arranging of the lay-outs so that the sun shall be able to enter the windows of the houses. The most favourable direction for the intersecting roads has been discussed, and a report issued by Sir John Tudor Walters' Committee agrees that roads running N.E. to S.W. are most advantageous for houses of the type now being erected throughout the country" (see appendix).

COMPARISON OF HOURS OF SUNLIGHT ANNUALLY WITH PITCHED ROOFS AND FLAT ROOFS.

Graph showing number of hours of direct sunlight unobstructed from house windows in the two cases 'FLAT ROOFS OPPOSITE' and 'PITCHED ROOFS OPPOSITE.' The upper curve in sunlight colour shows an average of nearly two hours extra every day in the year, allowed by the adoption of Flat Roofs.

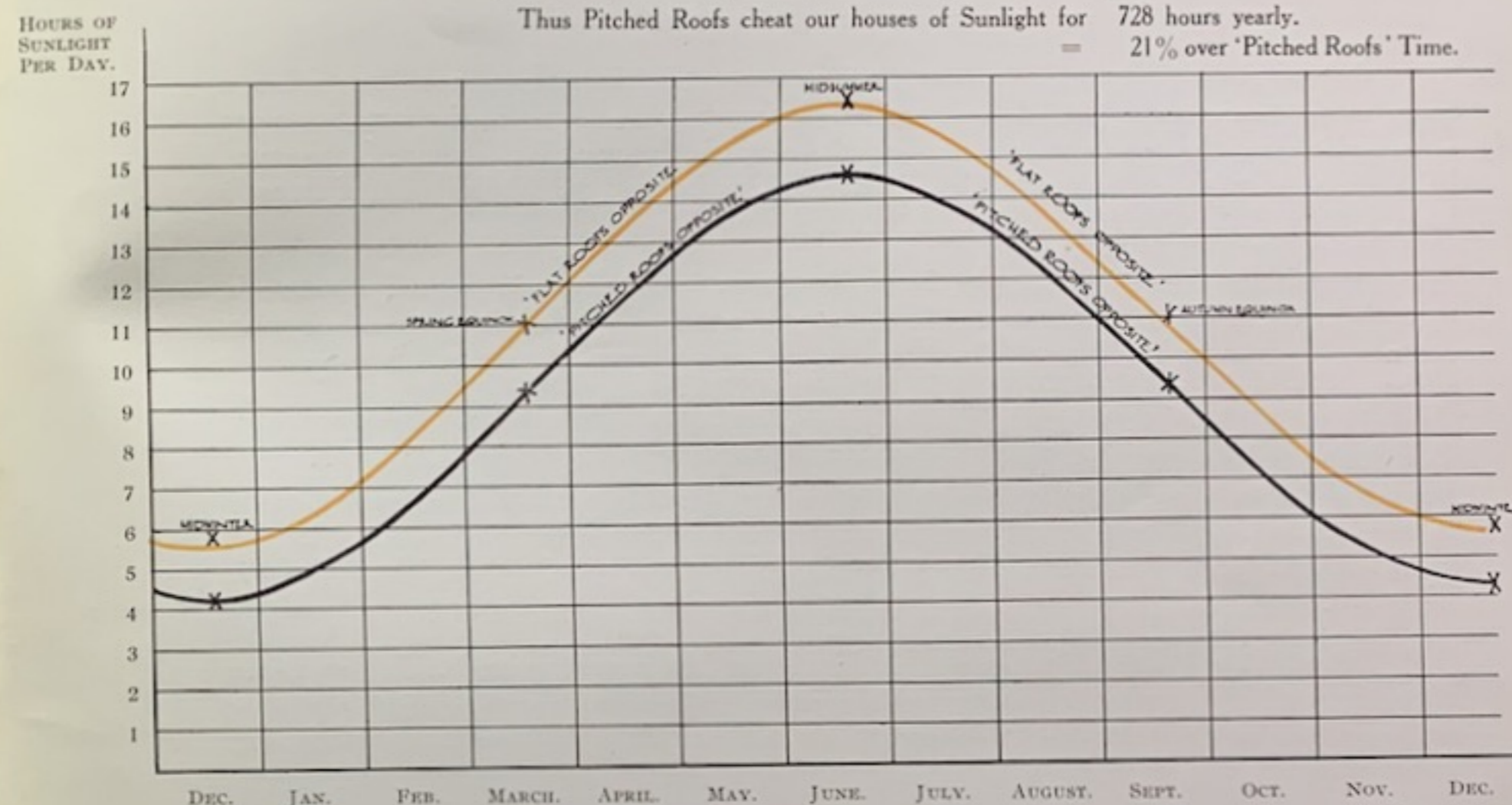
[Latitude 56° N.; Direction of Street N.N.E. to S.S.W., level; Two-storey buildings 70 feet apart.]

Number of Hours Direct Sunlight with 'Flat Roofs Opposite,' = 4129 per annum.

" " " " 'Pitched Roofs Opposite,' = 3401 " "

Thus Pitched Roofs cheat our houses of Sunlight for 728 hours yearly.

= 21% over 'Pitched Roofs' Time.



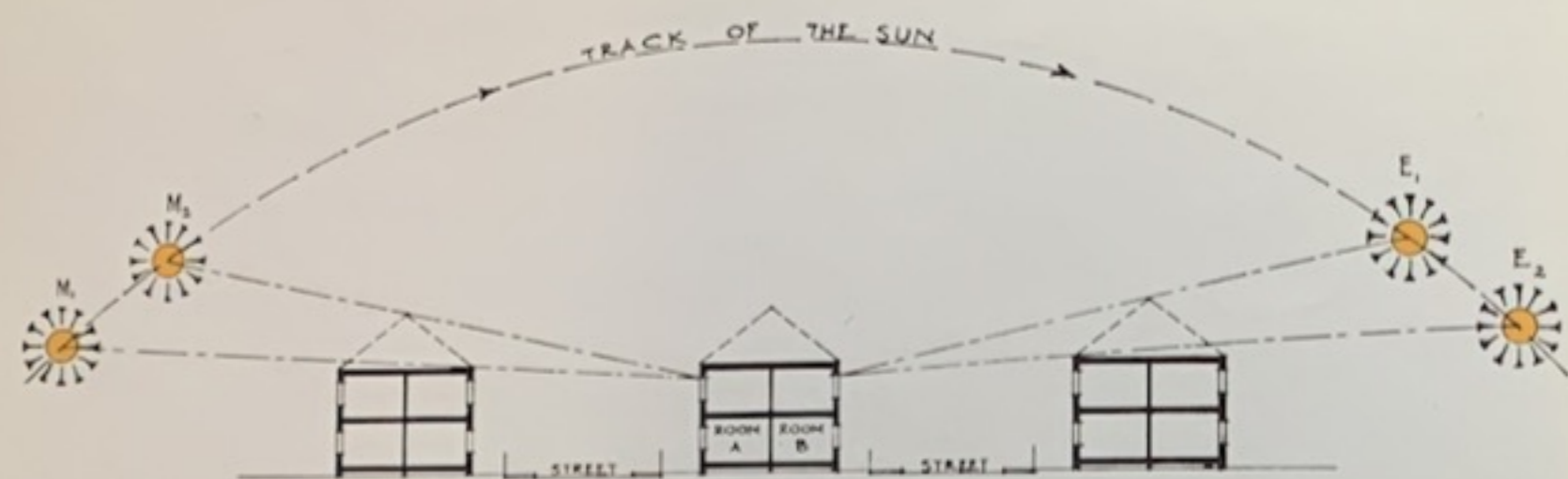
The article continues:—

"Attention has also been paid to the minimum distance between houses to ensure that the ridge of the house opposite shall not prevent sunlight from entering the windows of our houses."

But with the same width of streets and with the same height of eaves, here are comparative curves drawn from the results of astronomical calculations to find the number of hours of direct daylight (and therefore potential sunshine) entering our windows in the two cases of 'flat roofs opposite' and 'pitched roofs opposite.' The lower curve shows the maximum hours of sunlight possible with pitched roofs throughout the year, while the upper curve registers the greater number of hours possible with flat roofs, in otherwise similar conditions. From these curves we see that there is nearly two hours difference every day in the year, approximately one hour in the morning and another hour in the evening. Thus the uselessly projecting pitched roofs of our buildings annually cheat our houses of 728 hours of sunlight, which is 21 per cent. of the total possible sunshine throughout the year.

What blind inconsistency is this that makes us strive for the desirable regulations to limit building heights and then to negate the results by throwing the "useless height of pitched roofs into the eye of the sun"?

COMPARISON OF INSOLATION OF ROOMS
OPPOSITE PITCHED & FLAT ROOFS
ON SAME HEIGHT OF EAVES



SPRING & AUTUMN EQUINOX

A PITCHED ROOF B

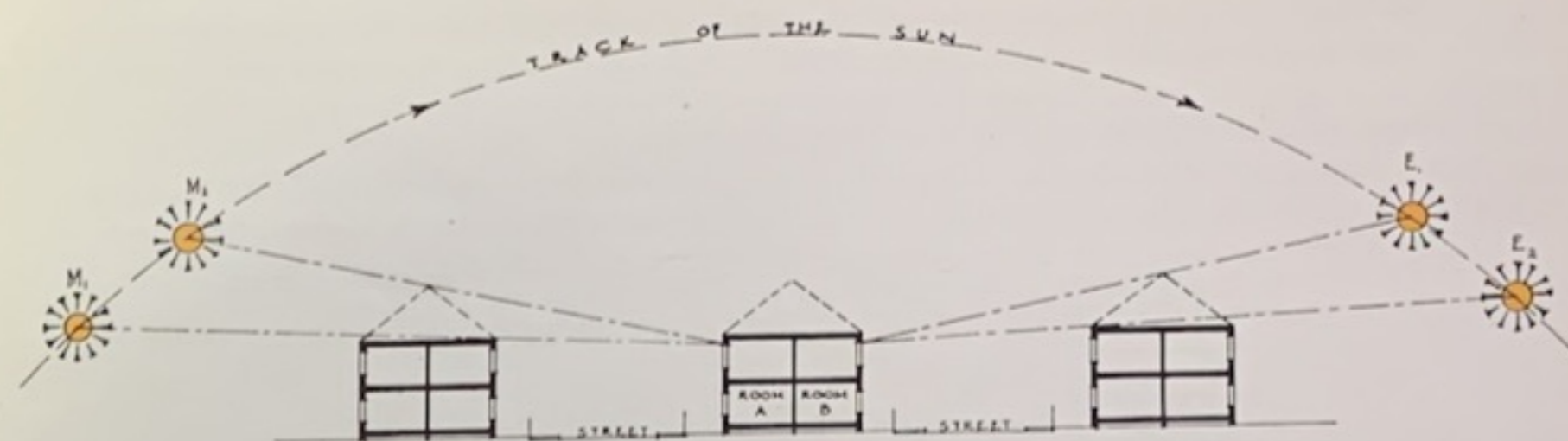


A FLAT ROOF B



PERSPECTIVE VIEWS OF ROOMS ON EACH SIDE OF THE HOUSE AT SPRING & AUTUMN EQUINOXES
UPPER VIEWS SHEW SUNSHINE ON WALLS OPPOSITE PITCHED ROOFS
LOWER - - - - - FLAT
NOTE: MUCH GREATER WALL AREA ILLUMINATED IN CASE OF FLAT ROOF

COMPARISON OF INSOLATION OF ROOMS
OPPOSITE PITCHED & FLAT ROOFS
ON SAME HEIGHT OF EAVES.



MID WINTER

A PITCHED ROOF B

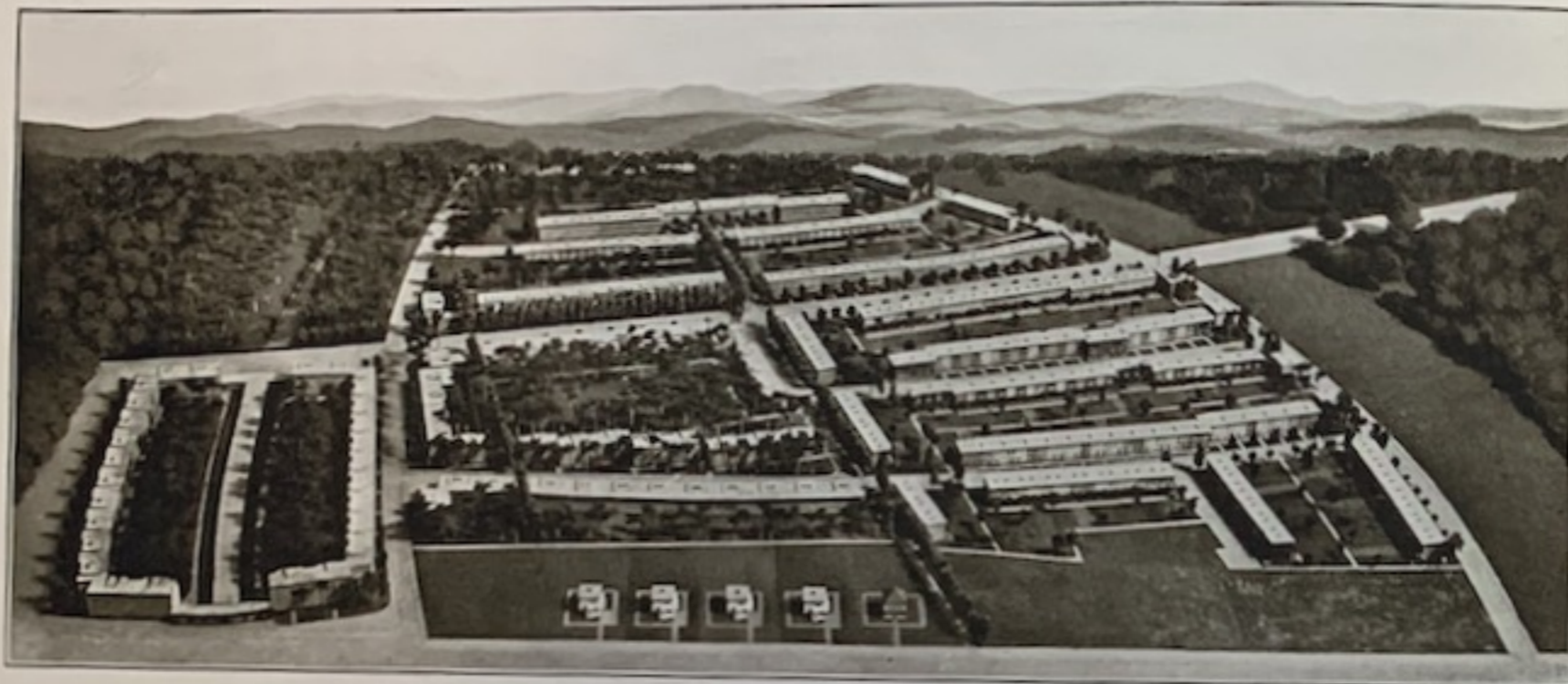


A FLAT ROOF B



PERSPECTIVE VIEWS OF ROOMS ON EACH SIDE OF THE HOUSE AT MID WINTER.
UPPER VIEWS SHEW SUNSHINE ON WALLS OPPOSITE PITCHED ROOFS
LOWER - - - - - FLAT
NOTE: MUCH GREATER WALL AREA ILLUMINATED IN CASE OF FLAT ROOF

Admittedly this point does not bear any reference to an isolated dwelling where there are no nearby roofs to obstruct the sunshine and the daylight from the windows, but we are concerned with the housing of the people in large centres of population where the area is necessarily built up fairly closely and to which all that we have written is applicable. The comparison of the two pictures on this page shows contrasted housing developments in Berlin and Glasgow, both fairly closely built up, but the Berlin Scheme shows the adoption of flat roofs whereas the Glasgow Scheme is a mass of pitched roofs each shutting out the sunlight from the neighbouring houses.



AERIAL VIEW OF A FLAT-ROOFED HOUSING SCHEME IN BERLIN'S BEAUTIFUL GRUNEWALD FOREST. COMPARE THIS WITH THE PICTURE BELOW.



A PANORAMIC VIEW OF KNIGHTSWOOD HOUSING SCHEME, GLASGOW. THE LAY-OUT AND HOUSE-PLANS ARE SPLENDID, BUT NOTICE THE MASS OF PITCHED ROOFS, EVERY ONE OBSTRUCTING LIGHT FROM THE HOUSES AROUND IT.

The comparison graphically demonstrates the adoption in Germany of the flat roof for this, amongst other reasons, while in this country we still obstruct the even rarer sunshine by the useless projection of slated and tiled roofs. Why should those of our people who most need the health-giving benefits of sunshine and daylight be deprived of them by thoughtless design?

XVII.—THE USE OF THE ROOFS—ROOF GARDENS, ETC.

Now while it is of great value to allow sunshine and daylight to penetrate into the rooms because of its light and warmth, yet the scientists tell us that not all of the health-giving rays of the sun penetrate ordinary glass, and such glass as does allow them to pass has not yet come into universal use.

So an even more vital necessity for healthy homes is to have access to the natural sunlight in the open air.

The Chairman of the New Health Society says—"To achieve complete health and become an A1 Nation we must have the opportunity in our homes to draw life-power from God's greatest gifts to humanity, Sun and Air."

The Medical Research Council states—"Only our house-tops are really on the earth's surface ready to receive the beneficial rays of the sun."

Surely the solution that presents itself is to adopt these house-tops so that the people can have access to them with sufficient privacy to enjoy sun and air baths when they so desire; even for those of us who have not yet realised the benefits of sun and air baths, the provision of a private open space for recreation or exercise would most assuredly prove a welcome addition to the amenities of the home.

Up till now, we in this country have missed altogether the vast possibilities of the use of our dwelling house roofs. In our cities, lack of space has always been the drawback to the building up of a healthy community. Here we have the solution to this problem; the man has the place to develop his health and enjoy the leisure of the long summer evenings literally at his bedroom door, the youth has his gymnasium in the open air and the mother is happy watching the kiddies play in safety from the traffic of the streets.

One thing only we should have to do:—Press still further for the abolition of the once-worse smoke nuisance.

Already this is being done by the adoption of smokeless fuels, smoke filters and purifiers, and other means of avoiding wasteful as well as unhealthy smoke pollution of the atmosphere. Still more will be done when the Grid System of the Electricity Commissioners is supplying cheap electric power all over the countryside; and we can look forward with Lord Newton "to the days when our city atmosphere shall be practically free from coal smoke, because of the ever growing use of more economical and more healthy fuels."

In Miss Marion Fitzgerald's book 'The Smokeless City' she shows how "Factory smoke is steadily decreasing owing to the growing use of electricity."

On this point also, Sir Oliver Lodge writes us—"I hope that your campaign for sunbathing establishments on the roofs of houses may progress The extension of electricity is growing, and so a better air for towns will arrive in due time," and this arrival of better air in towns to which Sir Oliver Lodge looks forward, would certainly be hastened when people realised that their flat roofs could be such idyllic havens of peaceful rest and healthy comfort if they each did their bit to carry the Smoke Abatement campaign still further.

As Sir William Arbuthnot Lane has said on this point alone—"It needs little imagination to forecast the benefit that would accrue to the workers of our great cities by the adoption of flat roofs."

Then Dr. C. W. Saleeby, Chairman of the Sunlight League and himself the Leader of the Smoke Abatement Campaign in England, writes us—"I am entirely with you in advocating flat roofs and foresee great possibilities in their use, especially when the Smoke Abatement Campaign is still further successful."

Sir Leonard Hill writes—"Exposure to sunlight and cool air converts sick and weakly children into splendid robust youngsters."—So there is no lack of authoritative opinion supporting us in these projects for the increased health of the community.

In realising the advantages of flat roofs for our buildings, we are only moving along parallel lines to our contemporaries in Scandinavia, as well as other parts of Europe and America; our review of foreign housing in pages 38 to 69 leaves no doubt of the universal adoption of flat roofs there, and to show that this is a conscious effort for increased health facilities, we may quote from various sources.

Walter Gropius of Berlin, reading a paper to the Continental Housing men of all countries at the International Congress of Modern Architects in 1928, pointed out that—"The healthy human being in his house in the first instance requires the maximum possible amount of air and light." Or the words of the President of the Work Soviet in Moscow—"We want to take in hand the planning of greater Moscow, when a new town-space will be created—that of the roof gardens; what glorious prospects of the utilisation of the roof tops."

Mr. Howard Robertson writes of the new flat roofed houses in France—"As regards light and air-space they mark a great advance."

And to any who would say that these remarks do not apply to this country we would point out our illustrations from the far North City of Stockholm on page 64, we would refer them to the sun bathing at Malären in Sweden, we would remind them that even the Scottish Cities of Edinburgh and Glasgow are not as far north as Stockholm, and indeed are nearer the latitude of Berlin.

Even apart from all that, surely it is obvious that the less sunshine climatic conditions afford us, the more carefully certain must we be to make full use of every available minute of it.

We trust that the foregoing pages have fairly and forcibly stated the case for the utilisation of our roofs everywhere, but even more imperatively in such cases as slum clearance schemes where no ground gardens are available. Robins Millar, whose play 'Thunder in the Air,' is now famous, wrote of flat roofs—"The problem of surfacing for this purpose (the use of the roofs) seems to be overcome nowadays, and the chances which flat roofs offer for enjoyment of sunlight either in cottages or tenements are worth having in our cities."

Already flat roofs are coming into uses that could be so illimitably extended. Our pictures show how flat roofs in this country are adapted as roof gardens, some of them with a particularly good show of flowers, probably because there are no neighbours' hens or dogs to come through the fence and destroy them. The fourth roof garden picture is perhaps rather elaborate, but it would be all the more easy to have a simple scheme like the photograph (at the foot of the opposite page), of a roof garden in Scotland on a building of which the present writer was the architect.



A PHOTOGRAPH SHOWING HOW SPLENDID A ROOF-GARDEN REALLY CAN BE.



THREE IMPRESSIONS OF ROOF-GARDENS ALREADY BEING USED IN LONDON.



A SIMPLE YET PLEASING ROOF-GARDEN ON THE ROOF OF A BUILDING DESIGNED BY THE AUTHOR.

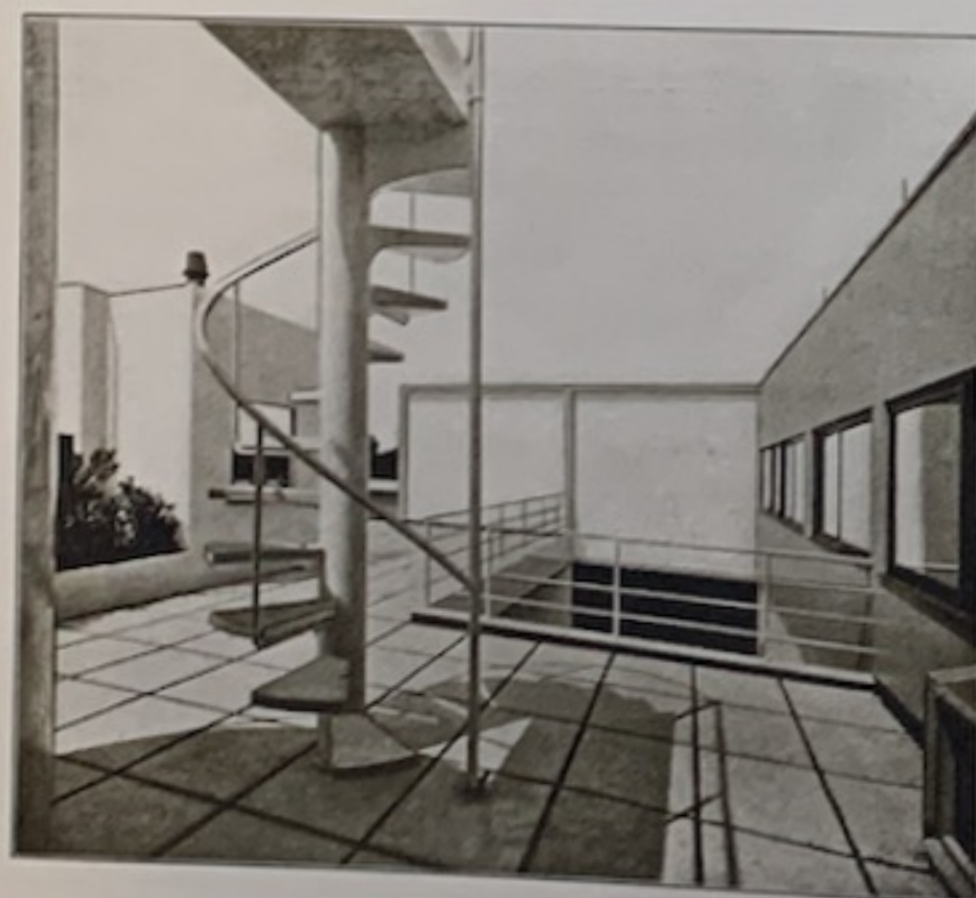
Flat roofs can be used as sun terraces as in these four illustrations of Continental houses.



A CONTINENTAL ROOF-GARDEN.



THE HOUSE FOR OUT-DOOR LIFE ; A STUTTGART ROOF-GARDEN.



A ROOF-GARDEN WITH AN AMUSING HINT OF A SHIP'S PROMENADE.



A PLEASANT ROOF-GARDEN, PRIVATE AND SECLUDED.



A SUN-LOUNGE IN THE OPEN AIR.
BOTH SUN AND AIR BATHS HAVE TREMENDOUSLY BENEFICIAL EFFECTS
ON THE HEALTH OF THE HUMAN BODY.

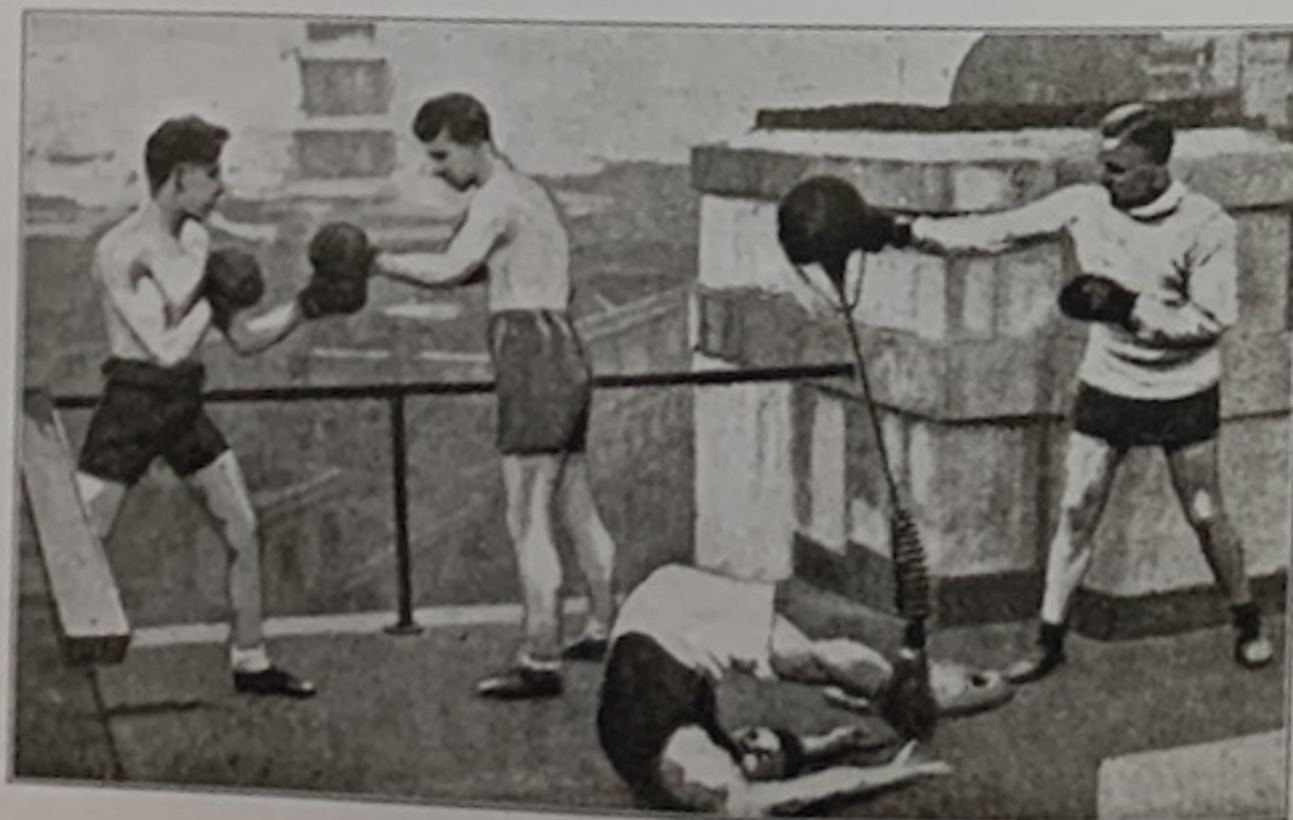
Flat roofs can be used for sun bathing for either children or grown-ups, as in our two photographs, one being of the kiddies on the roof beach of a London hospital where Dr. Ofenheim reports that the convalescent period has been halved by the open-air playground in the privacy and safety of the roof ; the other shows how grown-ups too, can find health and pleasure on the sun-lounges of the flat roofs.

Again, flat roofs are used for putting greens—maybe if we all had this chance of putting practice we could find a Britisher to bring one or other of the British Golf Championships back from America!



A ROOF-TOP PUTTING GREEN, WHERE THE INHABITANTS OF THE BUILDING MAY PLAY FOR PLEASURE OR PRACTICE.

Below is a flat roof adopted as a gymnasium and a boxing ring; while Professor Ashmole has a bathing pool on his flat roof, which becomes a skating pond in winter, like this one in the opposite photograph from Holland showing a school roof flooded and frozen over, in use as a skating rink. If all the schools did this there would doubtless be a considerable improvement in the winter attendances!

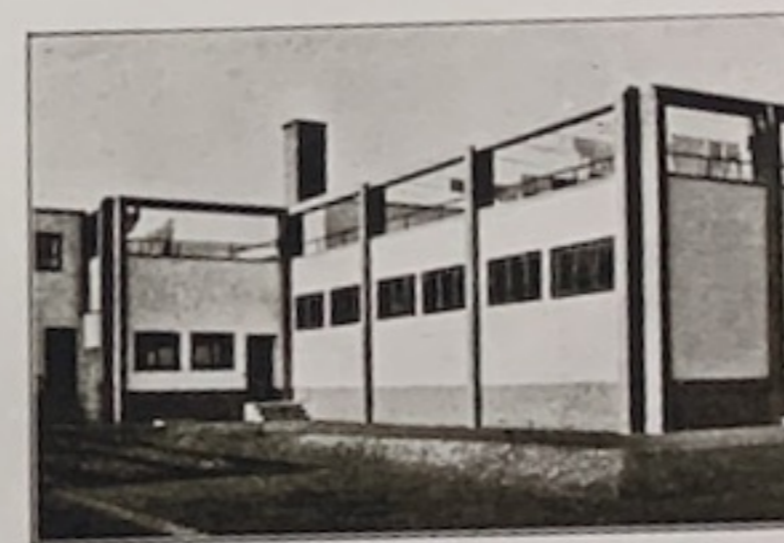


A FLAT ROOF AS A GYMNASIUM.



A WINTER SCENE FROM HOLLAND; SKATING ON A ROOF-TOP ICE-RINK.

In Paris flat roofs are used for clothes drying in the cleaner air up above, as we can see in this last picture.



DRYING CLOTHES ON THE ROOF.

Elsewhere they are being used for shooting ranges, for midget golf courses—manifestly there is a different use for them for the different tastes of each individual.

On schools and hospitals and other large buildings too, they can be used as pictured on pages 124 to 129. Let us therefore make the full use of the three dimensions we have—a more immediately practicable project than the investigation of the hypothetical fourth dimension.

These two points :—the much lesser obstruction of sunlight by the flat roofs than by pitched roofs, and the infinite possibilities of the use of the flat roofs for healthy recreation and exercise—are the two points which were most particularly stressed in the *Daily Mail* article on flat-roofed houses, and are perhaps the chief of the five great health-giving advantages of the construction. They are probably sufficient in themselves to warrant the adoption of houses so eminently designed for the maximum health facilities, yet they are not all, and we shall now consider further advantages from the all-important health aspect of popular housing.

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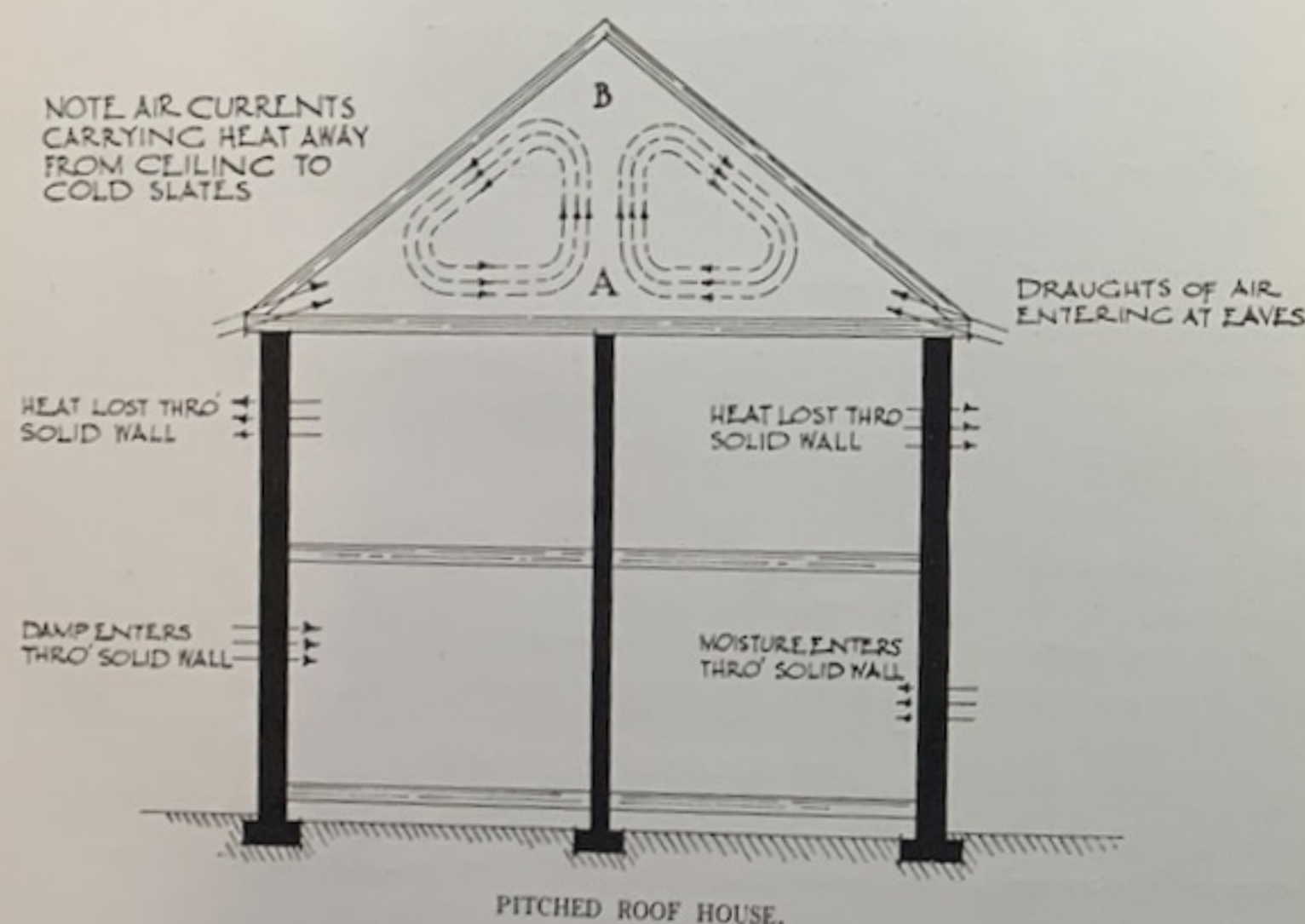
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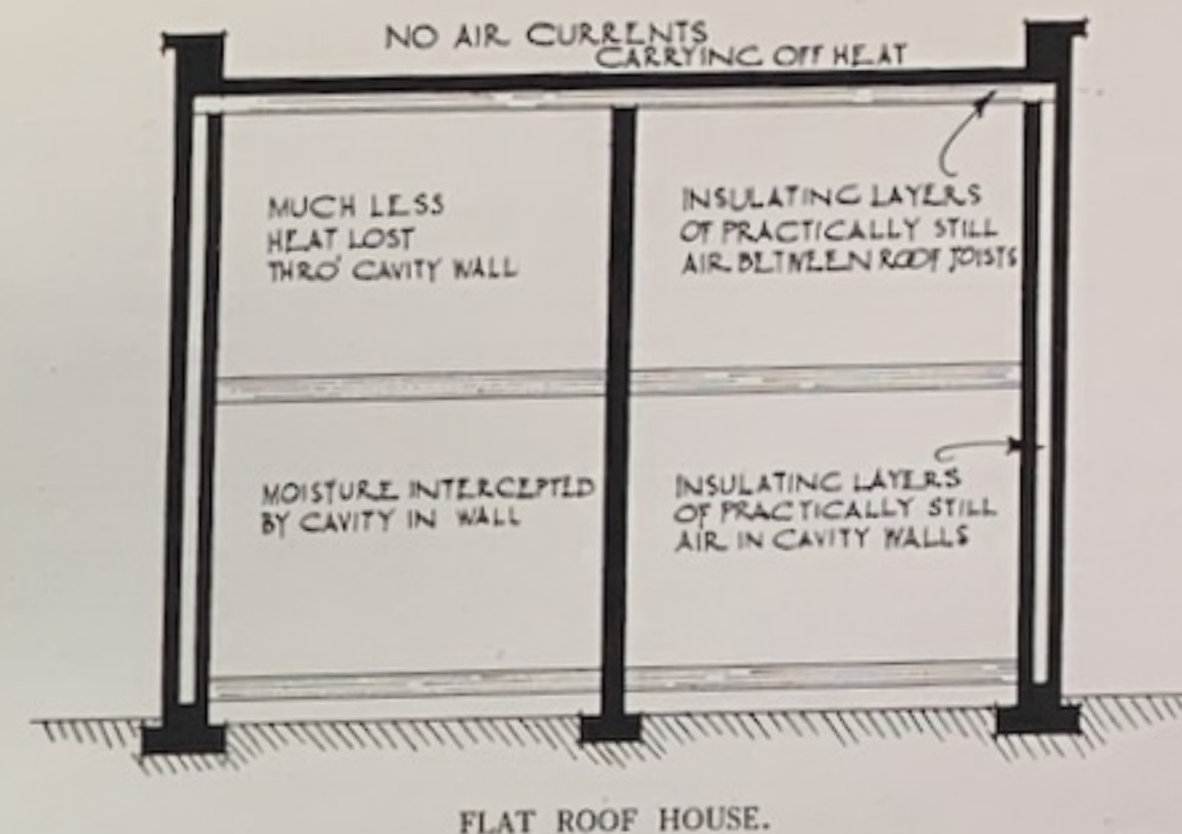
XVIII.—THE MAINTENANCE OF AN EQUABLE TEMPERATURE WITHIN THE BUILDING.

ANOTHER advantage of flat roofs is their prevention of heat losses such as occur by means of a pitched roof.

In a pitched roof, either slated or tiled, the triangular prism of air enclosed between the upper floor ceiling and the slopes of the roof is exactly the shape that is most conducive to the setting up, as shown in the diagram, of convection currents of air which carry off the heat from the warm rooms and dissipate it to the outer atmosphere through the cold slates or tiles.



For those who have perhaps left school too long to recall the exact effect of convection currents, we can express it in another way. In the triangle-space between the top ceilings and the sloping roofs, the layer of air just above the ceiling (around the point A in the diagram), takes the warmth from the room ceiling, and the air thus heated rises along the dotted lines towards B where it gets cooled by contact with the cold slates or tiles; it then passes round again to replace more heated air rising to carry more heat from the ceiling away to the slates. These currents of air are thus continuously extracting heat from the interior of the house and dissipating it to the outer atmosphere, the triangular prism shape of the pitched roof being just the very shape that assists such currents.



Now consider conditions with a flat roof. The air enclosed between the ceiling of the upper rooms and the flat outer surface of the roof is in thin flat layers running along between the joists. Now these thin layers of uniform thickness of air remain practically still, and the Building Research Board reports still air as having an exceptionally low conductivity—less than half that of even cork, slag-wool, or wood fibre, which are all used as insulators; still air is therefore the most efficient non-conductor of heat, and so with a flat roof, instead of actually promoting heat losses, as does the pitched roof, we definitely provide a blanketing effect, insulating the interior of the building from the exterior coldness.

This is a point which the present writer brought to the notice of Sir J. J. Thomson, the Cambridge Physicist, who was most interested in this practical application of the laws of physics and corroborated the fact and the diagram which we reproduce.

And as well as this very marked effect there is another fact that makes such roofs preserve the heat better than a tiled or slated roof; that is the fact as reported by an article in 'Heating and Piping' during 1930—that the heat loss through bituminous material is less than that through slates or tiles. So that, even apart from the shape of the roof, the heat lost from flat-roofed buildings is less than from slated or tiled roofs.

Thus the flat roof maintains a more equable temperature within the building—a requirement repeatedly stressed by medical officers of health as a primary necessity for really good healthy housing.

XIX.—THE VIRTUES OF CAVITY WALLS. HEALTH-GIVING ADVANTAGES OF FLAT-ROOFED CAVITY WALL BUILDINGS.

Now let us consider cavity walls, for it is in connection with the maintenance of an equable temperature that the provision of cavity walls is not only a desirable feature in itself, but is correlated with the adoption of the flat roof.

In a cavity wall, between the outer and inner leaves of the wall there is a space of some three inches, thus providing a practically still air-space surrounding all four sides of the house. Now, as we have shown, still air is a most efficient non-conductor of heat, and so this still air-space in the hollow walls—like the hollow sides of a thermos flask, that are not really a perfect vacuum—forms a non-conducting blanket all round the building.



OUR ARTIST ILLUSTRATES
INSULATION BY THE
CAVITY WALL.

This is a fact so generally accepted that it perhaps requires little confirmation, but we can quote the Report of the Building Materials Research Committee showing heat losses through 9-inch solid brick walls averaging 45% greater than through cavity walls having two leaves each of 4½-inch brickwork. Again, we may cite the results of investigations published at the National Physical Laboratory, showing that while the average co-efficient of heat transmission through a solid 9-inch wall was 0.526, the double 4½-inch wall with a cavity had a co-efficient as low as 0.368.

Thus the cavity wall also helps to maintain that equable temperature within the house which is so desired by the medical profession, and this is where the cavity wall is correlated with the flat roof. If you have a cavity wall building with a pitched roof you are merely nullifying the insulating effect of the cavity wall, because the convection currents in the pitched roof merely carry off the heat that the cavity walls would help to conserve; but if, on the other hand, the two features of the cavity wall and the flat roof are combined, then the blanketing effect round the walls is continued right over the roof of the building.

We have quoted the confirmation of Sir J. J. Thomson on these points, but they are not merely theoretical points; we have proved them to have actual practical results by reference to still higher authorities—the tenants of the houses themselves.

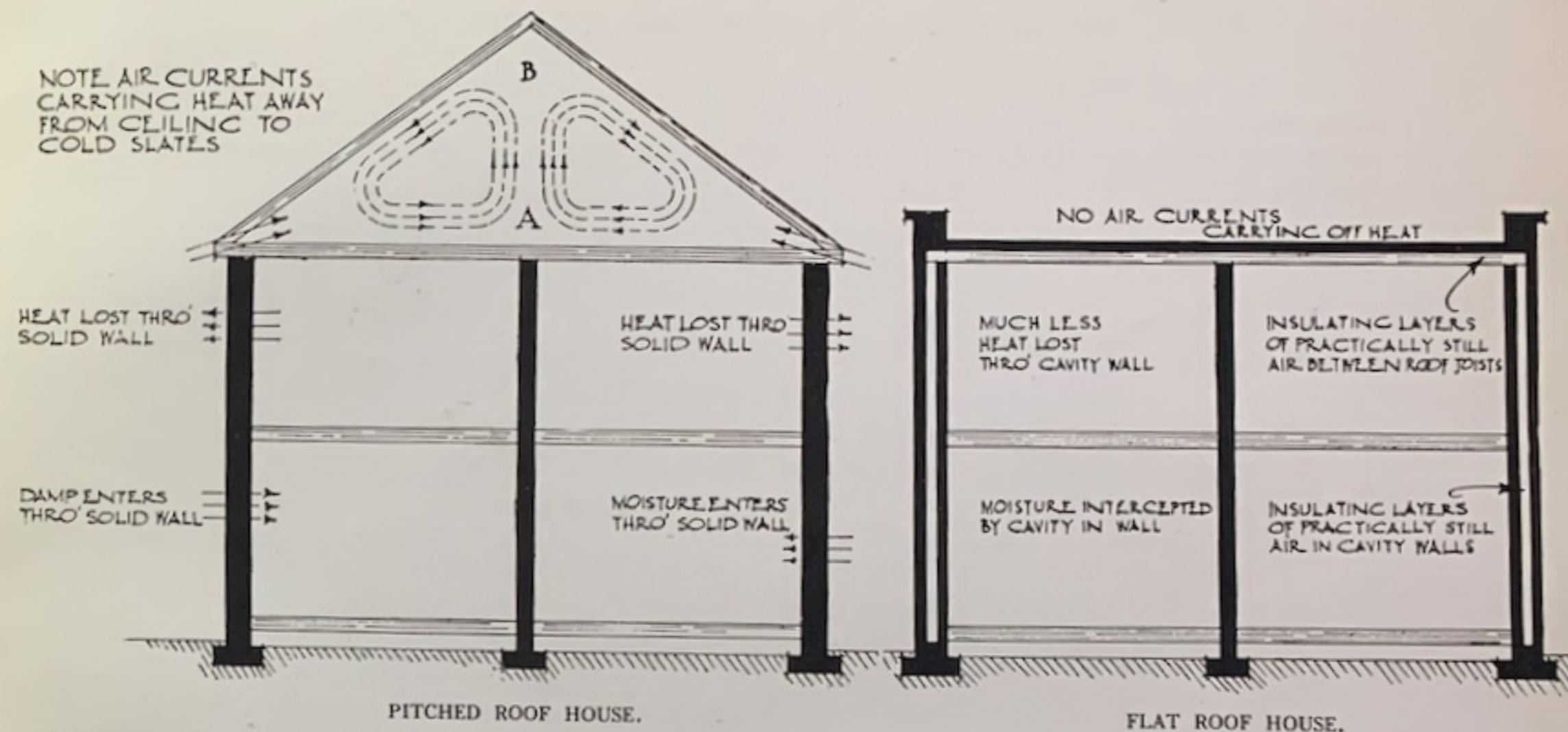
And here are two of their replies quoted verbatim—

"Warmer than the tiled house next door,"—and, another—

"Our friends from other houses notice how warm this house keeps."

Then here is the fifth point in favour of this type of construction in the attainment and maintenance of good health.

Not only does the cavity wall lose less heat than the solid wall, but it is very much less conducive to dampness. Any moisture that penetrates the outer skin of rough-cast on a solid brick wall is drawn by capillary attraction through the pores of the brick to the inner surface of the wall; contrast with this the cavity wall where the intervening cavity intercepts any such moisture or dampness.



Of course, in either type of wall there should be a horizontal Damp-proof Course in the wall above the ground level, to prevent the passage of moisture up the wall; but only the hollow wall, as Sir John Robertson says in 'The House of Health'—"provides a vertical Damp-Course" all the way up the wall.

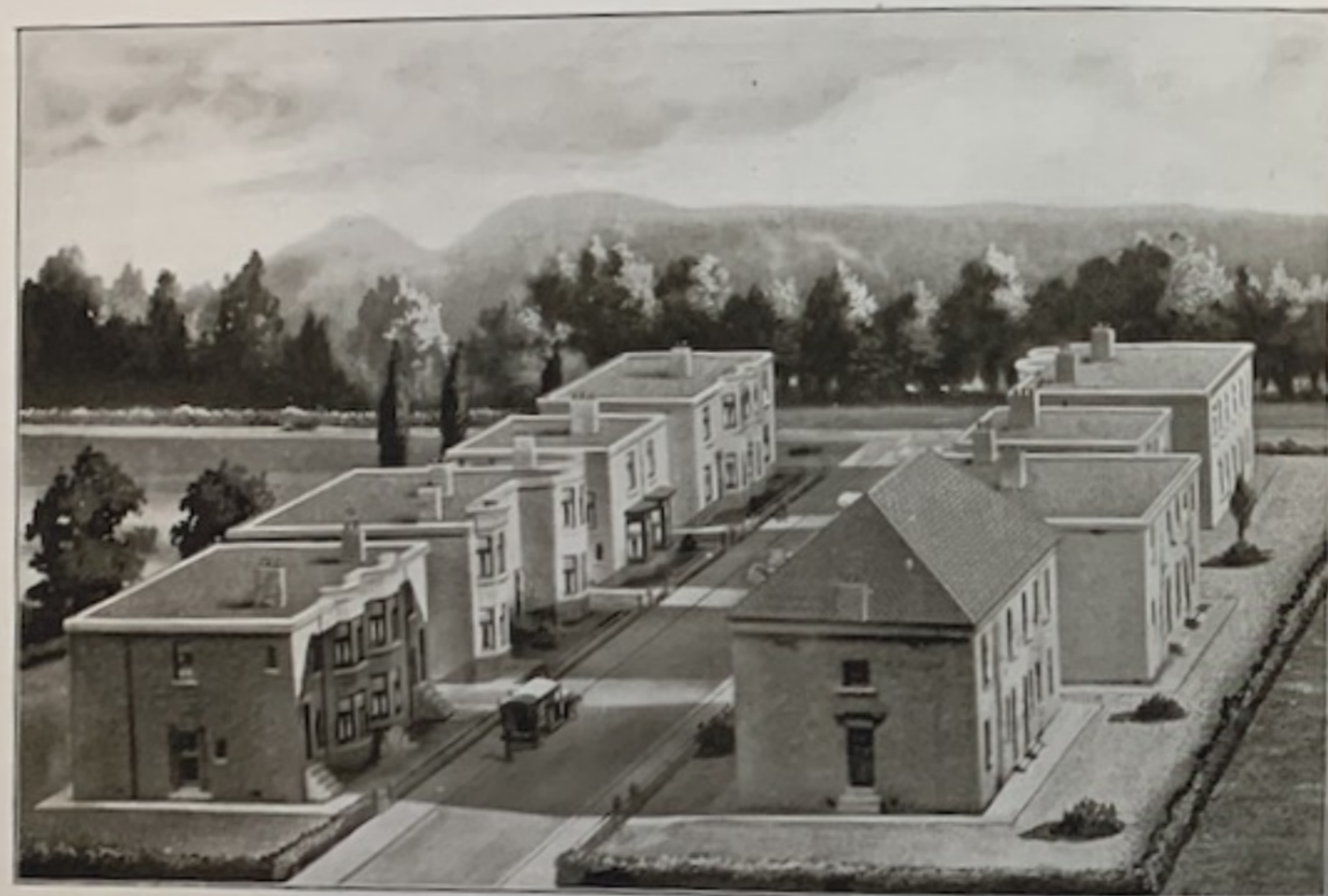
As he remarks, this is a very important consideration from the health point of view. The British Medical Association states—"Damp houses, as well as giving rise to all kinds of pulmonary diseases, are liable to set up in children, rheumatic affectations which later seriously affect the heart." Again, the Department of Scientific and Industrial Research reports in the Journal of the Royal Institute of British Architects that "a continuous cavity in an external wall provides the best means of preventing damp reaching the interior."

We have shown how a construction combining the principles of the flat roof and the cavity wall, provides for the admission of longer hours of daylight and sunshine in the home, makes possible the use of our hitherto wasted roof-space for healthy recreation and exercise, doubly insures the maintenance of an equable internal temperature by the insulating qualities of both roof and walls, and also prevents the penetration of moisture or dampness within the house—all points of real importance as regards the health and comfort of the inhabitants of the buildings.

Since the time of writing, there has been opened in London the new Dorchester Hotel, in which all the internal walls have cavities to insulate the rooms from noise as well as heat or cold; so here is another virtue of cavity walls—quietness.

XX.—ECONOMIES WITH FLAT-ROOFED CONSTRUCTION.

AND now we may pass on to the directly economical points of flat-roof cavity wall construction before proceeding still further to their practical and structural advantages, alluded to by the City Architect of Berlin in his words—"We are reminded of the practical advantage of flat roofs—their stability of construction, etcetra . . ."



WE REPRODUCE THIS PICTURE TO RECALL HOW PITCHED ROOFS ANNUALLY CHEAT OUR HOUSE WINDOWS OF 728 HOURS DIRECT SUNSHINE AND DAYLIGHT. FLAT ROOFS NOT ONLY AFFORD INCREASED HEALTH FACILITIES BUT ALSO A SAVING IN ARTIFICIAL LIGHT BY THESE EXTRA HOURS OF DIRECT NATURAL LIGHT.

☞ The considerations explained and corroborated in Section XVI. show how flat roofs allow the admission of 21 per cent. more sunlight and daylight into the rooms of our houses than do pitched roofs. We saw that 728 hours of sunlight are obstructed by the unnecessary height of pitched roofs. Now not only does this mean that flat roofs allow greater facilities for health and cleanliness, but it actually means a direct saving in artificial light bills, because we have direct daylight for those hundreds of extra hours every year. While a certain amount of light is still perhaps reflected around into our windows after the sun has passed below the ridge of the house opposite, this indirect light has only a fraction of the intensity of direct daylight. So that even if we do not save artificial light during the whole hour every morning, and the other hour in the evening, there is undoubtedly a considerable amount of extra light allowed over the flat roofs as compared with pitched roofs.

Who has not heard the complaint—"Oh, we have to put on the lights so early with that high building just across the road." Or who has not seen the walls of the internal wells down the middle of office blocks in the town, built with white glazed tiles in an endeavour to reflect the light down and through the windows? But what use to complain of the height of the buildings, or uneconomically to limit their height, if we continue to use up the height of an additional storey with the useless projection of the old-fashioned pitched roof?

☞ Then again, the point which was made in Section XVIII. demonstrating how cavity walls insulate the building, was brought out from the point of view of increased health by their maintaining an equable temperature in the building's interior. But as well as this it means a saving in fuel costs, an economy in coal or other means of heating. We showed that cavity walls have a co-efficient of heat conductivity some 45 per cent. lower than solid walls.

To the theoretically-minded we might quote the formula:

$$\text{Units of Heat lost through any wall} = A (t_2 - t_1) \times K$$

where A = Area of the Wall Surface
 t_1 = Outside Temperature
 t_2 = Inside Temperature

and K is a conductivity factor depending on the material and construction of the wall.

It was this factor K that was quoted on page 96 as 0.368 for a cavity wall and 0.526 for a solid wall; these figures mean that as much as 45 per cent. more heat may be lost through a solid 9-inch brick wall than through a hollow wall of two 4½-inch leaves.

Again we quote the highest authorities—the tenants.

A father with his eye on the comfort aspect, says—"The cosiest house we've ever been in"; while a mother with her eye on the household accounts, says—"This house keeps so warm that I use less coal than in any previous house."

☞ And these facts are due to the conservation of heat by the form and materials of the roof as well as by the cavity walls. The two features have conjugate effects; the one is comparatively useless without the other, since what is the use of stopping one hole in a vessel which can leak all the more rapidly through another. This is the point which appealed particularly to Lord Askwith, President of the Institute of Patentees, when the present writer was discussing the advantageous features of this patent construction with him.

☞ Further to this, the extra hours of sunlight coming over the flat roofs of the opposite houses mean extra heat from the solar radiation, as in the picture opposite; certainly this is not a large effect but it is very far from insignificant. It is a point that has had the attention of the National Physical Laboratory and the Building Research Station who report that solar radiation on walls amounts to as much as 269 British Thermal Units per square foot per hour.

So there are four points of direct economy to the tenants of Sunlit Homes, as these flat-roofed cavity wall houses have been so aptly named, and overleaf are two more savings by this type of construction, savings that affect both the tenants and the owners.

☪ The first is the much less maintenance costs of the roof itself as compared with slated or tiled roofs.

Every property owner or factor knows the slaters' and plumbers' repair bills that so frequently follow a storm of any severity in our climate. The wind displaces the slates or tiles and then the rain finds its way in and down to the ceilings of the upper floor, with the all too frequent result that not only have the slaters or tilers to be called in, but probably also the plasterers and joiners to repair the ceilings.

Strictly speaking, this point should perhaps be included in the list of structural advantages where we shall allude to it at greater length; but it is also quite definitely an economy both to the owner who has to pay for such repairs and to the housewife who has the trouble and dirt of workmen in the house, and has herself to replace little things that may have been damaged by the occurrence.

☪ Then here's a sixth point of economy due to the flat roofs.

Since such buildings allow us to provide gardens on the roofs, there is not therefore the same necessity to go so far into the country or suburban areas to build our new houses. The prospect envisaged by the President of the Work Soviet in Moscow—"A new town-space, that of the roof gardens" may not be too far distant in our own cities. And so, by reducing the necessity to build farther and farther out into the country, we are reducing the fares and travelling expenses of those who must travel to their work in the city.

Here, then, are our points of economy—

Economy in artificial light bills.

Economy in heating fuel or apparatus.

Economy in roof repairs, and

Economy in fares, by using the roof gardens for housing blocks not so far distant from the places where the people must work.

Several of the other points which are raised in the next chapter—on practical structural and architectural advantages—also make for economy but they are of more direct appeal to owners and architects so we shall consider them under this separate heading.

XXI.—PRACTICAL, STRUCTURAL AND ARCHITECTURAL ADVANTAGES OF FLAT ROOFS.

☪ FIRST in this group there is the advantage of the greater stability of the flat-roofed building because of the lack of wind pressure on the roof which would exist with a pitched roof. Those whose business it is to design structures know that frequently the wind stresses to be provided for in the members are even greater than the dead load stresses.

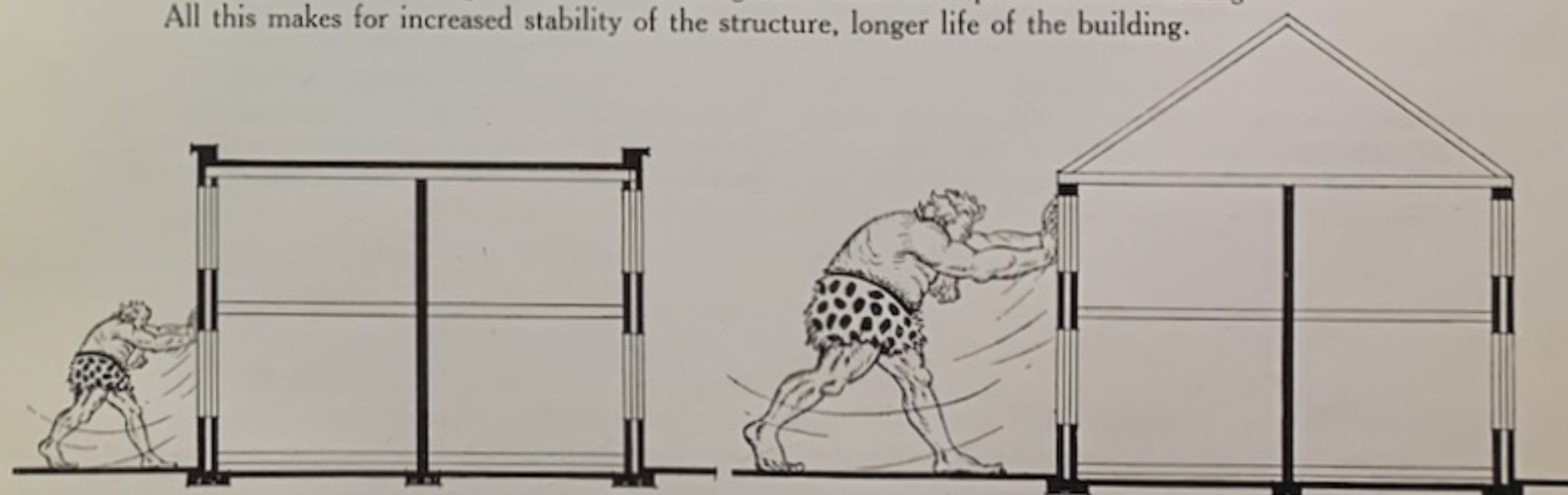
Now when a wind is blowing against the side of a house with a pitched roof, there is the wind pressure on the roof surface as well as on the wall surface of the building. The wind pressure on the vertical wall surface is of course proportional to the area of the wall, while the wind pressure on the roof surface is proportional only to the elevation or vertical area of one side of the roof. But this is very far from meaning that it does not have a very considerable effect; indeed the effect of wind pressure on the roof, as an over-turning force about the line of the foundations, is greater in proportion to the amount of the pressure, than the effect of wind pressure on the walls. This is because the roof is at a greater distance from the foundations and so the leverage of the force on the roof—regarded as pushing the building over at the base, which represents the actual conditions tending to occur—is more than the leverage of the force on the walls.

This means that for a standard two-storey building, and with a wind pressure of 40 lb./sq. ft. which is quite usual, the over-turning torque, as the engineers phrase it, is 86 per cent. greater with the pitched roof than with a flat roof.

The figures for the flat roof are :—Torque per lineal ft. along wall— $40 \times 22 \times 11 = 9,680$ ft. lb.
And for a pitched roof :—Torque per lineal ft. along wall— $40 \times 30 \times 15 = 18,000$ ft. lb.
Excessive effect on pitched roof building = 8,320 ft. lb.
i.e. 86% greater, figures

which have been confirmed by the Mechanics Lecturer of the Glasgow University Engineering Department.

The upsetting force in each case is proportionate to the size of the two figures shown in the sketches, the left-hand one showing the effective over-turning power on a flat-roofed building while the larger one on the right shows the much greater effect on a pitched roof building. All this makes for increased stability of the structure, longer life of the building.



THE TWO FIGURES, WHICH OUR ARTIST FONDLY CONSIDERS AS PORTRAYING THE GOD OF WIND, ARE IN PROPORTION TO THE OVER-TURNING EFFECT OF WIND PRESSURE ON A FLAT ROOFED BUILDING AND A PITCHED ROOF BUILDING, THE LATTER BEING 86% GREATER.

Then the flat roof has another direct advantage as regards stability: the building is more efficient and safer because the load of the roof is normally and evenly distributed over all the walls, whereas in the case of a pitched roof, the load of the roof is applied as an unequal outward thrust on the walls.



A DIAGRAMMATIC SKETCH WITH THE DOTTED LINES SHOWING HOW THE WIND LOAD AND THE DEAD LOAD FROM A SLOPING ROOF TEND TO THRUST THE WALLS OUTWARD. COMPARE WITH THE NEXT SKETCH.

THIS DIAGRAM ILLUSTRATES HOW THE WEIGHT OF A FLAT ROOF BEARS DIRECTLY AND EVENLY ROUND THE WALLS. THERE IS NO LATERAL PRESSURE FROM WIND SUCH AS EXISTS WITH A PITCHED ROOF.

The two sketches will illustrate the point and show how the outward thrust from the pitched roof tends to bulge the walls, whereas with a flat roof the load is a direct weight, or compression, on the walls.

Stability is a point which was noted in a *Glasgow Herald* article on Sunlit Homes, which concluded—"The latter attribute—the stability of the structure—might be said to have been adequately tested when the whole company, numbering more than a score, climbed to the roof."



A TESTIMONY TO THE STABILITY OF THIS FLAT-ROOFED CONSTRUCTION—OVER FORTY WORKMEN ON THE ROOF OF THIS BLOCK OF HOUSES.

Here is a picture of a house with over forty men on the roof—some slight testimony of the stability and strength claimed for the construction.

C Then there is claimed for flat roofs very much lower maintenance costs. In dealing with the wind pressure on the pitched roof, it was assumed that the wind blew *against* the slates or tiles, but not infrequently it blows *through* the slated or tiled roofs. The picture on this page shows a case of this in a village of tiled roofs. It was Mr. Rosslyn Mitchell, ex-M.P. for Paisley, whom we once heard painting a vivid word-picture with that rare eloquence of his, of the mother who would watch her kiddies playing healthily in the open-air space of the flat roof, far from the dangerous traffic of the streets; but this same gentleman had an eye also on the economic value of flat roofs when he borrowed this photograph for his lecture on their advantages.



THIS PHOTOGRAPH SHOWS TILED ROOFS COMPLETELY STRIPPED BY A STORM OF VERY MODERATE STRENGTH; IF THERE HAD BEEN ANY GREAT FORCE OF WIND, SOME ROOF-TIMBERS OR WALLS WOULD HAVE FALLEN, BUT THESE ARE ALL INTACT, THE TILES HAVING BEEN SIMPLY STRIPPED OFF.

The conditions shown in the picture were not brought about by a tornado or any mighty force of wind, because if this had been the case some of the walls and roof timbers would have been carried away; but the photograph shows quite clearly what has happened—the tiles have been stripped clean off the roofs, rendering the houses uninhabitable and necessitating much work in repair of the wreckage.

The damage is not always so intense, but in a lesser degree it is distressingly frequent; as a member of the Consultative Committee of the Ministry of Health points out—"Slated or tiled roofs often let in water during every storm of wind and rain which they encounter." The wind has only to displace one slate or tile and very soon a fair-sized gap is made in the roof, rain pours in and occasions moist discomfort to the inhabitants of the house. And these inhabitants are not likely to suffer in silence from leaky roofs, so that complaint is soon made to the factors or owners who have little more to do except pay the bills of the jobbing tradesmen called in to repair the damage.

These are conditions that can never arise with flat roofs, over which the wind sweeps unresisted, and the rain-water merely runs off to arranged collecting points where down rain-water pipes are placed. The absolute waterproof quality of the roof is amply proven when we know that we can build tanks of this material actually to contain a considerable weight of water.

Again, foreign tiles frequently become porous, absorb rain-water and crack in times of frost; the semi-circle ridges frequently become loose and admit rain, or they lose any good appearance they may originally have had by becoming black and discoloured, deteriorations which can never develop with flat roofs.

These comparisons show how it is that these flat roofs can be built with a maintenance guarantee for thirty times the six months' maintenance that goes with slated or tiled roofs.

And here's another point: Not only do slates or tiles torn from the pitched roofs leave gaping holes to let in the rain, but they come hurtling down on to the unfortunate heads of passers-by in the street below. Almost all of us have been in some gale when slates or tiles and chimney-pots were coming rattling off the pitched roofs down into the street below. Now in the case of the flat roof the only projection that may have to meet the force of the wind is the chimney-pot, and even if it does get blown over it merely falls a few feet on to the flat roof where a man can walk up—without scaffolding-irons, even—to repair it.



This is the point which is being explained to an obviously interested audience in the accompanying photograph. Mr. John M'Donald, F.Inst.P.I., founder and head of the firm of John M'Donald (Contractors), Limited, Sunlit Building Company, Glasgow, is explaining the point to Government and Local Housing Authorities; on the right is Mr. R. W. Horn, F.R.I.B.A., Director of Housing of Glasgow; and the three gentlemen to the left of Mr. M'Donald, are left to right, Mr. J. D. MacIntyre, Town Clerk Depute; Bailie John Livingston, of Glasgow, and the tall interested figure of Major Walter Elliot, then Under-Secretary of State for Scotland.

This point, of the damage done by slates and tiles coming rattling off the pitched roofs, is no minor point, as any of the Insurance Companies can testify. And mention of Insurance Companies brings us to the next point in favour of flat roofs.

This is their qualities of heat-resistance and fire-prevention. With regard to the former, the surface of Sunlit Roofing is heat-resisting because external heat merely serves to bed down the gravel or chips on the surface more firmly on to the mastic, thus forming a still more cohesive mass. At Greenock a chimney went on fire and ignited a heap of debris lying on a surface of this kind, but the roof was undamaged and the building saved.

But besides the surface being fire-resisting, the very form of the flat roof is actually preventative of fire.

Consider the comparison of flat-roofed and pitched roof buildings in case of a fire started within the building. In the case of the slated roof the fire is encouraged by the currents of air getting up between the roofing boards, and once a breach is made, the sloping roof acts as a funnel to encourage the flames, so that nothing can save the building.

Compare with this the case of the flat roof: not only does the flat roof tend to suppress the fire by its very flatness—just as one puts out a fire with a blanket—but also the joints of the roof boards are hermetically sealed by the mastic and no air currents can get through to provide the draught that is fundamentally necessary for combustion. This is a point which was most conclusively proved by a fire-test carried out by the British Fire Prevention Committee, who tested an ordinary slated roof and a flat Vulcanite roof, the flat roof being sound enough to walk on after an hour's subjection to fire, whereas the pitched roof had collapsed completely after only 47 minutes. We reproduce a photograph showing how combustion was prevented by the lack of draught in the case of the flat roof.



X Hole made after test.

(By courtesy of Vulcanite Limited.)

VIEW SHOWING THE UNDERSIDE OF A FLAT ROOF AFTER BEING SUBJECTED TO FIERCE FLAMES FOR A PERIOD OF ONE HOUR; THE TIMBER IS ALL CHARRED BUT THE FLAMES HAVE NOT PENETRATED BECAUSE THE ROOFING MATERIAL HERMETICALLY SEALS THE JOINTS OF THE BOARDING, THUS PREVENTING ANY DRAUGHT AND STIFLING COMBUSTION.

We need only add that the Insurance Companies, ever wary of novelty though they must be, have realised these points, and quote the most favourable terms for the Fire Insurance of the various types of buildings with Sunlit Flat Roofs.

C Speed of erection is one of the particular claims made in the advocacy of flat-roofed cavity-wall buildings.

In 1927 to demonstrate the possibilities of speed attainable in the erection of these Sunlit Homes, there was built a complete block of four houses in a period of twelve days. During this time were performed all the various works: excavator, concretor, bricklayer, drainlayer, carpenter and joiner, roofer, plumber, plasterer, glazier, asphalter, painter, electrician and gasfitter. And on the twelfth day the houses were ready for occupancy, as shown in the last of our series of photographs.

These are the houses with regard to which the Prince of Wales wrote expressly regretting that his Glasgow visit of 1927 was too short to allow him to review them. When one considers that four houses were thus built during twelve days, one can imagine the pace that could be set up with forty or fifty blocks under construction at the one time.

FOUR HOUSES IN TWELVE DAYS.



FIRST DAY.



SECOND DAY.



FOURTH DAY.



SIXTH DAY.



TENTH DAY.



TWELFTH DAY.

XXII.—SUMMARY OF ADVANTAGES OF FLAT-ROOFED CAVITY-WALL CONSTRUCTION.

LET us summarise the many advantages of a type of construction which embodies these new features—the flat-roof and the cavity-wall—features whose advantages are directly related to each other.

ADVANTAGES FROM THE HEALTH POINT OF VIEW.

FROM the health point of view there are five great advantages of flat roofs and cavity walls. Two points which have been strongly stressed by Sir William Arbuthnot Lane, the famous Health Authority—who has had articles on the advantages of Sunlit Homes in the *Daily Mail* and in his magazine 'New Health' are:—

- 1 Flat roofs do not project so high into the air as do the more usual pitched roofs, and therefore do not obstruct beneficial sunshine and daylight from the houses across the road as long as do the old high pitched roofs. It does not need the quoted assurances of Sir John Robertson and Sir Oliver Lodge to tell us of the benefits of more sunshine and daylight in the rooms of our houses, benefits which are being more and more appreciated every day. pages 79 to 86
- 2 Flat roofs could be used for healthy exercise and open-air recreation, as roof gardens, sun lounges, putting greens, etc.—a point which is of further value to health when we know from famous medical men like Sir Herbert Barker and Sir Leonard Hill that not only sunlight, but even daylight is a direct benefit to health. pages 87 to 93

[continued overleaf—page 112]



A ROOF GARDEN NEAR GLASGOW, SCOTLAND.



ROOF EXERCISES



'HIGH TEA.'



SPRING DAYS.



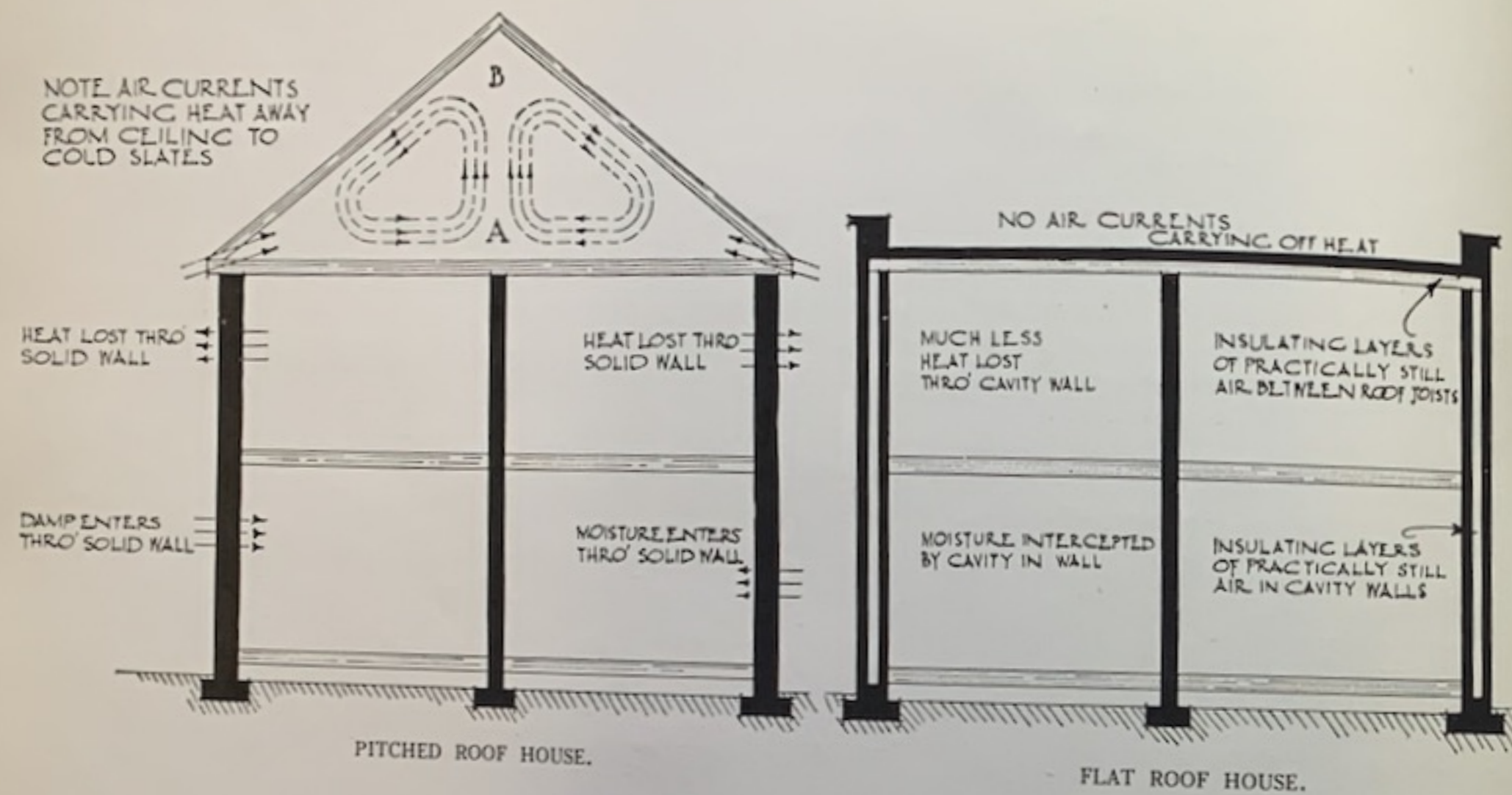
THE SOWER.



PRIVACY GARDENS.

THE LIGHTER SIDE.

Our artist illustrates the use of the roof.



The other three points from the health aspect are in the maintenance of an equable temperature and in the prevention of dampness in the house. These points, which have the scientific confirmation of Sir J. J. Thomson, are:—

- 3 Flat roofs do not promote the loss of heat by convection currents, as do pitched roofs by their triangular-prism shape and by draughts of air admitted at the eaves and through their external slates and tiles. Thus flat roofs help to maintain that equable temperature which the Medical Research Council desires as an aid to the continued health of the tenants of the houses. pages 94 and 95
- 4 Cavity walls, when combined with flat roofs, provide a non-conducting blanket of still air all round the house, thus insulating it from the effects of external changes of temperature. page 96

It is in this advantage that the flat roof and the cavity wall are shown to be correlated; the flat roof with its thin air spaces between the joists, continues the insulating blanket effect over the roof just as the cavity provides it around the walls.

- 5 The cavity wall intercepts moisture that would be drawn by capillary attraction through a solid wall, thus it obviates the evil effects of dampness in houses as reported by the British Medical Association whose findings are quoted in the section dealing with this point. pages 96 and 97

OUR ARTIST AGAIN.

Flat roof and cavity wall insulation.



THE BENEFITS OF CAVITY WALLS.

ADVANTAGES FROM THE POINT OF VIEW OF ECONOMY.

FROM the economical point of view there are other six advantages:—

- 1 Economy in artificial light bills because of the lesser obstruction of the daylight, which is one of the "best things in life that are free"; this obstruction, we have found, is caused by the pitched roofs for 728 more hours annually than by the flat roofs. The point is corroborated by Sir Frank Dyson, the Astronomer Royal. page 98
- 2 & 3 There is economy of fuel as practical testimony to the insulating effects of both the cavity wall and the flat roof. page 99
- 4 There is economy of heating also from the fact that direct solar radiation, unobstructed by pitched roofs, helps to heat the houses—more than we might think in this, as witness the National Physical Laboratories' Report that solar radiation provides as much as 269 British Thermal Units of heat per square foot of surface. page 99

These are points of economy which are corroborated by the highest of authorities—the tenants who have lived in flat-roofed cavity wall houses and whose opinions are quoted verbatim in the section relating to these points.

Then there are

- 5 Economy in maintenance costs, because there are no slates or tiles to blow off the roofs and necessitate repairs after a storm, as so often happens with ordinary roofs. page 100
- 6 There is economy of travelling expenses, because houses can be built nearer into the town, and yet have gardens and recreation space on the roofs, which could only otherwise be obtained by going farther out into the country. page 100



SUNLIGHT, LATE AND EARLY.



SLICED!



NO BILLS TO SLATE.



FOUND MONEY.

FLAT ROOFS AND CAVITY WALLS SPELL ECONOMY.

ADVANTAGES FROM THE STRUCTURAL AND ARCHITECTURAL ASPECTS.

FROM the practical view-points of owners, architects and builders also there are a number of advantages possessed by the flat roofs over the usual slated or tiled roofs :—

- 1 There is much greater stability, because wind merely sweeps over the flat roof instead of exerting an 86 per cent. greater over-turning force on the pitched roof building than it does on the flat roofed building of the same capacity. *page 101*
- 2 The building is a more efficient structure, and safer, because the load of the roof is normally and evenly distributed over all the walls by a flat roof—an advantage which does not hold good in the case of a sloping roof, with its unequal outward thrust on side and end walls, as reported in 'Building Science Abstracts' during 1929. *pages 102 and 103*
- 3 The holes left in the roofs by the fallen slates and tiles after a storm of wind and rain, bring complaints from the unfortunate tenants and jobbing accounts from the tradesmen who have been summoned to repair the damage. This annual and sometimes surprisingly expensive item is obviated by the adoption of the flat roof. *pages 104 and 105*
- 4 The storms also bring slates and tiles rattling down on passers-by in the street below, resulting in claims for damages to be paid by the owners of the buildings. This danger to life and limb cannot occur with the adoption of the flat roof. *page 106*
- 5 The flat-roofed building is less liable to fire damage, as is fully demonstrated by a Report of the British Fire Prevention Committee, from which extracts are quoted in the section on this point. *page 107*
- 6 Great speed of erection can be attained in the building of these flat-roofed houses. Photographs are reproduced showing a block of four houses erected in twelve days—which leaves to the imagination the speed which the firm could attain with forty or fifty blocks proceeding at the same time. *pages 108 and 109*
- 7 By the adoption of flat roofs an infinitely greater variation in elevation is economically possible than was possible with pitched roofs. This point is fully discussed in the next section. *page 119*



BULGY BILL



CHEERY CHARLIE.

STABILITY.

THE SLATER'S REVENGE.



DRIPITY DRIP.

THE WAY OF THE WIND.



TILE HATS.

THE DREADFUL PAST OF SLATES AND TILES.



YOUNG FLATROOFS KNOCKS OUT THE FIRE-EATER.



FLAT ROOFED BUILDINGS: SOUND AND SPEEDY.

FLAT ROOFS—SWIFT AND SURE.



The above pictorial representation of Egyptian buildings shows a strong resemblance to the lower picture of Devonshire House, one of London's latest and finest buildings. Architects are again obtaining the most pleasing effects in large buildings as well as in houses by attention to proportions rather than by "frilly gables, nooks, and pretty-pretty roofwork."



XXIII.—FLAT-ROOFED BUILDINGS PROVIDE THE AVENUE OF ESCAPE FROM THE MONOTONY OF PREVIOUS HOUSING SCHEMES.

THE unrelieved monotony which has so unfortunately characterised previous housing schemes throughout the country is widely complained of by those who are not housing architects, and as generally admitted by those who are.

But this monotony is not due to any inability of the architects to evolve designs with variations or varying features to relieve the monotony, but because so long as the pitched roof was in use, any such variation would have meant unwarrantably increased costs. This is because the provision of any variation such as an oriel of any depth, a bay window, or a projected porch, involved the provision of extra roof timbers, ridges and rafters, valleys and piends, and the cutting into the main ridges and rafters as well as some extra lengths of joists; also the cutting and shaping as well as the provision of extra slates or tiles, ridge-tiles, and lead valleys.

Even when little projecting roofs were afforded, they only resulted in what the author of 'Modern Architecture' terms—"The awkwardness of complicated roofs."

Now with the adoption of the flat roof, the only extra roof cost of any such variations is the relatively small addition of a few square feet of roof surfacing.

Here then is the opportunity for greater variety in elevation, deeper oriels, more circled or square bay windows, all possible without raising the costs to the extent that has made them impracticable in the case of pitched roofs. Thus Mr. H. C. Hughes, M.A., A.R.I.B.A., reports from a Garden City and Town-Planning Association Tour to Holland and Germany—"The flat roof does give the greatest possible flexibility of plan in the house beneath. Our own difficulty of trying to make a pitched roof that looks well on a square house, disappears."

So here we have the avenue by which our Housing Architects may escape from the enforced monotony for which they have so frequently been condemned, and which, before the era of flat roofs, was virtually unavoidable.

And besides the greater variety both in plan and elevation thus made possible by the flat roof, there is another added method which it affords for obtaining variety—the infinite variation that can be effected in the cope and features surrounding the flat roof, which, of course, do not even exist with the pitched roof. Thus, a low parapet wall can be carried up and finished with a cast cope, or it can be surmounted with a railing; or a good deep oriel can be superseded by a little feature, circled or square, diamond or cross.

And yet it is from the point of view of appearance, that the only objection we have ever heard to flat roofs, was raised; and even then only in a half-hearted manner.

Certainly, flat roofs on two and three storey buildings are unconventional with us—they are new to our minds and at first strange to our eyes, and because we are perhaps used to pitched roofs some of us may be prejudiced against the new flat roofs. That is what the *Glasgow Herald* complains of when it comments—"Some prejudice will require to be overcome."

The same prejudice used to exist on the Continent before "the public realised the numerous advantages to be derived from the flat roofs."

That is what Bruno Taut, of Berlin, referred to when he spoke of—"The vague sentiment that has, fortunately as we now see, never crystallised out into official proscription."

Jeanneret, of France, looks back contemptuously to—"Tiled roofs and all the other romantic paraphernalia," and "the roof—a jumble of garret-windows, tiles and gutters."

Surely any such sentiment as that which clings to the old-fashioned pitched roofs is only a weak passion for the past, like the pre-occupation of some mentalities that gloat over the spot where a particularly unsavoury crime was committed.

We do not believe with Bacon—"That houses are made to live in, not to look at," but we have surely said enough to show that not only are flat-roofed houses infinitely better to live in, but they are superior also to look at. After the erection of the speed test houses the *Glasgow Herald* reviewed them as follows—

AGREEABLE APPEARANCE.

"The model house at Burnside, after the inspection of which the Corporation contract was placed, allays any misgivings as to the appearance of the flat-roofed house. The flat roof permits of larger and more varied oriel windows than the ordinary type. . . ."

And in the contract for a thousand houses to be erected at Carntyne for the Glasgow Corporation to which the article refers, the oriels were actually constructed to project 2 feet 3 inches instead of the 9 inches which was all that was possible with the pitched roofs; and that without any additional cost to the Corporation.

It was of these houses that the local press wrote—"The exteriors of the houses present a pleasing picture. The monotony—the sameness, which is so prevalent in most of our Housing Schemes is absent from this new type. There are so many different designs to which the exteriors of the houses offer themselves."

These houses at Carntyne look splendid in spite of one peculiar disadvantage due to the particularly high site on which they were built. The height of the site necessitated the provision of unusually large storage cisterns for the water supply, and some of these large tanks were more noticeable on the flat roofs than the usual size of cistern which cannot be seen from the street level. The tank is showing, for instance, in one of the photographs overleaf on page 122, but even there the house is by no means unpleasant in appearance, and the photographs as a whole will justify the claim that these flat-roofed houses are of decidedly better appearance, with bolder lines than most housing scheme types.

It must be remembered too that these are relatively cheap Council houses, let for ten or twelve shillings a week, and not the residences of the rich. Even the slight difficulty of the provision of large tanks on any sites that happen to require them can be got over by arranging the dimensions of the tank to harmonise with the rest of the design, or by a water supply system making use of a combined cistern and requiring no roof cistern—but it is on points such as these that the experience of the firm which has been experimenting with these houses and building them is invaluable.



GLASGOW'S FLAT-ROOFED HOUSES.
NOT BUILT WITH ACCESS TO THE ROOFS, THEY
YET PROVIDE ALL THE OTHER ADVANTAGES OF
FLAT-ROOF CAVITY-WALL CONSTRUCTION.





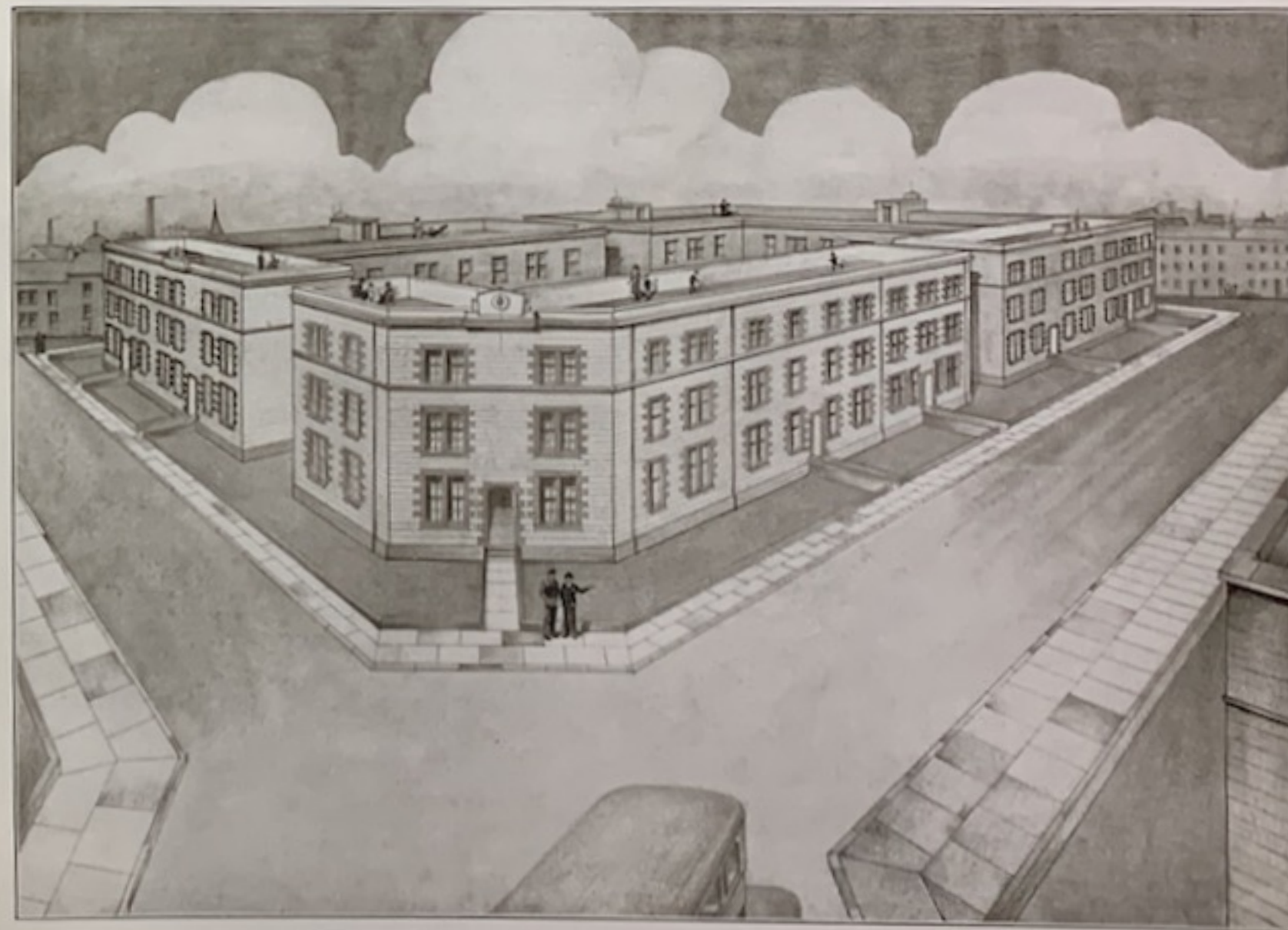
TWO MORE BLOCKS OF GLASGOW'S FLAT-ROOFED HOUSES.

The Corporation of Glasgow were manifestly satisfied with the houses at Carntyne, since, before the first half of the original order for 1,000 houses had been completed there, they had placed a further order for 500 more. These two contracts were placed mainly for the advantages of speedy construction, and since they were for suburban housing schemes, with ground gardens, the flat roofs were not at first made accessible; yet the tenants have the benefits of all the other advantages which we have enumerated. And many of these tenants have undoubtedly the desire to utilise the flat roofs. Here are a few of their remarks—"My neighbours and I have talked of a roof garden if only access to the roof was provided."

"If the roof was railed in the kiddies could play there while I get on with the housework."

"Roof gardens would be great, especially in slum clearance schemes, where they have no gardens."

This last remark is particularly shrewd, representing the opinion of those who do not see the full necessity for roof-gardens where there are ground gardens, but yet appreciate their desirability in re-housing blocks in the centre of the City. We have illustrated a few such blocks on this page. The small extra cost of providing access and carrying the external walls up into a cope or a parapet wall might easily be borne now that building costs are so drastically reduced from the levels of even three years ago.



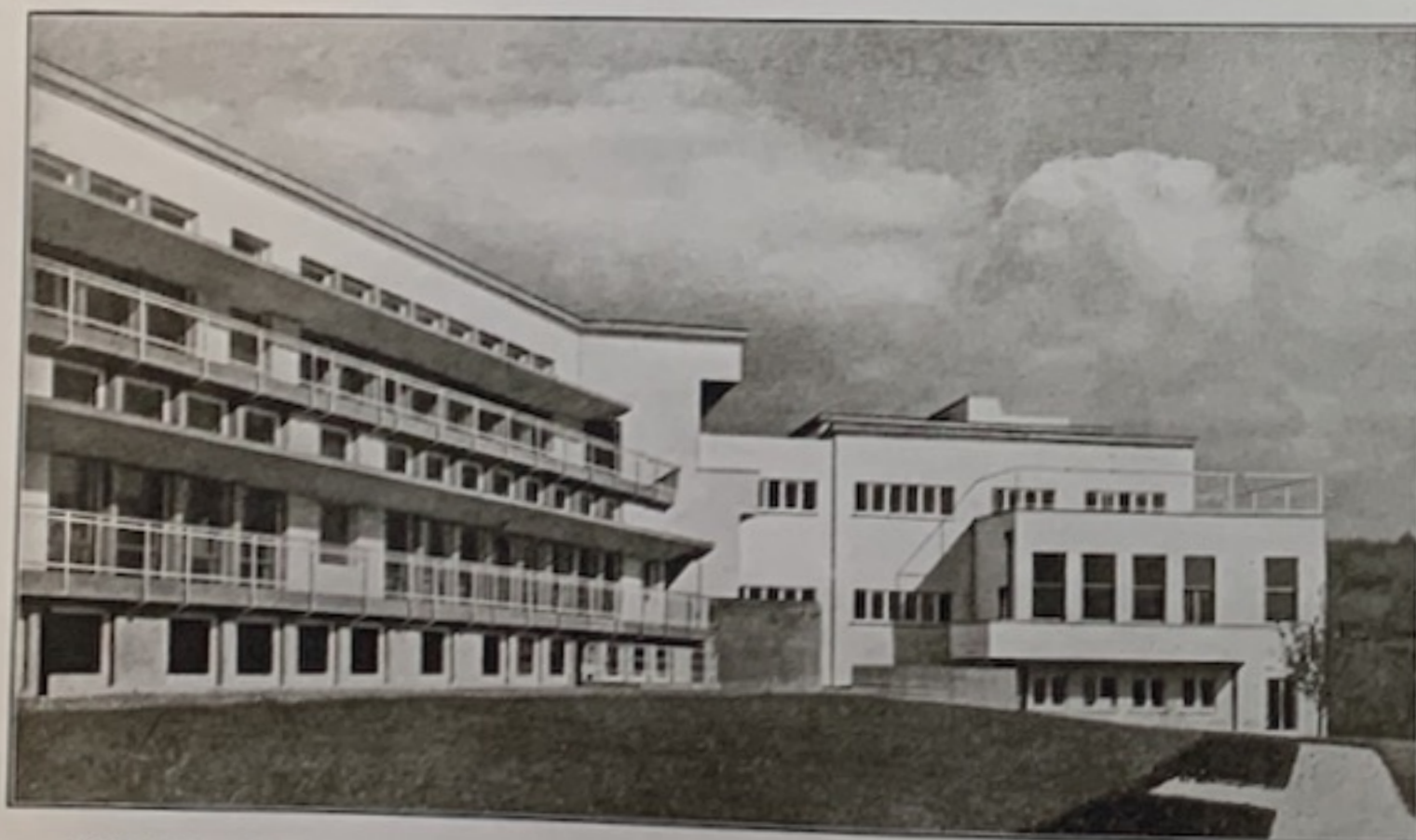
This opens up a magnificent vista of the future, of the giving to our people a real 'Place in the Sun,' or, as *The Glasgow Citizen* expresses it—"A vista of the Gardens of the Gallowgate."



HOSPITALS.

FLAT-ROOF cavity-wall construction is eminently suitable not only for housing, but for hospitals and schools also. The health-giving, economical and structural advantages which we have explained are no less applicable to buildings for children and invalids than to slum clearance or housing scheme dwellings for the people. Surely we no longer want "grotesque hospitals like palazzos," but buildings designed for health and comfort.

The virtues of flat roofs and sun terraces for hospitals were first stressed by Tony Garnier in the French City of Lyons, and this type is now the standard type on the Continent. Our photographs show one such hospital in Germany, another in France, and a projected hospital of this type in Russia; the noticeable feature in each case is the flat roof construction.



HOSPITAL AT WAIBLINGEN.

ARCHITECT: RICHARD DÖCKER.

NOTE THE SUN TERRACES AND FLAT ROOFS ON WHICH THE PATIENTS MAY HAVE ALL POSSIBLE SUNSHINE AND FRESH AIR.

MODERN HOUSING

125



ANOTHER CONTINENTAL HOSPITAL OF ECONOMICAL CONSTRUCTION, YET WITH THE MAXIMUM FACILITIES FOR HEALTH-BUILDING—CAVITY WALLS AND FLAT ROOFS.



PROJECTED HOSPITAL IN RUSSIA: AGAIN ROOF-TERRACES FOR SUN AND AIR.

Then we show other three pictures of kiddies on hospital roofs. The two on this page show the use of a hospital roof-beach in London.



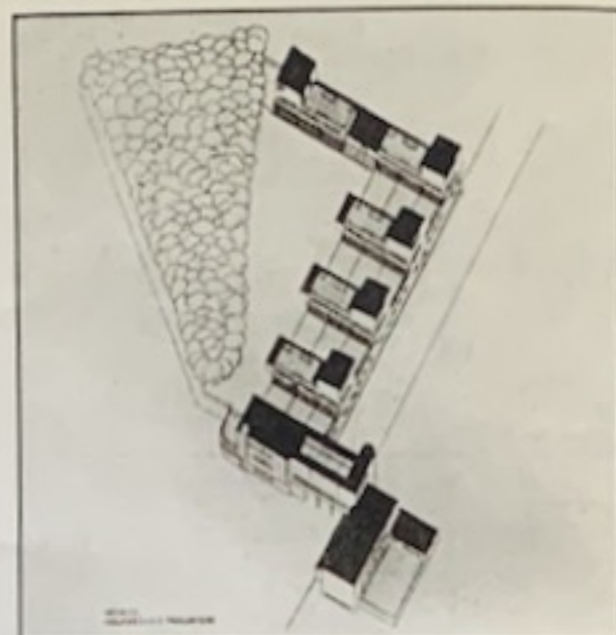
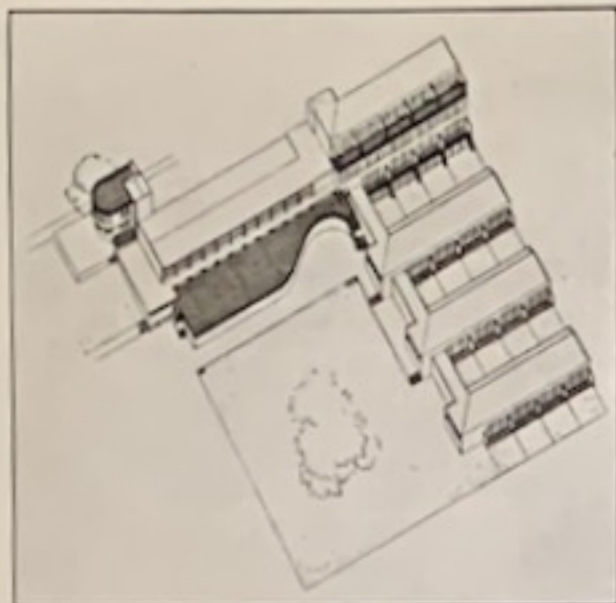
NURSES AND CONVALESCENT CHILDREN ON THE ROOF BEACH OF ST. JOHN'S HOSPITAL, LEWISHAM, WHERE AIR-BATHS AND SUN-BATHS HAVE HALVED THE CONVALESCENT PERIOD FOR THE CHILDREN.

We brought this development in hospitals, which above all should be of a construction affording the maximum facilities for health, to the notice of the Minister of Health, Mr. Greenwood, and Sir George Newman, and we have learned from the Minister that he has been much interested in the subject and has caused a particular note of the proposals to be made.

For hospitals, then, as well as houses, flat-roofed cavity wall construction is pre-eminently suitable, and their adoption should have the most serious consideration of architects entrusted with such work.



SUN AND AIR BATHS FORM AN IMPORTANT PART OF DR. ROLLIN'S REMARKABLE CURES OF RICKETS AND TUBERCULOSIS AT HIS OPEN AIR SCHOOL-HOSPITAL AT LEYSIN, SWITZERLAND.



SCHOOLS.

FOR schools too, the advantages of flat roofs and cavity walls hold good. Already the Continental architects are developing not only the provision of flat roofs but also the utilisation of them. Sheldon Cheney writes—"We want schools for health and efficiency, schools without reference to Renaissance Palaces or picturesque fortresses."

Our lower photograph shows a small school in Pernitz, Austria, and the opposite picture is of a large school near Berlin; both are equipped with accessible flat roofs for the use of the pupils. In the one photograph we actually see the children at exercise on the flat roof, while the third picture shows how a flat roof on a Frankfurt school has been laid out.



A SMALL SCHOOL AT PERNITZ, AUSTRIA. ARCHITECT: JOSEF FRANK.
NOTE THE RAILED-IN FLAT ROOFS WHERE THE CHILDREN EXERCISE

Sir Leonard Hill, the English authority on health, writes—"Exposure to sunlight and cool air converts sickly children to splendid robust boys and girls." Here we can see that at least Germany is making use of her flat roofs for this excellent purpose.

Then again, schools should certainly not be chilly when the children are not at exercise, as we learn from the "Effect of Chilly Schools on Absenteeism" a report published by the Industrial Health Research Board. This is where the virtues of cavity walls and flat roofs in insulating the building can be utilised.

Thus both in the actual use of the flat roofs, and in the maintenance of an equable temperature within the building by the flat roofs and the cavity walls, as explained on pages 94 to 97, such a construction stands out as particularly suitable for school buildings.

Herein lie great possibilities for the development of good health by the children of to-day, who are the men and women of to-morrow, and so to them too flat-roofed cavity wall buildings may bring Health—the greatest boon of all.



EXERCISE CLASSES ON THE FLAT ROOFS OF A BERLIN SCHOOL.



ANOTHER SCHOOL ROOF IN USE AT FRANKFURT-ON-MAIN.

YET ANOTHER USE FOR FLAT ROOFS.



A FLAT ROOF IN USE AS A PARKING PLACE FOR AUTOMOBILES.

CONCLUSION.

THERE are then, nearly a score of different advantages of flat-roofed cavity-wall construction. We are bound to ask why such a construction has not before now been universally adopted. The answer is two-fold: firstly, the advantages were not sufficiently realised; in fact this book is the first exposition of these advantages, stressing particularly that not only is the adoption of flat roofs a most desirable innovation, but also that cavity walls only afford the full benefit of their virtues when combined with flat roofs.

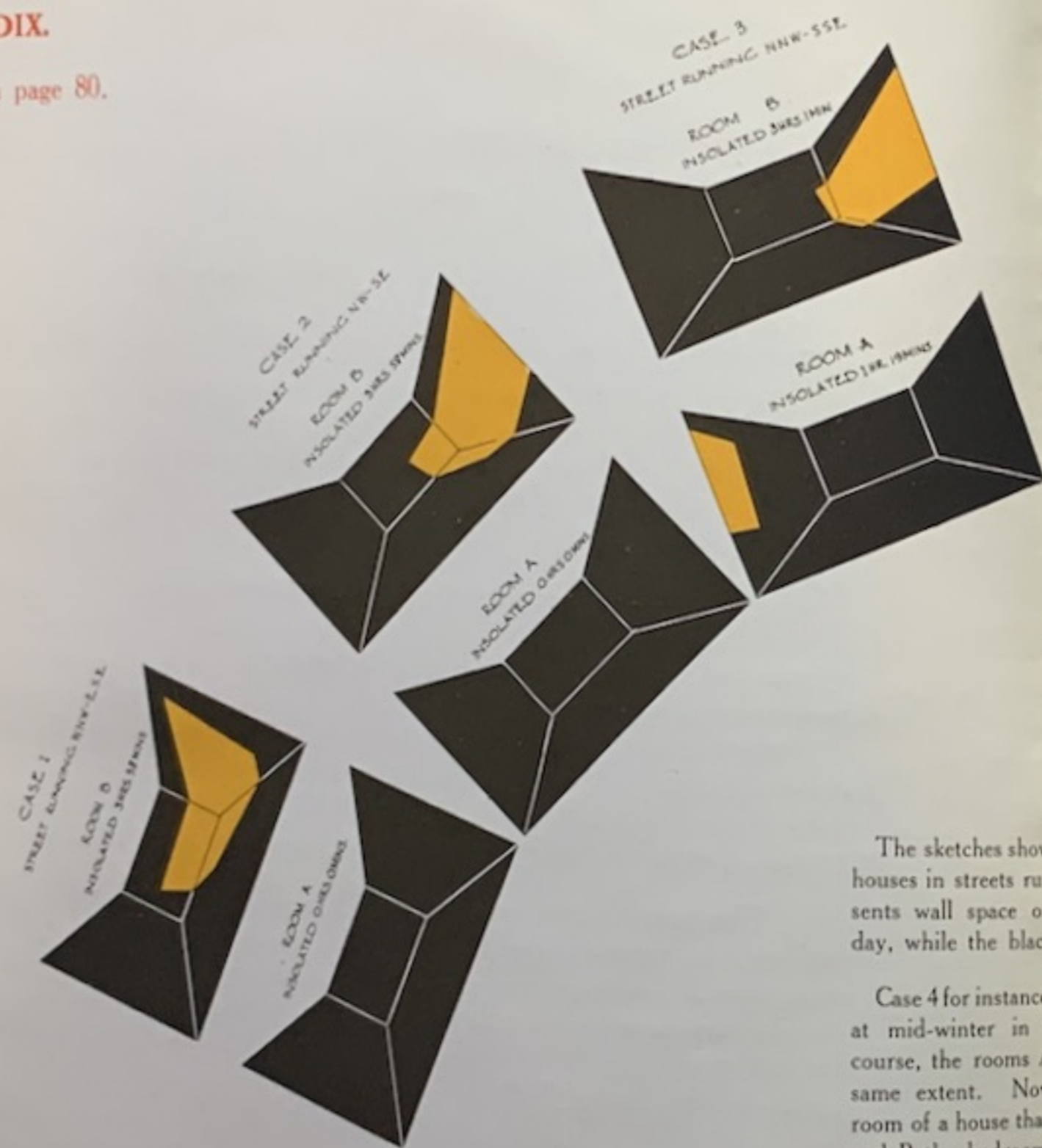
We are bound then to ask why this country has not before availed herself of the benefits of such a type of construction. The answer is two-fold: firstly, these benefits had not been fully appreciated, the many advantages of flat roofs had not been sufficiently realised; secondly, flat roofs being new to us and at first a little strange to our eyes, we were apt to cling to the conventional and traditional form of pitched roofs for our dwelling-houses. To some of us flat roofs were apparently quite new and unorthodox, and being unorthodox, of course, impossible; but that idea was only tenable at first. When this new principle is studied, its virtues are so apparent and indispensable that it is not only accepted but hailed with acclamation.

The remarks and quotations on pages 119 and 120 will surely expose any remaining hesitance as nothing more than prejudice, a prejudice which has been overcome abroad as it must now be overcome here. We in this country are admittedly slow to adopt new ideas, clinging too long to conventionalities that were habits of our fathers and grandfathers. But to the reader who has followed the discussion and the argument in this book, we would quote the words of Saint Paul:—

“Probe all things, hold fast that which is good.”

APPENDIX.

Referred to on page 80.



The sketches show houses in streets running in the various directions; the yellow area of wall represents wall space on day, while the black

Case 4 for instance, at mid-winter in a course, the rooms A same extent. Now room of a house than and B the bedroom, to S.S.W. This total insolation is 10 while the bedroom the beds are being

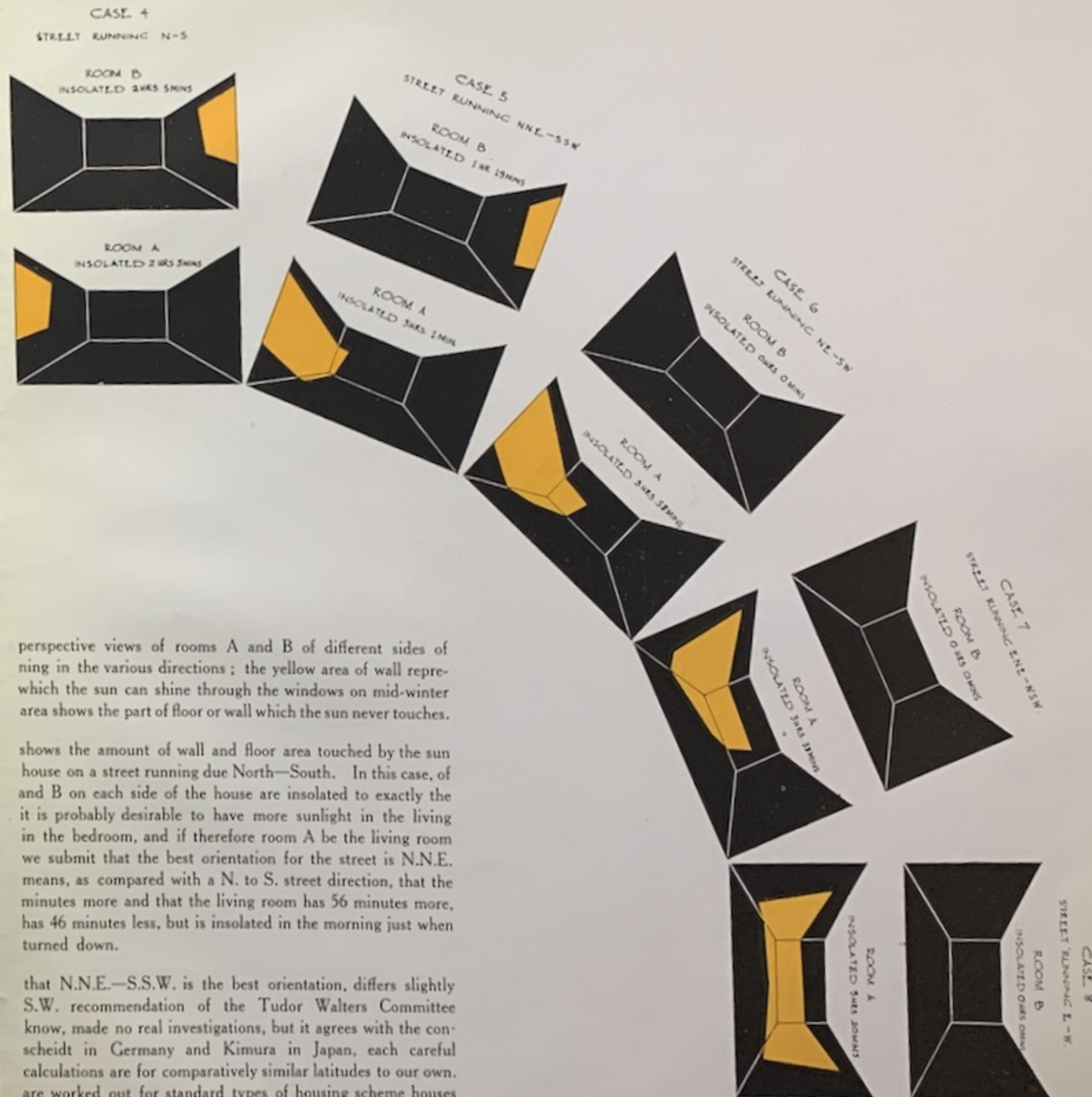
This conclusion from the N.E. to which, so far as we clusions of Schwagen investigators whose The above diagrams as shown in section interesting to com winter conditions.

CASE 4
STREET RUNNING N-S

perspective views of rooms A and B of different sides of ning in the various directions; the yellow area of wall repre- which the sun can shine through the windows on mid-winter area shows the part of floor or wall which the sun never touches.

shows the amount of wall and floor area touched by the sun house on a street running due North-South. In this case, of and B on each side of the house are insulated to exactly the it is probably desirable to have more sunlight in the living in the bedroom, and if therefore room A be the living room we submit that the best orientation for the street is N.N.E. means, as compared with a N. to S. street direction, that the minutes more and that the living room has 56 minutes more, has 46 minutes less, but is insulated in the morning just when turned down.

that N.N.E.-S.S.W. is the best orientation, differs slightly S.W. recommendation of the Tudor Walters Committee know, made no real investigations, but it agrees with the conscheidt in Germany and Kimura in Japan, each careful calculations are for comparatively similar latitudes to our own. are worked out for standard types of housing scheme houses on page 80, and are calculated for pitched roofs. It is therefore pare sketch 5 with the sketches on page 85 both for mid-



250 B.C.

TWO THOUSAND YEARS LATER—

1750 A.D.

TWO HUNDRED YEARS LATER—

1950*With acknowledgements to Tuileries de Courtrai for our illustrations.*