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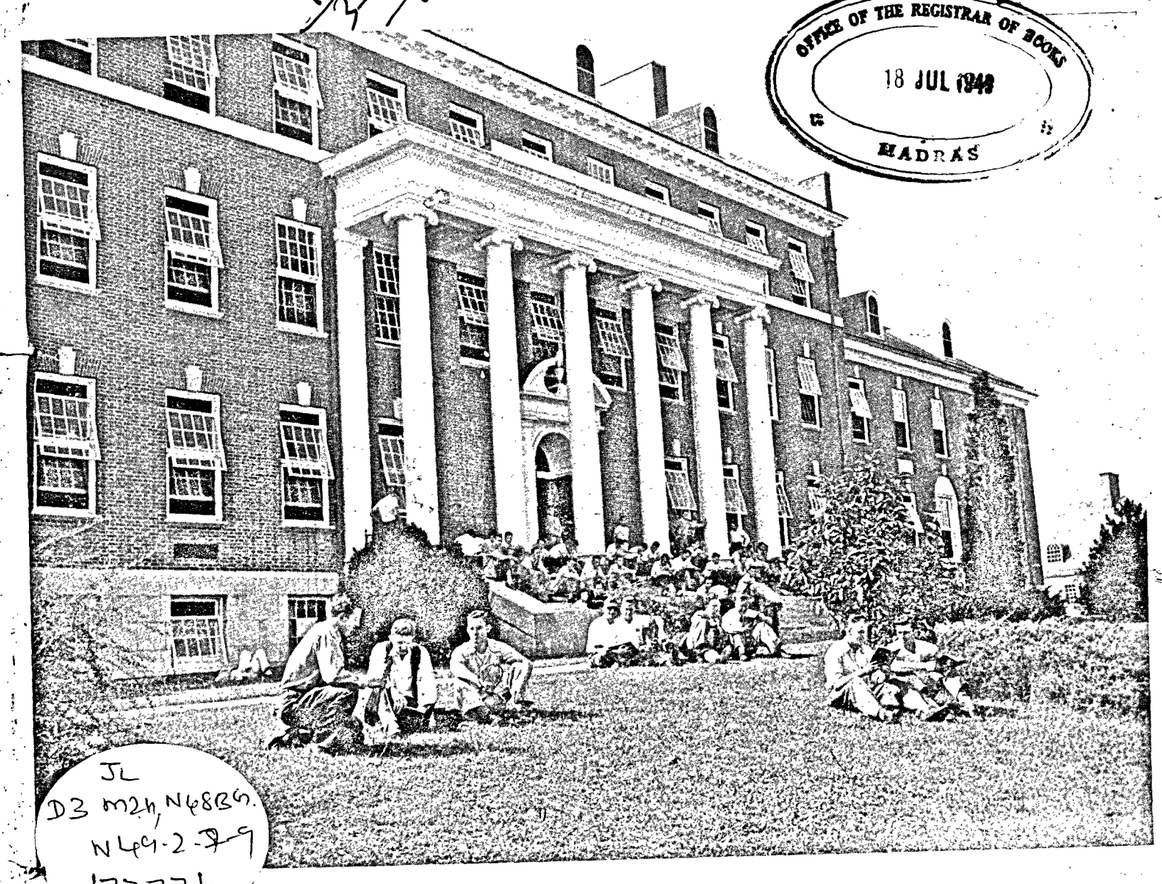
THE BUILDING GAZETTE

VOLUME 2 | JULY 15, 1949 | NUMBER 7



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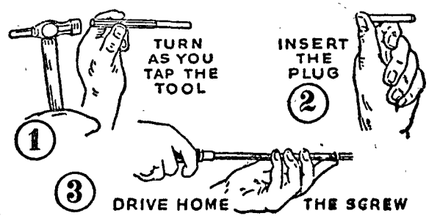

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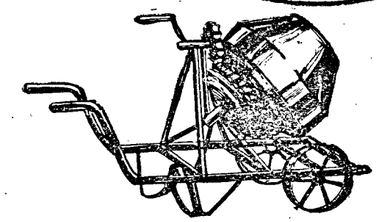

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THE BUILDING GAZETTE

1/11, MUKKER NALLAMUTHU STREET

G.T., MADRAS.

EDITED BY T. N. SUBRAMANIAM

Associate, Faculty of Surveyors of England

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PRINCIPAL CONTENTS

BANKS AND BANKING

INTRODUCED THROUGH THE BUILDING GAZETTE

Figures indicate the current rates per cent of interest to new investors. Investors are advised to communicate direct with the Bank of their choice so that they may obtain full details of any special advantages which are available.

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BUYERS' GUIDE

ADMINISTRATION

Administration is fast becoming one of the key problems of our day. Inevitably, as human society increases in complexity and social organisms grow correspondingly larger and more complex, so the problems involved in administering such organizations multiply and it becomes increasingly important to see clearly the relationship of the individual to the whole.

With the war, the Government was driven to a greater measure of both control and participation in the general framework of national economy and has also exposed weaknesses in governmental organization and methods. Recently the Finance Minister of Madras has said in the Assembly thac he was unable to implement the recommendations of the Retrenchment Committee.

We are, however, moving into a period of planning—and it is unlikely that we shall ever be able to revert to an unplanned society, even if there may be some who would wish to do so. Speaking at a conference in London, Professor J. D. Bernal said: "War has brought home to all nations. . . that a modern industrial state can only develop if its activities are co-ordinated in a common direction. . . Planning is an immense task which will occupy the best human activities for many years, and it must be carried out scientifically."

The governmental machine today badly needs a special organization charged with the research into, and analysis of, the operations of the mechanism of Government itself. It should be independent of the Treasury. It should have the right of entry into any Government organization to carry out a review of its activities in association with the staff, because such a review is a self-educational process for the staffs making it, apart from any critical intent. It should have access to all relevant matter and the right to present its reports to the highest quarters.

It should have among other duties that of scrutinising the Administrative Budget of each Department and calling for such justification for overall or individual items of expenditure as it may consider necessary to enable it to assess whether the Department is operating with all possible economy in administration.

In this it would parallel the U.S. Bureau of the Budget which is an Office of the President and reports to him.

Journals, in fact, have been forcibly reminded of the truth, that "To tax and to please, no more than to love and be wise, is not given to men"; but will our Ministers agree to increase the efficiency of their offices and thus effect savings in Administration by co-opting the services of eminent administrators who are now leading 'retired' life?

NOTES & TOPICS

Asbestos Cement Sheets

The Mysore Government have under investigation the possibilities of manufacturing asbestos cement sheets, using asbestos deposits available in Holenarasipur taluk.

Nehru Stadium in New Delhi

A magnificent sports stadium, befitting the grandeur of the capital of India, and named after Pandit Nehru, is to come into existence in New Delhi before November 1950.

Cantonments

The Central Government has appointed a Committee to examine cantonments present boundaries, the Act of 1924 and other matters connected with their administration. Some will think Cantonments are better administered than Municipalities. Cantonments epitomize much of the political history of 18th and 19th century and Secunderabad, the now biggest of these, accommodate more than 2 lakhs of civilians. Cantonment Boards were almost wholly nominated; civilians lacked amenities and even denied civic rights; the Act of 1924 must, therefore, be overhauled.

Piece-work

I.N.T.U.C.'s. resolution on piece-workers working on old machinery seemed to display a misunderstanding of the principles by which piece-work prices are fixed. The piece-worker is paid for a unit of outturn or work. Such rates are generally fixed by "time-study," an actual timing of the whole operation necessary for the outturn of one unit. Calculations taking into account the condition of the machinery, if machinery is used, and the speed at which it works, or a combination of "time study" and such calculation, are also used for this. Whichever method is used, the condition of the machinery is entirely provided for in the piece-work price, and deterioration of machinery, involving a slowing down of the operation, is sufficient reason for a revision of the piece-work price. These principles are universally accepted, and there would appear to be no need for compensation, as I.N.T.U.C. suggested. If employers declined to revise any piece-work price which had become too low owing to deterioration of machinery, suitable pressure may be brought to bear on them.

Expanded Metal Industry

Started and developed under the stimulus of war-time shortage of expanded metal, the expanded metal industry in this country today comprises four manufacturers with an annual production of 1,500 tons of expanded metal against a rated capacity of 3,000 tons per annum. The lag between the rated capacity and the actual production is due to the acute shortage of black steel sheet which stood in the way of the full utilisation of productive capacity, with consequent increase in the cost of production. The estimated demand for this product in this country is placed at 3,000 tons a year.

Aluminium in Engineering

Great strides are being made in the employment of aluminium in all phases of engineering, and much of the rapidity of progress is due to the activity of the British Aluminium Development Association, which is a body comprising most of those concerned with aluminium production. At the annual meeting of the Association it was recorded that the most striking development completed during the year was the aluminium alloy bridge opened at Sunderland. Structural and building applications have accounted for a considerable number of the Association's resources, and substantial progress has been made in connection with standardisation of building components.

Bombay's Tallest Building

Bombay's tallest building—an eight-storeyed 95-feet-high structure in the Mazgaon Dock area—is expected to be completed in a few months. Providing the latest amenities and estimated to cost Rs. 15 lakhs it will serve as quarters for the supervisory staff of Mazgaon Dock Ltd.

Unauthorised Structures in the Capital

Over 7,000 unauthorised structures, excluding stalls, have been erected by refugees and local elements, taking advantage of unsettled conditions, on areas belonging to the Delhi Improvement Trust. It is pointed out in this connection that the authorities are making arrangements to shift these unauthorised occupants to prefabricated houses to be set up by the Government.

Training Apprentices

The Government of West Bengal have set up a 12-man Expert Committee in Engineering Industry. It will be an advisory body and suggest schemes for standardisation of occupational terms in different engineering firms and classify workers into different categories. The Committee will report on the existing systems of training of apprentices in different engineering firms and recommend schemes for their theoretical as well as practical training with the object of turning out an adequate number of skilled workers and supervisors. It will also suggest allowances and other conditions of apprenticeship.

Improvement Trust for Jullunder

An Improvement Trust has been formed at Jullunder for expansion of the town under the Provincial Government's development scheme.

Testing Dam Sites: A New Method

A device fashioned from steel-capped rubber cylinders and lengths of copper tubing is expected to save millions of dollars in dam construction costs in the United States. It is the invention of E. D. Rhoades, a driller of the United States Bureau of Reclamation.

Rhoades is one of the small group of experienced men who help engineers decide the best sites for dams. Using long, diamond-tipped drills, they probe deep into the earth's bedrock to find out whether the rock structure will bear the weight of the huge dams and to what extent underground streams running through the bedrock will cause reservoirs to leak.

Ordinarily, scores of test holes have to be drilled to test the site for a single dam. It has been necessary to drill a separate hole to test each underground stream. With Rhoades' device, however, as many as eight streams can be measured by drilling a single hole. When it is considered that drilling each hole costs 1,500 dollars or more, the advantages of his device become readily apparent.

In Rhoades' invention, the "multi-packer," long copper tubing extends through rubber cylinders, each of which is about 12 inches long. Steel caps at each end of a cylinder have holes through which to fit the copper tubing. The part of a copper tube protruding below a rubber cylinder is perforated.

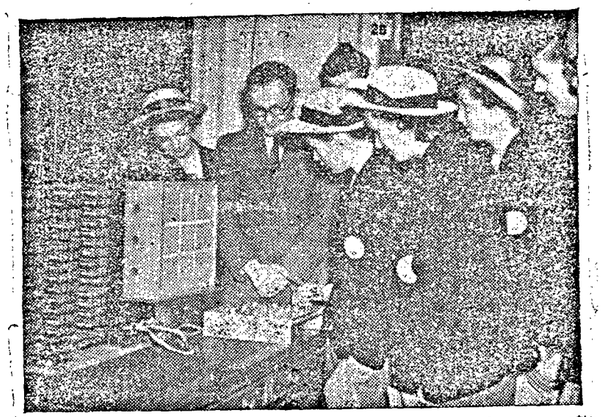
From specimen strata brought up to the surface by the diamond drill engineers can determine at what depths underground streams, or "water tables," occur. After the hole has been drilled through all the water tables" to the desired depth, the "multi-packer" is brought into use.

The device is prepared so that a copper tube will reach from the surface to the bottom of the hole, and so that a rubber cylinder will reach a level just above the lowest underground stream. It is then lowered into the hole and the rubber cylinder inflated with air. Pressing against the sides of the drill hole, the cylinder forms a temporary seal across the top of the lowest stream. A mixture of concrete and water, poured down over the steel cap of the inflated rubber cylinder, makes the seal permanent. Water from the stream seeps into the perforations in the copper tube below the seal and up the tube to ground level, enabling engineers to test the stream's depth and flow. Another copper tube, long enough to reach to the next lowest stream, and another rubber cylinder which will stand just above the stream are lowered into the same hole, and the process repeated. This procedure goes on until each stream between the base of the drill hole and the surface of the ground has been tested.

For his invention, Rhoades received the U. S. Government's highest award given to its employees for ideas increasing efficiency or reducing expenses. A luncheon in his honour was attended by high Government officials and members of the U.S. Congress.

Calcutta Underground Railway

Calcutta's underground railway may have to be laid deeper than in most other cities of the world owing to soil conditions resulting from the heavy monsoon. Boring has been started in central Calcutta to test the subsoil and will be continued in different areas. They are proceeding with the idea of building the underground tunnels with cement concrete, as India could not afford to import 2,500 tons of cast iron pipes, the quantity estimated to be required for the system. The French engineering mission who are entrusted with investigation has proposed to follow the main streets of the city and not delve under areas where building had been re-erected.



Youngsters see "Noughts and Crosses" Machine

A party of schoolboys and girls recently paid a visit to the Royal Society, Burlington House, London, to see the "Noughts and Crosses" machine. Invented by 25-years-old Donald Davies, a member of the mathematics division of the National Physical Laboratory, the machine "plays" human beings—and wins every time. The machine supplies the Os. Jennifer Hicks, aged 16, plays the machine, watched by fellow students of the Royal Masonic School, Rickmansworth, while Mr. Donald Davies, the inventor, looks on.

BUILDING DRAINAGE

*F. L. BARROW, M.Sc., A.M.I.C.E., M.I.Struct. E., F.R.S.I., A.M.A.S.S.E.

The following is an extract of the paper read at the Institution of Sanitary Engineers of England, by F. L. Barrow Esq., of the Building Research Station of England.

IN the course of the many talks I have had about plumbing and drainage matters with a very large number of sanitary engineers, sanitary inspectors, plumbers, manufacturers, architects and others, one outstanding fact has emerged. This is that there are substantial difference of opinion over the whole range of plumbing and drainage. Many of these differences cannot be accounted for by the fact that practice must necessarily vary according to different conditions on different jobs. It goes much deeper than this. It means, as I see it, that no one man, however wide and lengthy his experience may be, can be accepted as final authority on every point. Two very knowledgeable men of equal breadth of experience may, therefore, differ on quite important issues.

In the field of Building Drainage these differences occur in matters of pipe sizes, gradients, changes of direction, support of pipes, trapping and ventilation and, last but not least, access. You may agree with me that it might be a good thing if something practical could be done to resolve some of these differences, because now, as never before, there is a need to bring drainage practice to the highest level of efficiency—by which I mean doing the best possible job from the sanitary standpoint without wasting labour and materials. The phrase "best possible job" in this connection is meant to include making the best possible balance of sanitary precautions one against another. You will know better than I that one precaution cannot always be taken to the limit without interfering with another, hence the need for a rational balance in each case.

Various aspects of building drainage have already been listed. They were pipe sizes, gradients, changes of direction, support of pipes, trapping, ventilation and access. Some of the differences of viewpoint in these matters are as follows:

Pipe Sizes

While some people seem to base calculations for pipe sizing of branch drains and private sewers on self-cleansing flow, others recognise that no drainage system so close to buildings, at any rate houses, can be continuously carrying discharges in all parts of it and thus there must be periodic deposition of solids. Hence, the pipes cannot really be self-cleansing in the strict sense of the word and all one can hope to do (all perhaps that one needs to do) is to prevent actual blockages.

Blockages are often caused, apparently, by solid objects which should not properly be in the drain at all, such as cleaning brushes, cloths, children's toys, and other (stranger) articles. If this is true it seems rather essential to base pipe sizing on a successive increase in diameter in the series: W.C. outgo, branch drain, private sewer. The first of these seems to control the sizing very largely. When the outgo is 3½ ins. in diameter the branch becomes 4 ins., and then if the private sewer is made 6 ins. it helps towards confining blockages to the branch drains.

When pipe sizing is done on this basis it does not seem necessary to worry very much about fluid flow capacity because in the normal case the sizes are more than ample to take the liquid discharges.

It seems appropriate in this connection to refer to American domestic drainage practice where, because of the use of syphonic closets with 2½ ins. to 2½ ins. outgoes, there is a case for 3 ins. diameter branch drains; and some American engineers think a minimum of 3 ins. is correct for their practice. A point in using a small outgo is that it tends to localise blockages in the closet pan, which, from the sanitary engineer's point of view, would seem to be rather a good thing.

Five-inch drains are used in Scottish and also in American practice, but in England it seems usual to jump from 4 ins. to 6 ins.

I would like to know what you think of the idea once given to me that a domestic drain should be of ample size in view of the possibility that at some future date more connections may be made to it. Is this a justification for permitting relatively sluggish discharges until such times as the additional connections are made?

Gradients

The foregoing remarks about self-cleansing flow in relation to pipe sizes would seem to apply also in connection with gradients. May I read what the Plumbing Committee's Domestic Drainage report† says in this connection?

* By courtesy of the Institution of Sanitary Engineers.

† Plumbing Committee of Building Board. Post-War Building Studies No. 26 "Domestic Drainage", London, 1947.

"In view of the limited amounts of water passing through domestic drains and the intermittent nature of these discharges it is to be expected that small accumulations of solid matter will be deposited temporarily at points between the house connections and the public sewer. What probably occurs is a successive shifting of these deposits as the discharges take place. The falls should be sufficient to prevent build-up of solid material.

"Data for the exact calculation of minimum gradients necessary in each particular run of drain (to prevent interference with flow due to build-up of solids) are lacking, so one has to rely, at present, upon rules which have given satisfactory results in the past. These are: 1 in 40 for 4-in. pipes, 1 in 60 for 6-in. pipes, 1 in 90 for 9-in. pipes. For the present we recommend adherence to these rules (for both foul and surface water) with the rider that experience seems to justify using 1 in 50 for 4-in. pipes and 1 in 75 for 6-in. pipes where falls are restricted and where the drains are well designed and well laid.

"It is perhaps worth while to point out that the practice, sometimes adopted where falls are restricted, of using a 6-in. diameter pipe instead of a 4-in. diameter pipe merely to justify laying at 1 in 60 instead of 1 in 40, cannot result in increasing the velocity of flow. On the other hand, it reduces the depth of flow, and for this reason alone the practice is to be deprecated."

In Scotland it seems normal to accept gradients of 1 in 48 for 4-in. and 1 in 72 for 6-in. pipes. In America I found people recommending a variety of gradients from 1 in 48 to 1 in 100 for 4-in. and 6-in. pipes.

I think it is over-simplifying the problem of minimum gradients in domestic drains to relate them solely to size of pipe. The proper clearance of such drains is also affected by the initial velocity of the discharges, their amount and the type of solids carried. Because of these factors, the conditions of flow are not the same in different parts of the system, initial velocity, for example, having much more effect near the houses.

It seems important that it should be determined with rather more certainty than has been done so far just how small the gradients can be made without adversely affecting clearance, because obviously if they are made steeper than necessary a lot of money may be wasted in excavation, the cost of which goes up rapidly with increased depth of trenches.

When stoppages occur in drains which happen to have an unusually small gradient it should be established, I think, that these stoppages really *are* due to insufficient gradient (and not, for example, to bad joints) before attributing the trouble to not abiding by the time honoured rules of 1 in 40 and 1 in 60.

Before leaving the subject of gradients may I quote what the Plumbing Committee's report says about *maximum* falls for pipes.

"A gradient sufficient for satisfactory performance should not be exceeded if it costs more to do so, but it frequently occurs that the gradient of a branch drain is dictated not by minimum requirements for flow but by the difference in level between the house connections and the adjacent length of sewer. (In the typical example illustrated in the back of the reports) the steepest gradient for a branch drain entering the foul water private sewer becomes 1 in 8. It would, of course, be possible to lay all these drains at 1 in 40 for most of their length and then ramp down, but on balance we favour . . . avoiding the ramp, because there are advantages in respect of laying and performance in not changing the gradient in a run, and the amount of additional excavation involved is relatively small."

Changes of Direction (in Plan)

The Plumbing Committee's report, referring to its illustrative drainage system, says: "Changes of direction are as few as possible and where two branch drains meet and combine only one of them changes direction. Changes of direction are 90° or less, except when the connections are made in manholes."

Presumably, there is no particular magic about the 90° figure, but this is a convenient rough limit to work to. Here again, however, perhaps there is over-simplification. Maybe the factors of initial velocity, etc., mentioned in connection with gradients, should again be considered and possible *rate* of change of direction is a factor. If the radius of bend in one case were, say, double that in another could this be taken to justify a greater change of direction in the first case than in the second?

Concrete Support of Pipes

On the subject of concrete support for drains, the Domestic Drainage report says:

"It is not possible at the present time to specify the exact conditions under which a stoneware pipe can or cannot be bedded directly on the ground without risk of settlement sufficient to cause fracture. Reliance has to be placed upon practical experience. Unfortunately, practical experience has not always given the correct answer; and in some cases stoneware pipes have been laid directly on ground not suited to this type of construction and in other cases concrete has been unnecessarily, and thus wastefully, used. The first of these defects is serious because fracture of pipes or joints may lead to pollution of water supply (even at considerable distances) besides permitting infiltration of ground water and penetration by plant roots. Waste of labour and materials is also a serious matter, particularly at the present time. When ground is not good enough to support stoneware pipes laid directly upon it, it may be found preferable to use cast-iron pipes instead of stoneware with concrete supports. Sometimes concrete support and haunching has been specified as a safeguard against insufficient care and skill in workmanship, but we do not think this is a correct approach, because inferior laying and jointing of pipes is not redeemed by concrete sup-

port, and special attention to supervision, and employment of proper skill in laying directly on the ground, may give better results at lower cost."

One trouble about concrete support, it appears, is that the fundamental causes of the cracking of pipes and joints apply also to the concrete, so to be logical one should ensure that the concrete can bridge over the parts where support is going to be lost by settlement. This may call for reinforcement.

Another question is whether we are not setting ourselves an impossible task in trying to lay impervious drains (if that is what is really wanted) with brittle materials such as stoneware pipes, with cement joints, in ground that must often, of necessity, undergo some movement after the drain is laid, particularly close to the buildings. And if this is so, should not further efforts be made to introduce more flexible materials? The Domestic Drainage report says:

"The development of plastics during the war period raises the question whether some of the new materials of this type might not be applied with advantage to the manufacture of drain pipes and fittings. Some of the materials have the advantage of high resistance to corrosion combined with toughness, likeness and a useful degree of flexibility."

Finally, in this section, a word on drainlaying is relevant because of the claims that concrete support can often be omitted if drains are well laid. I will merely say that opinion seems to be divided as to how far, and how often, first-class drainlaying can, in fact, be obtained in current practice.

Trapping and Ventilation

"Trapping" and "Ventilation" are presented together for reasons which are explained (if any explanation is necessary) in the following quotation from the Domestic Drainage report:

"*Foul Water System.*—In the typical example, the only traps are those on the appliances within the houses and at the gulleys. This permits a free flow of air from the public sewer to the open tops of the soil stacks—except for the short runs of branch pipes from the trapped gulleys to their junctions with the soil branches.

"*Surface Water System.*—In the example the rainwater gulleys on the surface water system are trapped, hence a through current of air is not obtainable as in the case of the foul-water drains. The rainwater gulleys, however, cannot receive foul-water discharges (such as yard washings or kitchen waste) because the only connections to them are of the back inlet type, i.e., there is no surface inlet through a grating. The chief requirement, as regards ventilation, for the branch surface water drains, is the prevention of airlock during heavy rainfall. This is adequately met here by the open covers on the manholes."

Now we come to the hoary old subject of the Intercepting Trap. Some in this meeting will be able to recount much better than I the history of the controversy surrounding this question. The Plumbing Committee say:

"It has to be considered whether the risk of leakage of drain air through the above-ground soil pipe-work is sufficiently great, and the air in these pipes sufficiently noxious, to need a 'second line of defence' in the shape of additional intercepting traps on the underground drain. It is important that the need for such trapping, if it exists, should be properly established, because second trapping is attended by certain serious disadvantages.

(*a*) They increase the liability to stoppage or partial stoppage of drains.

(*b*) They obstruct flow.

(*c*) They retain foul matter in the water seal.

(*d*) They create difficulties in ventilation and require special fresh-air inlets, and it is generally agreed that fresh-air inlets are liable to be damaged and put out of order.

(*e*) They add to costs in respect of materials and labour.

"We hold that intercepting traps are essential safeguards in some old drains and sewers, where, owing to inefficient design and construction, they are a good deal fouler than if they had been laid according to modern standards of good practice. At the same time, it must be recognised that in certain cases such drains might have been more efficient and cleaner without their intercepting traps.

"A special case arises when a few buildings are connected to an old sewerage system in which the drains from the existing houses on the system are intercepted, in which case we would recommend the use of intercepting traps in the new work, because it is not reasonable that the old sewer should be ventilated through the soil stacks of the few buildings only."

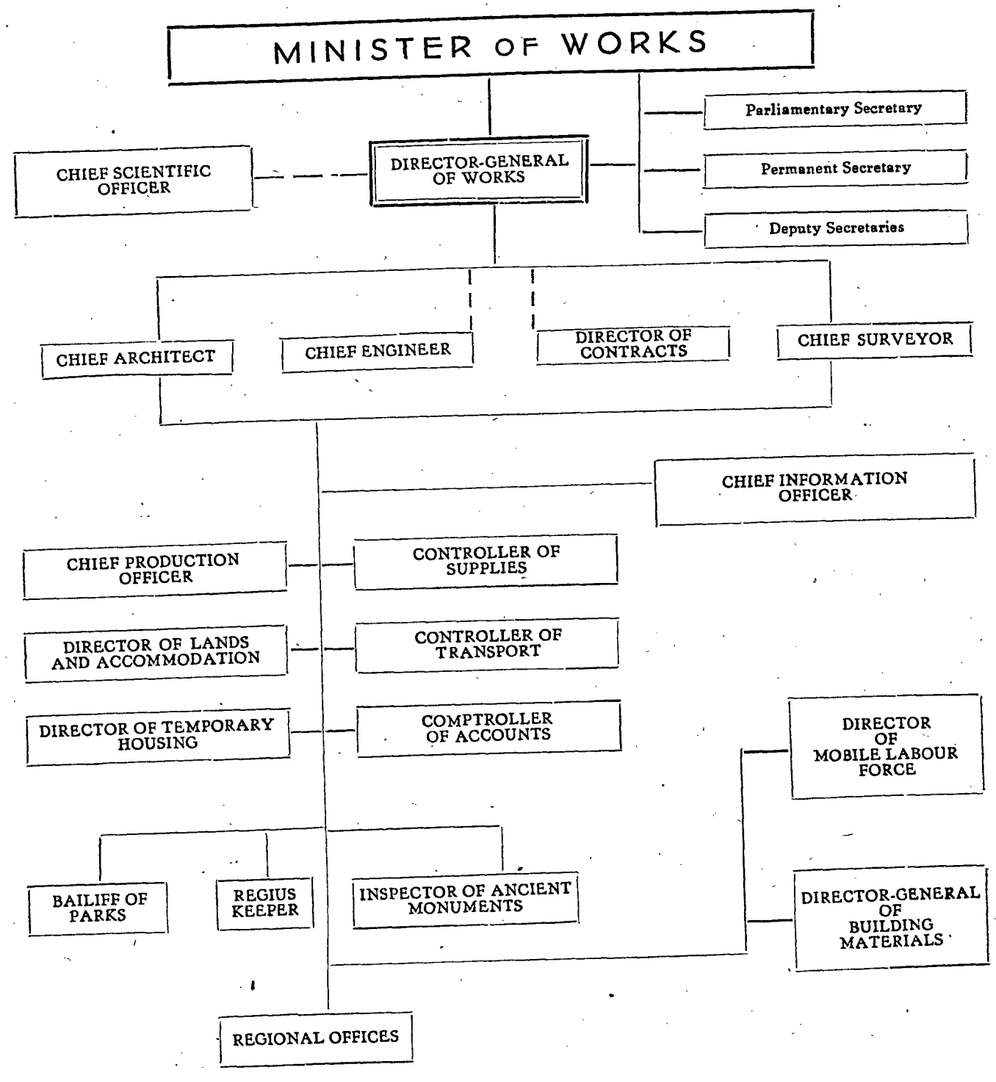
In Scotland intercepting traps seem to be favoured rather more than in England. In America, according to my limited information, they are usually omitted now in domestic drainage. No doubt it depends upon circumstances, but what needs to be decided more definitely by actual observation is, on the one hand, the incidence of noxious vapours in and around buildings because there is no intercepting trap and, on the other hand, the incidence of stoppages caused by the presence of an intercepting trap. Then it may be possible to get nearer to an answer to the question: When is the intercepting trap necessary?

Access

To introduce the question of access to domestic drains, i.e., the provision of manholes, rodding eyes, etc., I will quote again from the Domestic Drainage report:

"To say that a drainage system has been properly designed, constructed and tested implies that all

(*Continued on page 14*)



The above illustration is that of the Organization of the Ministry of Works of the United Kingdom. Director-General of Works is an Architect by qualification. The Minister of Works is advised on all the wider questions affecting the building industry by the National Consultative Council, established in 1942.

BUILDING DRAINAGE

(*Continued from page 12*)

known precautions have been taken to prevent stoppages occurring, and experience shows that when this has been done stoppages are extremely rare, and manhole access is only really called for at certain critical points in the system. Elsewhere, it is, in our view, preferable to take the slender chance of stoppage (and dig out as necessary) rather than burden schemes with numerous manholes which, in all probability, will never be needed for access, and which may in themselves be the cause of stoppages. This last point is worth stressing, because for a variety of causes, e.g., fracture of manhole covers, failure of renderings, improperly formed channel inlets, unauthorised lifting of covers (for throwing in waste matter), etc., manholes have frequently been the cause of drain stoppages, either partial or complete. Hence a generous provision of manholes (which may add seriously to costs) is not necessarily the best way to reduce maintenance trouble to a minimum. It should perhaps be repeated that these recommendations can refer only to properly designed, constructed and tested drains. Buried rodding eyes are sometime used as a cheaper alternative to manholes, but some of the arguments for reducing the number of manholes apply also to these.

"In the typical example (used in the Report for illustrative purposes) we have implemented the policy outlined above, and have used manholes on the private sewers only—at the top ends, at lower ends near the public sewers, and at changes of direction. The straight runs of these sewers are 250 ft. or less, and therefore not long enough to require intermediate manholes. One of the results of using so few manholes in this case is that the line of some of the branch drains cannot be detected from the surface; but we do not consider that the expense and other disadvantages of manholes should be incurred merely to facilitate the tracing of drain lines. In our opinion, it is better to do this by carefully recording on plans the line of the drains as constructed, and keeping these plans for reference."

There may be other opinions about access to domestic drains, but I would suggest that one way to help everybody in the future to follow the most sensible practice—meaning practice which gives the minimum of trouble without waste of money—would be to study existing drainage systems in a systematic manner, and on a statistical basis, to note what access is really required for the stoppages which really occur.

Conclusion

In conclusion, I hope you will not be feeling that the foregoing conflicting ideas about domestic drainage have been presented just, as it were, to annoy! The purpose of these notes is more positive than that. It is to raise the question as to what can be done to infuse a little more reliability and beneficial uniformity into domestic drainage design, and to make a plea for a common storehouse of observed facts to leaven our exchanges of opinion. I do not think this job of work should consist merely of assembling a lot of cases of domestic drainage troubles with probable reasons why they occurred. Besides this it is necessary to know whether a certain practice leads to a certain trouble in every case, once in 100 cases, once in 10,000 cases or once in a million. If it causes trouble very infrequently it may be worth the risk, not only to save money, but also because precautions in domestic drainage introduce complications when carried beyond a certain limit. It has already been noted how this can happen with intercepting traps and manholes. What is needed, I suggest, is systematic observation of the performance of the building drains in a large number of housing estates, or other housing groups, with proper sampling. In this way the relative importance of the various factors may become more correctly evaluated. It might at least be discovered from such surveys whether a certain precaution could be stiffened up because the lack of it has caused trouble in a relatively large number of cases or, conversely, whether another precaution could be relaxed because it has cost a great deal to apply while preventing trouble very rarely indeed. No one man can possibly cover the whole field in this matter. It needs to be a co-operative job. It seems to me that your Institution is eminently one to foster or organise such a research project. May I leave this thought in your minds and ask you to give it special consideration in your discussions, to which I shall look forward with very much interest.

PERSONAL

Mr. Kanwar Sain

Mr. Kanwar Sain, Chief Engineer of the CWWINC is to leave for the U.S. in connection with the preparation of the final design for the Hirakud River Valley Project. The U.S. Bureau of Reclamation in Colarado has agreed to undertake the work of analysis and a detailed design for the Kosi Valley Project as well as finalisation of the design for the Hirakud Dam. Mr. Sain, it is understood, will also discuss problems connected with other river valley schemes in India with the U.S. Bureau of Power. Before returning to India, he will visit Norway and France.

Dr. S. Trone

Dr. S. Trone, an eminent American engineer and a world authority on the planned utilisation of national resources, has been engaged by the Cabinet Secretariat to advise the Government of India on the development schemes and projects. He is expected to arrive in India in August. He was associated with the execution of the first two five-year plans of the Soviet Union and was responsible for the construction of the famous Dnieper Dam. He also acted as an adviser to the National Resources Commission of the Kuomintang Government of China.

Mr. B. K. Kapur

Mr. B. K. Kapur, Superintending Engineer, P.W.D., East Punjab, has been nominated as India's representative at the Bureau of Flood Control, which was recently constituted by the E.C.A.F.E.

TOWARDS QUALITY PRODUCTION

Col. D. R. JOHNSON

IT has sometimes been suggested that advantages would become apparent if manufacturing firms concentrated the capacity of their Tool Rooms upon experimental work and manufacture connected with the production of prototypes, special models, maintenance of existing tools, etc., leaving gauges, measuring instruments, jigs, tools, etc., to be manufactured by firms specialising in such production.

Whilst this suggestion has much to commend it, especially at the present time when skilled tool-makers are at a premium, and very rarely is it found that an adequate number of skilled tool-makers exist in one concern, excluding, of course, those firms engaged solely upon tool-making, it is an allied subject which brings up a matter of, at least, equal, if not greater moment —that is, the paucity of inspection generally in production.

After a very considerable first-hand contact with a number of engineering firms in the U.K. it has been most emphatically brought to notice that there are three major schools of thought as regards inspection.

Firstly in the case where the manufacturer is producing an article of a consumer nature, i.e., pots and pans, electric light fittings, pieces of equipment for the consumer to assemble, and so forth, very often no inspection department whatsoever checks the particular product during any stage of production, it apparently being assumed that provided the necessary tools engaged on the manufacture of the component are checked periodically, any defect occurring in the product is "one of those things," and is bound to be located by the consumer at a later stage, if at all, when if necessary the particular defective part can be exchanged under guarantee.

Whilst this method may have some advantages in that the cost of an Inspection Department concerned with the product is eliminated, it is suggested that from the Home market point of view, it is an exceptionally short term policy, as sooner or later the present user will change his source of supply to a competitor.

Secondly, there are still a considerable number of firms engaged upon the manufacture of goods who rely solely upon the skill and craftsmanship of their old and trusted employees to produce a satisfactory article, merely by the utilisation of only such skilled labour.

Whilst in turn this method of manufacture is temporarily entirely satisfactory, it is suggested that the method of training and the education of skilled personnel has very seriously decreased in the development of individual craftsmanship since the time when the present old craftsmen were trained, and the present time. As an example of this point, many so called apprenticeships are now served by apprentices in engineering shops where the majority of their instruction consists in learning the efficient operation of specialised and complex machine tools against the time study schedule prepared by the estimating staff, and although this may be an admirable state of affairs when the trainee is ultimately put into a production line and becomes highly proficient in the usage and operation of, say, a milling machine, shaper, radial drill, etc., it is bound to subsequently occur that the particular operator will be called upon to operate a machine tool of an entirely different type, and as he has only been trained in the operation of specific types of machine tools, valuable time, and possibly valuable products, may be lost before he becomes proficient in such work; whereas, had he received the initial training in the principles of machine tool operation and general component manufacture, he would very easily and quickly achieve the degree of efficiency which could only be reached in a much longer period by the so-called later method.

Taking this a step further, the trainee of today does not usually receive instruction in the use of his hands, and it is suggested that only a very few of the present day trainees could produce, given a block of steel and a file, the one inch cube, which was the test of a steady skilled hand a number of years ago. Even this by itself is not sufficient, as the interpretation of a component drawing into a finished product calls for a degree of experience in general engineering practice which is now not usually taught. It would appear, therefore, that the present specialist methods of manufacture are bound, sooner or later, to lead to a state of affairs when although the product, which has been specially tooled up, can be economically produced, the introduction of an occasional non-standard product will result in considerable manufacturing difficulties and probably losses, during the course of manufacture.

In both the above cases it is felt that the method of manufacture is not in accordance with true British Tradition, whereby the best possible product at the most reasonable price is put upon the market, and it remains, therefore, at present for the firms described below, in the third category to produce such an article in the most

economical way and yet maintain the high quality standard which will guarantee future sales; such production being based on a long term policy.

In this third group, the manufacturers have become aware of the advantages to be gained by the installation of an adequate Inspection policy.

It is in order that manufacturers generally should appreciate the necessity for an adequate Inspection Department that this article has been written.

Broadly speaking, at the present time, any manufacturer in this country has sufficient orders on his books to enable his plant to run for a considerable period, more often than not at a considerable profit, and it is therefore considered by such a manufacturer to be to his advantage to supply his products at the fastest possible rate provided that he continues to have orders in hand on which delivery has been promised, which is not considered excessive during the present period. It is feared that this type of short-sighted policy is far too general, but it may be that the various manufacturers have considered the problem of Inspection, and have decided against it, because no matter how well or how badly the product is at present being manufactured, the installation of an Inspection Department can only cause a resistance to production, until such time as the quality of the product has reached that standard which is specified in the original design. It is probable that in a number of cases such a decision as regards inspection may have been financially right, but no matter what the products are which are now being produced, it must be realised that by virtue of the small total number of available manpower, and the consequent restricted number of machine tools, etc., which can thereby be operated, we cannot attempt or hope to achieve a state of affairs when we can effectively compete with the larger producing nations in the sphere of mass production, and it would be far better that the manufacturers' policy should be directed to producing and providing a product which, although possibly more expensive, has so much additional refinement to commend it that even the Home Market of the larger producing nations will be more anxious to obtain delivery of the higher quality article, rather than support their own Home production, when such production obviously must fall short of the quality of the properly manufactured and inspected products.

In order to consider the introduction of proper inspection methods at every stage of manufacture it will probably be of interest to follow the development of inspection in relation to a new quality produced product. The product will not be specified in the following paragraphs, but the principle will remain the same irrespective of the type of manufacture concerned.

1. Generation of Inspection Department

Personnel and Functions.—It is of fundamental importance that the decision having been taken to install an Inspection Department, the personnel allocated to that department should be of suitable calibre for the job in hand. Inspection as a function is not one which can be carried out by a staff consisting solely of semi-skilled personnel.

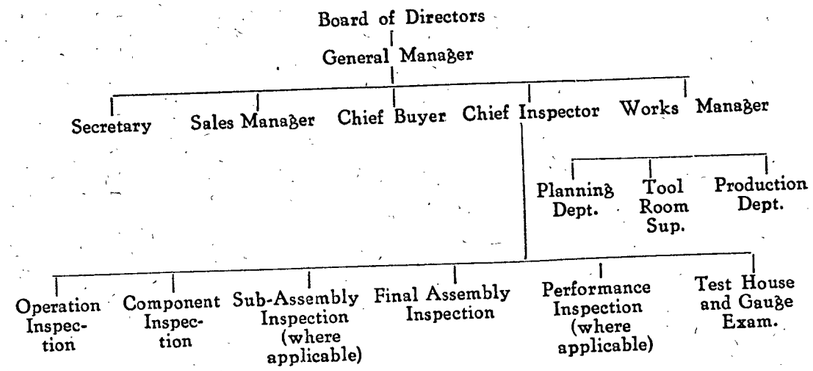
The first appointment made should naturally be that of Chief Inspector, and it is not infrequently possible to find within the manufacturers existing production staff a person having the requisite qualifications to become Chief Inspector, whilst at the same time having the distinct advantage of some knowledge of the problems which are liable to arise in respect of the product being manufactured. It goes without saying that these qualifications must include an original apprenticeship in Engineering, a good knowledge of Machine Tools and the operation thereof, manufacturing processes, an ability to quickly appreciate new engineering problems as they arise, and a resoluteness of character which will enable him, once having made a decision, to adhere to that decision despite the fact that the Production Department may be emphatic that their required output figures may be affected.

It is not sufficient, however, merely to upgrade an existing skilled employee to the title of Chief Inspector without making it clear to the works generally that once the appointment is made, any complaints received relative to the quality of the product produced must be in the first instance referred to him, and secondly it is most important that he shall be in no way influenced by production target figures, either by financial inducements, direct pressure from Production Departments, or have his effectiveness neutralised by partial or total circumvention whereby finished or part finished products are not submitted for inspection before being sent forward to the next production stage or despatched to a customer.

It is suggested that the following diagramatical layout of functions show the true relationship between the Inspection Department and the remaining Departments of a typical producing firm. (It is emphasised that this is diagramatic, and it is appreciated that a number of functions apart from those covered by the Inspection Department have been omitted.)

Whilst the actual engagement of personnel for the Inspection Department can be carried out by the Secretary (or Employment Manager), it is most important that the Chief Inspector should have every facility for, firstly, specifying the type of skill of the individual people he requires, and secondly carrying out all interviews in connection therewith, as well as laying down the details of any tests for proving the craftsmanship of the potential inspection personnel.

The number of assistants the Chief Inspector will require obviously must vary in direct proportion to the quality, complexity and quantity of the products being produced, but it is felt that the following functions of Inspection must be provided with a



sufficient quantity of Inspection personnel to ensure that the finished product is made exactly to specification.

During the manufacture of an individual component of any product it can normally be assumed that, owing to the utilisation of semi-skilled productive labour, the component produced will be in the first instance as accurate as the tools have been set by the toolsetter, but will depart from that original accuracy in direct proportion to the wear on the tools themselves. If the manufacture of the component necessitates more than one operation, and no inspection is applied after the first and each subsequent operation, then it is possible for an inaccuracy not to be located until the component is completely finished, with the probable result that a considerable batch of components, in all stages of manufacture from the first operation and onwards, will have to be scrapped, or at least rectified.

The Chief Inspector should, therefore, ensure either that each operator at each operation stage has adequate gauges to check the accuracy of the individual operation, or alternatively, the Chief Inspector should have an assistant whose function it is to check, in continuous rotation, the products of each operation throughout the whole sequence of operations concerned with the production of the component.

Similarly, where individual components are mated together in the form of an assembly or sub-assembly, gauges, jigs or fixtures should be provided at each stage of such assembly, or alternatively, the Chief Inspector's assistant should continuously inspect the production at each assembly stage by means of such equipment.

In either case it will be seen that it is necessary for adequate gauges, jigs or fixtures to be available, either for the operator's own use, under the supervision of an assistant of the Chief Inspector, or for that assistant's own use.

Assuming that the assembly when completed is capable of performance, then such inspection equipment as will enable this performance to be compared with the designers' specification must be provided to and operated by members of the Chief Inspector's staff.

In addition to the Inspection staff engaged whole time on the detailed examination of the product itself it is necessary that there shall be a separate section, also under the Chief Inspector, where all gauges, jigs and fixtures in use during manufacturing processes, can be periodically examined to a high degree of accuracy, and special tests made, for example, fatigue test, wear test interchangeability test, etc. This section, by virtue of its function will also ensure, by periodical spot checking, the quality of component manufacture, and construction and assembly of completed products, that the Inspection Department itself is performing satisfactorily. Needless to say this must be definitely regarded as a secondary function. The primary purpose of the section is to ensure that the working equipment of the Inspection Department remains continuously in good condition and within the prescribed tolerances in all cases, as otherwise products will be checked by inspection equipment on which wear has taken place to such a degree that not only are the finished products not in accordance with the design and specification to which they are supposed to be built, but, further, the entire Inspection staff and inspection equipment are useless.

2. Accommodation

Once the staff of the Inspection Department have been appointed, it is necessary for them to be stationed within the manufacturer's premises at the most effective points, during the sequence of component manufacture, assembly and final test. Where line production is resorted to, these points present no major difficulty in finding, but where this type of production is not carried out, it will be necessary for each manufacturer to consider the suggestions put forward by his own Chief Inspector as to the best available sites. Primary considera-

tion should be given wherever possible to bringing inspection to production, rather than causing the production to be transported to a distant point for examination by the Inspection Department.

The Chief Inspector's office should be within the Works, preferably centrally located, so that at all times he is in a position to visit any part of the shop with the minimum of delay, and make immediate decisions as regards the acceptability or otherwise of the product.

Gauge Store and Test House.—Excepting in the larger firms it is preferable for the personnel of the Test House to be located away from the main production plant, as owing to the degree of accuracy of that Department's particular work, it is imperative that vibrations and shocks, even of a relatively minor nature, should be eliminated as far as possible, and as this will possibly necessitate the erection of a separate room, either inside or outside the main plant walls, it is felt that at the same time as this is being constructed, allowance should be made for the inclusion of a Gauge Store, where reserve gauges can be retained and issued on an exchange basis.

As regards this Test House, by virtue of the accuracies involved, it may be necessary for special temperature controlling plant to be installed, giving a permanent temperature of 68° F., in which case special attention will have to be given to double windows and walls, ventilation and airlocks in all instances.

3. Equipment

A considerable amount of information is available relative to the types and usage of what can be termed Standard Inspection equipment. This equipment has not usually been designed for any specific purpose, and is capable of performing a function of inspection rather than being suitable for one purpose only. It is, therefore, necessary for the manufacturer, through his Chief Inspector, to consider the number and types of such functions as will require to be inspected, and for certain of this Standard equipment, which is suitable for this purpose, to be selected and obtained.

As an indication of the quantity of types of this so-called Standard inspection equipment, one Gauge and Toolmaker of repute in U.K. lists no fewer than 65 items, all of which are capable of performing a different inspection function.

It goes without saying, however, that certain items must be found in any Inspection Department, and Slip Gauges head the list of such items. These slip gauges are usually followed by Slip Gauge Accessories, which enable the slip gauges to be used, for example, as Height Gauges, Internal and External Gap Gauges, Internal and External Diameter Checking Gauges, Scribers, either vertical or horizontal, Radius checking gauges, etc., all being accurate to millionths of an inch.

Although the Slip Gauges themselves are manufactured from material having a very high resistance to wear, it is obvious that by constant usage, wear will ultimately take place, and whilst it may be possible for such wear to be corrected by the original manufacturer of the Slip Gauge Set, and a chart provided showing the variation from Standard size of each individual Slip Gauge, it is necessary for the Set of Slips to be returned to the manufacturer for this to be done, and their use is thereby lost for a period, which is normally in the order of 14 days, for Workshop and Inspection Accuracy Sets.

It is suggested, therefore, that to avoid the possibility of a hiatus occurring in the Inspection Department at any time, at least two sets of Slip Gauges should be held—one set to be permanently in use and the other set held solely as a reserve until such time as the former set is worn and has to be returned to the manufacturer for examination.

Apart from the Standard Gauges referred to in the foregoing it will be necessary for the manufacturer to have available for checking purposes, gauges, jigs and fixtures applicable solely to his particular product, and these gauges can either be manufactured from his own drawings, which should be prepared by the Chief Inspector in conjunction with the Chief Draughtsman, or by a manufacturing firm of Gauge and Toolmakers of repute, who will consider the particular inspection problem involved, and thereafter produce a gauge design, which will be submitted for approval to the manufacturer's Chief Inspector prior to the gauge or gauges being manufactured.

For all gauges of this nature, it is most strongly recommended that three off each gauge should be available. This suggestion is based on practical experience, which has proved that gauges used on individual dimension inspection normally receive rapid wear especially when used by other than Inspection staff, and it is therefore necessary to always have one gauge in the Gauge Store available for replacement of the worn one, as soon as excessive wear on the latter has been established. The third gauge of the Set, assuming that it has already been used and worn, would then be normally in the hands of the Tool Room undergoing rectification to its original accuracy.

4. New Production Requirements

The necessity for the introduction of new products can either be brought about by general demand or by the theoretical development of known and tried principles, or finally by an ad hoc inspiration, either by a member of the manufacturer's staff, or by an individual who files a patent.

In the case of the latter the design may or may not be detailed, and if not, the procedure of development is in line with the foregoing other two.

In order that the manufacture can commence, it is necessary for

(*Continued on page 22*)

AVOIDANCE OF CRACKING IN MASONRY CONSTRUCTION

*The following are abstracts of notes received from the Building Research Station of England.**

With any brick or block construction a certain amount of cracking is almost sure to be caused by the shrinkage that takes place as the work dries out. Even where the units themselves (i.e. the bricks or blocks) are of a type that has a low drying shrinkage, the mortar usually shrinks enough to cause fine hair cracks, These fine cracks due to mortar shrinkage are, however, generally confined to the mortar joints, and are therefore not so important.

The kind of cracking with which we are concerned here is that caused by the shrinkage of the units, which can be much more serious than that due to the mortar. It is very likely to occur when units having a relatively high drying shrinkage—all concrete products and most sand-lime bricks—are built in a moist condition into a structure that restrains their movement during the drying-out process. Unless precautions are taken to keep the total amount of cracking as small as possible or to distribute it in the form of finer and less noticeable cracks, the appearance of the building may be spoiled.

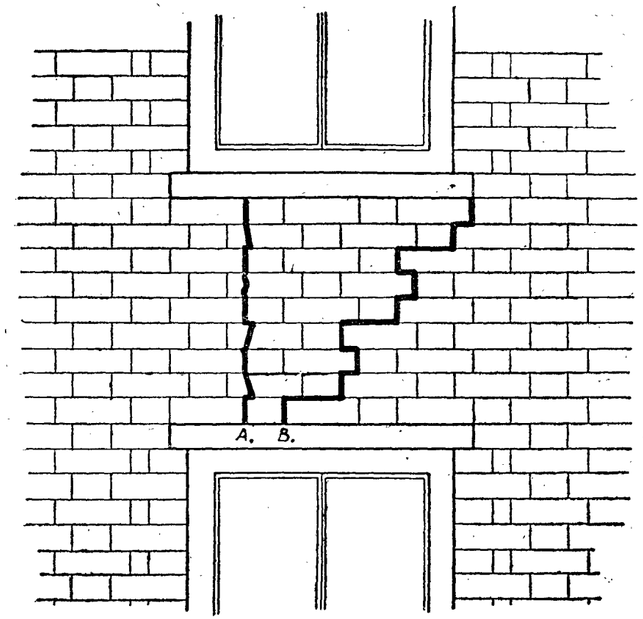


Fig. 1: Shrinkage cracking in brick or block construction.

Types of Crack

Shrinkage cracks in buildings usually run more or less vertically, and they occur mostly at places where the cross section of the brickwork is reduced, as for instance above or below the corners of door or window openings. They may be of either of two types—running straight through the unit and joint in alternate courses (crack A in Figure 1), or following a zigzag path along the joints (crack B). Which of these two types of crack will occur depends mainly on whether the mortar is stronger or weaker in tension than the unit.

Since the type of crack shown at B is more easily made good if this should become necessary, it is obviously better to make the joint weaker in tension than the unit. With a weak mortar joint, moreover, there is a greater tendency for the units to shrink individually without stressing the wall as a whole, and thus for negligible hair cracks to form around each unit rather than for wider cracks to form. On both of these counts, therefore, it is better to use a mortar that is weaker than the units. The units must also, of course, have a reasonable strength in tension if they are themselves to resist cracking.

Amount of Cracking

The total amount of cracking to be expected is of interest. In house construction, openings such as

doors and windows forming weak points in the wall will usually occur at intervals of not more than about 12 ft. With a maximum shrinkage of 0.04 per cent., the total possible movement on 12 ft. is 0.06 or 1/16 in. If this total movement were to be manifested as one crack it would be conspicuous. Generally, however, various factors tend to operate naturally to reduce the total shrinkage occurring or to distribute the stresses set up and, under normal conditions in practice, the total crack width does not often exceed about half of the maximum possible (0.03 or 1/32 in. in the above example.)

As mentioned above, all concrete products and most sand-lime bricks shrink significantly on drying from a wet condition; the magnitude of the shrinkage varies according to the type of product and the nature of the curing treatment before delivery. The British Standard Specifications for products of this type limit the permissible shrinkage, as shown in the table.

Type of Product	British Standards	Maximum Permissible Drying Shrinkage (%)	
Concrete Blocks ...	B.S. 492 and 728-1944 Partition blocks	Lightweight aggregates ...	0.08
		Dense aggregates ...	0.06
	B.S. 834—1944 Blocks for external rendered walls	Lightweight aggregates ...	0.06
		Dense aggregates ...	0.04
Concrete Bricks ...	B.S. 1180—1944	Bricks for special purposes ...	0.025
		Building bricks:	
		Class A (i) ...	0.025
		Class A (ii) ...	0.04
		Class B ...	0.06
Sand-Lime Bricks ...	B.S. 187—1942	Bricks for special purposes ...	0.025
		Building bricks:	
		Class A (i) ...	0.025
		Class A (ii) ...	0.035

Compliance of the units with the requirements of the relevant B.S. does not imply that there will be no risk of shrinkage cracking, but that the manufacturer has reduced the shrinkage as far as is practicable with present knowledge; other precautions must be taken by the user.

Precautions

The following precautions can be taken by the user to keep down the shrinkage, and to distribute shrinkage stresses in such a way that the risk of major cracks is reduced, or that cracking is confined to mortar joints.

I. *Storage.*—Units should be stored on the site in such a manner that they are reasonably dry when used. If they are to be held for any length of time the stacking should be sufficiently open to allow air circulation, which will assist drying after rain: or the stacks may, with advantage, be sheeted over. Where manufacturers take steps to ensure delivery of the units in a dried condition the units should not be held for any lengthy period on the site unless they can be kept dry.

II. *Wetting.*—The more absorbent types of unit sometimes have to be wetted by hosing or dipping in order to reduce the suction and facilitate proper laying and bedding. Such wetting should only be done where necessary, and even then it should not be overdone.

III. *Mortar.*—Mortar should be of a relatively weak type. A mix of one part of Portland cement, with two parts of hydrated lime and eight to nine parts of sand, all by volume, is generally suitable. A rather stronger mix (1: 1: 5-6) may be necessary in work carried out in winter or for special conditions. Mixes with a lower proportion of cement (e.g. 1: 3: 10-12) are suitable for internal work carried out in summer. Where a mortar stronger than the 1: 1: 6 is for some reason necessary, units of very low drying shrinkage should be used.

IV. *Reinforcement.*—The use of reinforcement in the bed joints of brickwork or block construction will reduce the risk of cracking. There is at present little information as to the amount of reinforcement necessary with units of given shrinkage.

V. *Design.*—Where the design of the building permits, dividing the wall into suitable lengths or panels with freedom from restraint at the ends will eliminate the risk of cracking. Various methods of treatment may be used at the edge of such panels to exclude moisture or to secure a suitable finish.

It is apparent that precautions I, II and III can most readily be applied in spring and summer and, even when no special precautions are taken, less cracking is likely in work built during the warmer part of the year, since the units are more likely to be dry when laid.

Under normal circumstances shrinkage cracking is important only because of its effect upon appearance. It does not affect structural stability nor, in the case of cavity wall construction, does it affect the exclusion of rain. The cracks usually develop during the first summer after building.

Where, with external work, a rendered finish is to be applied over units having high drying shrinkage, there will be less risk of the rendering being cracked by movements of the background if the rendering is applied when the wall has dried out. It is thus preferable with work built during winter or during a wet period to defer application of the rendering.

If it is necessary to make good any cracks, the work should be done during the summer months, when the brickwork has dried thoroughly, by cutting out the cracked joints and replacing any broken bricks, using the same mortar mix as was used for the original brickwork.

THE ENDOWMENT PLAN

An Enquiry into the Comparative Costs of Repayable and "Endowment Plan" Mortgages

T. A. BAKER, A.C.A.

Assistant Manager, Leicester Temperance and General Permanent Building Society

THE Endowment House Purchase Scheme is by no means a new venture for building societies. It has been operated for several years by many societies in conjunction with reputable insurance companies, but, during the post-war era, the scheme seems to have entered upon quite a new phase of popularity. Whereas in the pre-war years the average borrower did not appear to be over-anxious to tie up his endowment policy with a fixed mortgage, the scheme is now being enthusiastically adopted by all sections of the community, and in some quarters even threatens to supplant the normal repayable mortgage operated by building societies for the past hundred years.

The main reason for this sudden change in attitude on the part of the general public is to be found in a simple document, freely circulated by insurance companies or their agents, proving, at least to the satisfaction of the prospective borrower, that the "endowment plan" mortgage is actually *cheaper* than the normal repayable mortgage!

Table A may be accepted as a mild version of this persuasive document, but its main argument is both false and misleading, and unless the inherent fallacies are ruthlessly exposed there is a danger that certain borrowers of slender means may be "talked" into taking up an "endowment plan" mortgage when a repayable mortgage might have better suited their particular needs. The former type of mortgage is ideal for the young man with an assured steady income who wishes to make adequate provision for his dependants in the event of his premature death, but if the sole attraction of the scheme is its comparative cheapness, then disillusionment on the part of the borrower is invited.

TABLE A

Specimen Comparative Table for a Loan of £1,000 over a period of 20 years

Plan (A) Building Society.

To Complete Purchase in 20 years (rate £73.58 per annum).	£
Total Payments will amount to 20 x £73.58	1,471.6
Deduct Principal	1,000
Difference (Gross Interest payable)	471.6
Less Income Tax Relief at 9s. in £	212.22
Net Interest payable	£259.38

Total Net outlay over 20 years. Principal + Interest £1,259.38 (Net Annual Outlay £629.7).

Plan (B) The X Assurance Company.

(Alternative Plan with mortgage redeemable by Endowment Assurance at the end of 20 years *or at Previous Death*).

	£	£
Interest on £1,000 at 4 per cent	40	
Less Income Tax Relief at 9s. in £	18	
Net Annual Interest	22	
Annual Premium on Policy for £1,000 (for a life aged 35 next birthday—payable by equal monthly instalments)	£48.35	
Less I.T. Relief at 3s. 6d. in £	8.46	
		39.89
Total Net Outlay per annum		61.89

Total Net Outlay over 20 years. £1,237.8.

Summary. Saving under Plan B.

Difference between £1,259.38 and £1,237.8 ... ... £21.58

It will be seen that the net advantage of the "endowment plan" mortgage over the repayable mortgage for the full 20 years is purported to be £21.58 per £1,000 borrowed, but a larger surplus is frequently shown in the insurance company's computation by "dressing" some of the relevant figures—thus:—

(*a*) A higher building society repayment, e.g., £74.1 may be quoted in Plan A. This is due to the fact that some societies prefer to round off the repayment rates to figure slightly in excess of £73.58 per annum stated in the table, thereby reducing the actual repayment term of the mortgage. The latter figure is, however, the correct actuarial calculation for a £1,000 mortgage on a 20-year repayment term, when the rate of interest is 4 per cent per annum compounded at annual rests.

(*b*) A premium payable by annual instalments, e.g., £47.17 may be quoted in Plan B, instead of one payable by monthly instalments for which an extra 2½ per cent is charged by the insurance company.

(c) The endowment policy quotations may be further reduced by selecting a life aged 25 or 30, both of which are well below the general average of applications received under the scheme.

Two Inherent Fallacies

On the other hand, in compiling the data shown in Table A, any doctoring of the figures in favour of the repayable mortgage has been studiously avoided, so that the inherent fallacies contained in the main argument might be more readily revealed. Thus the gross annual premium figure of £48.35 included in the computation is the actual rate charged by one of the leading insurance companies, and may be accepted as being fairly representative of the rates charged by most first-class life offices, although it is conceded that certain mutual or lesser known insurance companies may be able to quote a slightly lower premium.

Notwithstanding the arithmetical accuracy of the figures appearing in Table A, it still remains a most misleading statement, two fundamental errors being contained in the general logic of the argument.

(a) A simple average over 20 years is used in comparing the relative costs of the two schemes, viz.: £62.96 p.a. in the case of a repayable mortgage and £61.89 in the case of the "endowment plan" mortgage. Although justification for this method of presenting the data may be sought on the grounds of simplicity, it very conveniently glosses over the highly important fact that the "endowment plan" mortgage is decidedly more expensive to the borrower during the first nine years of the mortgage!

(b) The figures are presented on the basis that the standard rate of Income Tax will remain at the abnormal rate of 9s. in the £ for the next 20 years! Even the most convinced pessimist would hardly venture such a rash prediction!

TABLE B

Annual Comparative Table for a loan of £1,000 over a period of 20 years

	Repayable mortgage			"Endowment plan" mortgage	Excess cost of E.P. mortgage over repayable mortgage
	Gross interest paid	Income Tax at 9s. in the £	Net annual cost*	Net annual cost	
Year	£	£	£	£	£
1	40.00	18.00	55.58	61.89	6.31
2	38.65	17.39	56.19	61.89	5.70
3	37.26	16.77	56.81	61.89	5.08
4	35.81	16.11	57.47	61.89	4.42
5	34.29	15.43	58.15	61.89	3.74
6	32.72	14.72	58.86	61.89	3.03
7	31.09	13.99	59.59	61.89	2.30
8	29.39	13.23	60.35	61.89	1.54
9	27.62	12.43	61.15	61.89	.74
10	25.78	11.60	61.98	61.89	— .09
11	23.87	10.74	62.84	61.89	— .95
12	21.88	9.85	63.73	61.89	—1.84
13	19.81	8.92	64.66	61.89	—2.77
14	17.67	7.95	65.63	61.89	—3.74
15	15.43	6.94	66 64	61.89	—4.75
16	13.10	5.90	67.68	61.89	—5.79
17	10.68	4.81	68.77	61.89	—6.88
18	8.17	3.67	69.91	61.89	—8.02
19	5.55	2.50	71.08	61.89	—9.19
20	2.83	1.27	72.31	61.89	—10.42
Total ...	471.60	212.22	1,259.38	1,237.80	—21.58

* Gross annual cost of repayable mortgage is £73.58 as shown in Table A.

(*Continued on page 32*)

Towards Quality Production

(*Continued from page 18*)

the components of the product to be drawn out in detail, for the method of assembly to be defined, and for the standard components, i.e., nuts, bolts, washers bushes, etc., to be listed. At this stage, the Inspection Department can advantageously be brought into the picture, as they can often indicate points in the new component design which on previous production have caused poor assembly, lack of interchangeability, etc., any of which will cause excessive production costs, if not corrected at the design stage.

It is not intended that this article should try to cover the entire field of inspection, and the economies to be obtained therefrom, but it is hoped that sufficient has been said to cause manufacturers of products who at present have either no Inspection Department or an inadequate one, to consider the advantages to be gained by installing adequate inspection staff and equipment. This will then ensure a finished product which is invariably of the highest possible quality, and although it may have to be sold at a higher price than the same type of product produced by foreign competition, it earns by its superior quality such a reputation that when the present sellers' market disappears and a buyers' market exists, no customer will show any hesitation in the placing of repeat orders, as they will already have proved by experience that the slightly increased initial cost is completely outweighed by the effective life of the product.

(Adopted from "*Machinery Lloyd*" with grateful acknowledgements.)

LAW REPORT

Nagpur High Court

Before Mr. Justice Pollock.

Nagpur Premier Housing Society, Ltd. *v.* Ganesh Gangadhar.

This case raised an important question as to whether Registrar, Co-operative Societies, has authority to review or amend an award when there is some mistake or error apparent on the surface of the record.

Delivering the judgment Pollock, J. observed that on the 19th January 1933 the respondent G. G. Bhide executed a mortgage in favour of the Nagpur Premier Co-operative Housing Society, Limited, Nagpur, the appellant, as security for a sum of Rs. 8,000, which he had borrowed from the Society for the purpose of building a house. The money carried interest and was repayable by instalments. On the 25th March 1937 the Society applied to the Registrar of Co-operative Societies for an award against Bhide, alleging that he had defaulted in the instalments. On the 2nd August 1937 the Senior Deputy Registrar suggested a compromise which was apparently accepted by the parties on the 30th August 1937. This was that the whole debt including overdue instalments should be paid in monthly instalments of Rs. 100 with interest as already agreed upon, and that on a single default the whole amount shall become due. Shortly afterwards the Society contended that Bhide had again defaulted, and on the 21st September 1937, the Deputy Registrar passed an award against Bhide directing him to pay Rs. 7,114-2-0.

On the 5th October 1937, Bhide submitted an application to the Senior Deputy Registrar stating that he had committed no default and asking him to "reconsider and kindly revoke the award." The Senior Deputy Registrar made further enquiries, and coming to the conclusion that there had been no default by Bhide he passed an order on the 15th November 1937, stating that under his inherent powers he directed that the final award passed by him be held in abeyance '*sine die*'.

The Society filed an application on this before the Registrar contending that the order holding the award in abeyance was *ultra vires*, but the Registrar held that he had no jurisdiction to entertain any application for revision or review although he had just previously reviewed his own award. The main dispute between the parties was about how interest should be calculated, and it was decided by the Senior Deputy Registrar after hearing the parties and going into the amounts, that the amout due was Rs. 7,004-8-11, which was to be repaid by instalments of Rs. 100 per mensem with simple interest at 6 per cent, interest being calculated on the principal sum annually, that all recoveries would be taken to overdue interest first, and that the final award of the 21st September 1937 was cancelled. This was apparently a reversion of the compromise of the 2nd August 1937 as the Senior Deputy Registrar interpreted it.

Subsequently there was further disputes about how interest should be calculated, and eventually on the 8th February 1945, the Deputy Registrar passed a final award or order directing Bhide to pay Rs. 1,409-12-0.

After the first award had been passed on the 21st September 1937, an application was made to the Civil Court to execute it. That application was dismissed in default on the 29th November 1937, presumably because of the order of the 15th November 1937 directing that the award should be kept in abeyance. After the second award had deen passed on the 8th February 1945, there was an application to the Civil Court to execute that award. The lower Appellate Court held that the award of the 21st September 1937 was final, that the Deputy Registrar had no jurisdiction to amend or cancel it, and that therefore the second award of the 8th February 1945 was *ultra vires* and could not be executed. Against this decision the Society preferred this appeal.

According to the rules under the Co-operative Societies Act (II of 1912) any dispute touching the business of a Co-operative Society between a member and the committee shall be referred to the Registrar, who shall give a decision in accordance with the justice, equity, and good conscience: rules 26 to 29. Rule 32 indicated that a decision of the Registrar is as between the parties to the dispute, not liable to be called in question in any Civil or Revenue Court and shall be in all respects final and conclusive. Rule 33 indicated that any award or decision or order shall on application to a Civil Court having local jurisdiction be enforced in the same manner as a decree of such Court. It was therefore clear that no Court can sit in judgment over a decision by the Registrar, but he did not think that that meant that the Registrar was powerless to correct an award, at least if there was some mistake or error apparent on the face of the record. To deny the Registrar such an inherent power seemed to him to deny justice. Dewan Bahadur Brahma in his commentary on *The Law of Co-operative Societies* had expressed the opinion on page 158 of his second edition that there was nothing to prevent parties from applying for a fresh award on the ground that the former one was taken under a mistake. That view seemed to be correct, but, even if it was not so, the respondent could not first get the award set aside on his own application and then contend that it was still operative so that the subsequent award was invalid.

Whether the interest has in fact been calculated correctly or not, was not a point that could now be debated. The Deputy Registrar had, in his opinion, jurisdiction to pass the order or award of the 8th February 1945, which was passed after hearing the parties and looking into the accounts, and that order could not now be called in question in a Civil Court.

The appeal was allowed and the case remanded to the executing Court for proceeding with execution. The appellant-society was allowed its costs in this Court and the lower Appellate Court. Costs in the executing Court as already ordered.

Type A

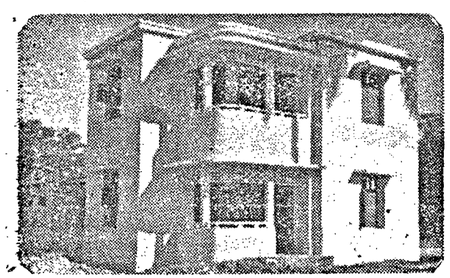
Type A

Type A

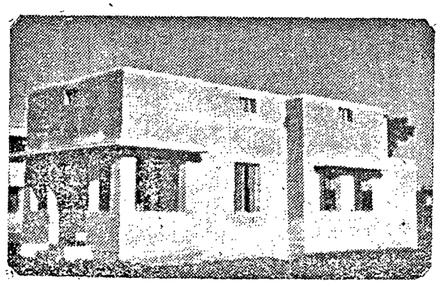
PHOTOGRAPHS OF BUILDINGS AT GANDHI NAGAR COLONY, MADRAS.

Built by

THE MADRAS CO-OPERATIVE HOUSE CONSTRUCTION SOCIETY, LTD.



Type B



Type C

EDUCATIONAL

INSTITUTE OF BUILDERS

THE Institute was founded in 1834. Its main objects are: To promote excellence in the construction of buildings, and honourable conduct in business; to develop technical education for the industry, to provide lectures for this purpose, to test by examination or otherwise the competence of persons in or about to enter the industry, to award certificates and distinctions and to establish scholarships, grants, and other benefactions; to arrange and promote the adoption of equitable forms of contract; to promote sound legislation to discuss with other bodies matters affecting the industry; to establish an industry library and to diffuse among members information of interest; to encourage and discover inventions for use in the industry; to encourage the settlement of disputes by arbitration and to nominate arbitrators.

The Institute is incorporated under the Companies Acts. Its members are individuals whose liability is limited. Membership is divided into six groups, viz., Fellows, Members, Associates, Licentiates, Probationers and Students, the first four of which are entitled to use the distinguishing letters F.I.O.B., M.I.O.B., A.I.O.B. and L.I.O.B. respectively.

It is governed by a Council composed of the officers, past presidents and 30 elected Fellows and Members or such other number as a General Meeting may appoint. The Council may co-opt to its assistance others, being Fellows, Members, Associates or Licentiates. The Council has power to delegate its authority within defined limits to local or district representatives or committees.

From the income of funds at its disposal the Institute offers: The *Aidous Travelling Studentship* (£100) for studying building abroad, to the most deserving successful candidate each year in the examinations for Members and Associates: the *Matthews Macfarlane Travelling Studentship* (£25) and the *Sapcote Travelling Studentship* (£25) both for studying building in a home or continental centre selected by the holder, to one of the two most deserving successful candidates each year in the examination for Licentiates; four *Awards* (£10 each) for books, instruments or special tuition, to the most deserving candidates each year admitted as students. The Institute may in any year vary or withhold any of these awards.

The Institute possesses a circulating library and a small collection of reference books.

A scheme for the award of *National Certificates and Diplomas in Building* is administered by the Institute of Builders in conjunction with the Ministry of Education (England and Wales) and with the Scottish Education Department.

The address of the Institute is 48, Bedford Square, London, W.C. 1.

VERMICULITE DEPOSITS IN MYSORE

Deposits of Vermiculite, a mineral which is being extensively used in the construction of sound-proof and fire-proof buildings in the United States and England (the details of which appeared in *The Building Gazette* of May Issue) have been discovered in some parts of Mysore State. The mineral was first noticed in Tumkur District, and recent investigations by the Mysore Geological Department have revealed that it occurs in bulk at Malavanghatta (Channarayapatna Taluk), Baghespura and Nandihalli (Arsikere Taluk), Chunchinkatte (Krishnarajanagar Taluk), and other places.

Vermiculite is a yellow, brown or green micaceous mineral which when heated has the characteristic property of exfoliating and expanding about 15 times its original volume, and as a result the specific gravity is reduced from 2.6 to 0.1 or less. Such expanded vermiculite weighs only about 8 lbs. per cubic foot whereas a similar volume of sand or clay weighs nearly 90 lbs. The uses of vermiculite are based mainly on its being comparatively refractory with low conductivity for heat and sound.

Exfoliated vermiculite is used either as a loose filling or moulded into slabs, cemented into flexible sheets, or applied as a plastic mass. When combined with suitable binding materials, vermiculite is fabricated into pipe covering, insulating blocks, plasters, tiles and structural roof slabs. As a light-weight aggregate in concrete, vermiculite has been largely employed for cast slabs used in the construction of prefabricated houses, and for the decks and roofs of ships and buildings subject to bombing attack. It is a substitute for rock wool and glass wool, and has increasing application for insulating buildings, ovens, furnaces, and refrigerators. The heated material takes on brilliant silvery or golden sub-metallic lustres, and so the powder is employed in wall-paper decoration.

(*Continued on page 26*)

MACHINE BORING RATES

The Government of Bombay has revised the rates of boring work done by boring machines of the Directorate of Agricultural Engineering. The revised rates are:

Depth Group	4" Bore per foot	5" Bore per foot	6" Bore per foot
0' to 100'	Rs. 9-0-0	Rs. 11-0-0	Rs. 14-0-0
101' to 200'	Rs. 10-0-0	Rs. 12-0-0	Rs. 15-0-0
201' to 300'	Rs. 11-0-0	Rs. 13-0-0	Rs. 16-0-0
301' to 400'	Rs. 12-0-0	Rs. 14-8-0	Rs. 17-8-0
401' to 500'	Rs. 14-0-0	Rs. 16-0-0	Rs. 19-0-0

Depth will be measured from ground level, and not the well bottom, for the purpose of adopting the group rate.

The cultivator will supply unskilled manual labour and bear the cost of one way transport and of casing pipes and shoe cutters, in addition to the charge levied by the Government. In the event of a cultivator not supplying unskilled manual labour, transport charges, casing pipes, shoe cutters, etc., within a reasonable time-limit to be fixed by the Director of Agricultural Engineering, the authorities concerned will get the work done at the cost of the cultivator.

Simultaneously, the Government has laid down conditions for the handing over the power boring machines to District Local Boards for working. One of the conditions is that the Boards should charge only the above mentioned rates to the cultivators. The Government will pay to the Boards a sum equal to two times these charges for their entire working expenses. The machines will, however, remain the property of the Government.

The Boards will carry out the boring work according to their own programmes and incur all expenditure, except that which has to be borne by the cultivator, while depreciation and interest on the machines will be borne by the Government.

Vermiculite Deposit in Mysore

(Continued from page 25)

Till about 20 years ago, this mineral was considered only as of scientific interest, but with the progress of science and the development of industry, vermiculite has come into its own on account of its commercial value. The chief producer and consumer of the mineral is America, but the mineral has also been reported to occur in the Ural Mountains, Russia, parts of the Transvaal, Tanganyika and Australia.

Mysore State is probably the only place in India where the mineral has so far been noticed, and this discovery is an addition to the mineral wealth of the State. The Mysore Geological Department has undertaken intensive prospecting work to estimate the extent and quality of these occurrences.

SPECIFICATION

British Standard for Waterproof Building Papers (B.S. No. 1521 : 1949)

A new British Standard has been issued containing requirements for waterproof papers for use in the building and civil engineering industries for a variety of purposes, which fall into two main groups.

The first of these groups includes such purposes as the prevention of draughts, and of the penetration of moisture in walls or roof structures, but these papers should not be used as damp-proof courses. The requirements for this first type of paper include tests for tensile strength, both wet and dry, and resistance to water penetration.

The second group is intended for the protection of concrete during the curing period or for use as an underlay to prevent loss of moisture due to absorption by the subbase. For this type the requirements include tests for bursting strength and resistance to water penetration.

As there is a large range of different building papers it has not been possible to standardize the construction of the paper itself; the requirements for quality in the B.S. are the minimum to which the finished product should conform.

Copies of this British Standard may be obtained from the Sales Department, British Standards Institution, 24, Victoria Street, London, S. W. I., price 2/- post free.

HOW WAS AUGUST

For Building

A rainy day is one in which 10 cents or more rain is recorded. The following figures show the average rainfall in inches and the average number of rainy days in the month of August based on data up to 1940:—

	Rainfall in Inches	*Number of Rainy Days*
Agra	8.1	10.3
Ahmedabad	8.1	11.0
Allahabad	10.0	14.7
Ambala	7.9	9.0
Asansol	13.3	17.0
Aurangabad	4.8	8.9
Bangalore	5.0	9.3
Bellary	2.4	4.0
Bhopal	10.9	14.8
Bhuj	2.9	3.7
Bombay	13.4	19.0
Calcutta	12.9	18.0
Cawnpore	11.2	13.3
Chittagong	20.4	17.1
Cochin	13.9	18.7
Colombo	3.7	6.9
Dacca	13.3	17.6
Gaya	13.7	15.7
Hyderabad (Dn.)	5.3	9.9
Jamshedpur	15.4	18.0
Jhansi	11.6	13.3
Jiwani	0.	0.
Jodhpur	4.8	5.9
Jubbulpore	17.4	17.4
Lahore	5.1	5.7
Madras	4.6	7.9
Mangalore	23.5	25.1
Marmagoa	17.1	21.2
Masulipatam	6.3	10.2
Nagpur	11.4	13.3
New Delhi	7.2	9.0
Patna	13.1	13.9
Peshawar	2.0	2.5
Poona	3.5	8.3
Puri	10.9	12.9
Quetta	0.3	0.7
Rawalpindi	9.2	9.1
Sambalpur	19.0	18.9
Srinagar	2.4	5.3
Trichinopoly	3.8	4.7
Trincomalee	3.9	4.8
Trivandrum	4.7	9.8
Vizagapatam	5.2	8.2

FOR DISCUSSION

Town planning and town running are today a science which demands study and research and wherein are integrated diverse phases of social and national life.

* *

Traditional craftsmanship in India is of high quality, and diverted into the requirements of the machine age, it could be trained to answer the new demands made upon it.

* *

Individuals may form communities, but it is institutions alone that can create a nation.

* *

If a man be gracious to strangers, it shows that he is a citizen of the world, and his heart is no island, cut off from other islands, but a continent that joins them.

* *

All the strength and force of man comes from his faith in things unseen. He who believes is strong; he who doubts is weak. Strong convictions precede great actions.

* *

The higher the character or rank, the less the pretence, because there is less to pretend to.

* *

We always like those who admire us; we do not always like those whom we admire.

* *

They who depend on the merits of ancestors search in the roots of the tree for the fruits which the branches ought to produce.

* *

To see what is right, and not do it, is want of courage, or of principle.

PROPOSED NEW WORKS

Amritsar

A township-project of 500 houses has been sanctioned to be built in the vicinity of Amritsar for rehabilitation of refugees. A master-plan is under preparation by P.W.D. engineers of East Punjab.

Bhopal

The Bhopal Government is awaiting the financial sanction of the Government of India for a hydro-electric-cum-irrigation project at Lakhari. The scheme, which is estimated to cost Rs. 400 lakhs, has already been approved by the Central Waterways, Irrigation and Navigation Commission.

Calcutta

A proposal for constructing a 30-mile long ship canal from Calcutta to the Bay of Bengal at Diamond Harbour is under investigation at the River Research Institute of the Government of India at Poona.

Faridabad

The Government of India propose to build a new township in Faridabad 16 miles from Delhi, to rehabilitate displaced persons from the Frontier Province and from some other areas. The scheme aims at housing 60,000 persons and is estimated to cover over Rs. 2 crores, half of which has already been sanctioned. Dr. Rajendra Prasad, President of the Constituent Assembly, will be the Chairman of the Development Board formed for the new township.

Lucknow

The U.P. Government will complete the building of 4 townships by the end of 1950 for the resettlement of 30,000 refugees, at a cost of Rs. 56.5 lakhs.

The townships to be set up are: Race Course Maidan (Dehra Dun), Nawabganj (Lucknow), Naini Industrial Colony (Allahabad); and Modinagar Colony (Modinagar).

The scheme will be financed by the U.P. Government, for which necessary loans will be advanced by the Government of India.

CONTRACTS OPEN

The dates at heads of paragraphs are those for the submission of tenders. Application for forms and particulars should be made to the address given at the end.

BOMBAY : Press Building

July 18.—Construction of a new building for Ticket Printing Press and Counting Machines at Byculla. The Divisional Engineer, G.I.P. Railway, Loco Offices Building, Parel, Bombay.

BOMBAY : Tenements

July 18.—Constructing residential buildings for 256 tenements on the Worli neighbourhood Unit area. Estimated cost Rs. 17,93,520. The Executive Engineer, Housing, Bombay West Division, Institute Barracks, Worli, Bombay.

ALLAHABAD : Quarters

July 18.—Construction of 34 units of A Type Quarters and 13 units of B Type Quarters at Rura, Ambyapur, Jhinjak, and Kanchansi for the E.I. Ry. Divisional Superintendent, E.I. Ry., Allahabad.

BOMBAY : Plumbing

July 18.—Plumbing work for 256 tenements on the Worli neighbourhood Unit Area. Estimated cost Rs. 2,41,072. The Executive Engineer, Housing, Bombay West Division, Institute Barracks, Worli, Bombay.

ALIGARH : Quarters

July 18.—Construction of Refugee Quarters at Aligarh and Hathras. Estimated cost Rs. 5,00,000. The Executive Engineer, P.W.D. Temporary Division, Aligarh.

DHANBAD : Plumbing.

July 19.—Providing water-supply and sanitary installations for the residential accommodation at I.S.M. Dhanbad. Estimated cost Rs. 33,677. The Executive Engineer, C.P.W.D., Dhanbad.

BAMRAULI : Furniture

July 20.—Providing furniture for C.A.T.C. at Civil Aerodrome, Bamrauli. Estimated cost Rs. 1,26,127. The Executive Engineer, Aviation Division, Allahabad.

AMAUSI : Terminal Building

July 20.—Constructing Intermediate 'A' Type terminal buildings at Civil Aerodrome, Amausi. The Executive Engineer, Aviation Division, Allahabad.

BOMBAY : State Transport

July 20.—Development of the land at Byculla and carrying out construction of bus stand, etc. Estimated cost Rs. 99,750. The Executive Engineer, State Transport, Bombay.

BAREILLY : Hospital

July 21.—Reconstruction of ward No. 4 in the Mental Hospital, Bareilly. Estimated cost Rs. 1,45,000. The Executive Engineer, Provincial Division, Bareilly.

BAREILLY : Barracks

July 22.—Construction of 3 double storeyed constable barracks and reconstruction of line school, etc.. for constable quarters at Bareilly. Estimated cost Rs. 1,12,000. The Executive Engineer, Provincial Division, Bareilly.

SURAT : Reservoirs

July 26.—Constuction of Raw Water Reservoirs, Gate House and Garages and post office building in connection with the steam power station at Utran near Surat. Estimated cost Rs. 1,03,396. The Executive Engineer (Civil) S.G., Electric Grid Offices, Foreshore Road, Bombay-1.

BHUBANESWAR : Sewerage Works

End of July.—Supply and Erection at site of a complete Sewage purification and disposal plant capable of dealing with 20 lakh gallons of raw sewage daily for Bhubaneswar, capital of Orissa Province. The Public Health Engineer, Orissa, Cuttack.

REWARI : Quarters

August 1.—Staff quarters at Rewari for B.B. & C.I. Railway. Estimated cost Rs. 50,000. The Engineer-in-Chief, B.B. & C.I. Railway, Ajmer.

AGRA : Quarters

August 2.—Construction of 550 Nos. of houses for Refugees in Agra Division at Ferozabad, Mathura and Aligarh. The Executive Engineer, Provincial Division, Agra.

DAMODAR VALLEY : Corporation

August 2.—Supply and erection of 132 kv out-door sub-station equipments and indoor control accessories for Ramgarh, Jamshedpur, Loyabad, Sindri, Maithon and Raniganj sub-stations of the Damodar Valley Grid. The Chairman, Central Electricity Commission, Simla.

KIRKEE : Workshop

August 8.—Provision of Workshop and Stores Buildings for R.B.E.S., Kirkee, Poona. Estimated cost Rs. 2.5 lakhs. The Chief Engineer, Southern Command, Poona.

RESULTS OF TENDERS

Closed April 2.—Constructing an earthen dam, etc. at Ranand :—*Tender of G. I. Kanhere for Rs. 13,00,841 accepted.*

Closed March 24.—Construction of Technical High School at Hubli :—*Tender of M. N. Dalavi & Sons rejected; fresh tenders will be called for in September 1949.*

Closed March 22.—Constructing 56 H.P. culverts in Khed Ambavli Birmani Road O.D.R. :—*Tenders rejected as the rates are too high.*

Closed March 22.—Construction of Quarters for the National Chemical Laboratory at Poona :—*Contract awarded to B. D. Gulati.*

Closed March 18.—Construction of Central Bus Stand for Mangalore Municipality :—*Tender of K. Sanjeeva Shet is the lowest and is accepted. It is 3½ per cent above estimated rates.*

Closed December 2.—Construction of 127 miles overhead Transmission lines of 66 K.V. in Madura-Rajapalayam-Tenkasi and Negamam-Pollachi :—*Supply of Towers : Departmentally; Supply of ground cable: Easun Engineering Co.; Supply of other materials: P. Natesan & Co. Erection: P. Natesan & Co. for the former and departmentally for the latter.*

CURRENT MARKET PRICES OF MATERIALS

1. Prices vary according to quality and quantity ordered.
2. Those given below are average market prices in Madras.
3. Owing to the unsettled state of market most prices are liable to fluctuate.

		Rs.	A.	P.
CONCRETOR				
A.C.C. cement controlled price per bag		4	11	3
Blue metal ½" gauge	per 100 c. ft.	56	0	0
" 1½" "	"	40	0	0
River Sand	per 100 c. ft.	15	0	0
Reinforcement, M.S. rods ⅜" dia.	per cwt.	18	15	0
" ½" "	"	19	2	0
" ⅝" "	"	20	3	0
" ¾" "	"	22	11	0
Binding wire 16" gauge	per lb.	0	12	0
BRICKLAYER				
Country bricks 2" G.M.	per 1000	26	0	0
Stock bricks 3" T.S.M.	per 1000	45	0	0
Shell Lime	per 100 c. ft.	62	0	0
ROOFER				
Malabar Tiles	per 1000	225	0	0
Malabar Ridge Tiles	per 100	75	0	0
Terrace bricks	per 1000	14	0	0
Asbestos Corr. Sheets	per sq. ft.	0	5	9
Asbestos Trafford Sheets	"	0	6	3
G.I. Corr. Sheets 24 gauge	"	0	4	3
CARPENTER				
Burma Teak scantlings	per c. ft.	20	0	0
Malabar "	"	15	0	0
Mango planks	"	4	8	0
Insulation boards ½"	per sq. ft.	0	8	0
Asbestos plain sheets ¼"	"	0	6	4
" 5/32"	"	0	4	0
Wire-nails	per lb.	0	9	0
Wood-Screws ¾"	per gross	1	12	0
" 1"	"	2	0	0
" 1½"	"	2	4	0
Butt Hinges cast brass 4"	per pair	2	12	0
" 3"	"	2	8	0
Cast brass cabin hooks 4"	each	1	0	0
" 6"	"	1	4	0
Barrel bolts cast brass	per R ft.	4	8	0
All-drop bolts cast brass	each	11	8	0
GLAZIER				
Sheet glass cut to size, ordinary glazing quality 16 oz.	per sq. ft.	0	10	0
Sheet glass cut to size, ordinary glazing quality ⅛"	per sq. ft.	1	2	0
Plate glass ¼"	"	4	0	0
Figured glass, white	"	0	14	0
" coloured	"	1	6	0
IRONWORKER				
R.S. Js. 4" x 3"	per cwt.	18	14	0
" 5" x 3" to 15" x 6"	"	18	8	0
" 18" x 6" and over	"	18	14	0
Channels, angles and tees	"	19	12	0
M.S. plates	"	20	0	0
Black sheets 20 gauge	"	22	10	0
G.I. plain sheets 24 gauge	"	22	10	0
G.I. barbed wire, 2 ply, 12 gauge	"	39	4	0
Rivets, flat or round head	"	75	0	0
Steel Rolling Shutters (up to 120 sq. ft.)	per sq. ft.	5	4	0
PAVIOR				
White glazed tiles 6" x 6"	per 100	6	8	0
Coloured "	"	8	0	0
White or grey marble tiles ¾" (polished)	per sq. ft.	4	0	0
PLUMBER				
Squatting pans, English 18"	each	54	0	0
Pedestal closets without seat	"	45	0	0
W.W.P. Cisterns 3 gal. (Elephant brand)	each	44	0	0
Sinks 30" x 18" x 10"	"	158	0	0
W.H.B. 25" x 18" with waste and one tap	each	118	0	0
Flat urinals, English	"	56	0	0
PAINTER				
Distemper J. and N.	per lb.	0	11	6
" 'Aquatinta' oil bound	per lb.	1	1	0
'Neurolac' synthetic enamel	per gal.	32	0	0
'Goodlass' wall paints	per lb.	0	10	9
Linseed oil	per gal.	9	10	0
Copal varnish	"	9	8	0
Glue	per lb.	0	15	6
Putty	"	0	12	0
Sand paper	per doz.	1	4	0

THE ENDOWMENT PLAN

(Continued from page 22)

Perhaps a third possible fallacy might have been added—that it presumes the continuance for the next 20 years of an arrangement whereby insurance companies secure a double concession from the Chancellor of the Exchequer on behalf of their policy-holders, mamely, Income Tax relief at the rate of 3s. 6d. in the £ on the gross annual premiums paid *as well as* a tax-free interest on the sinking fund created by the endowment policy. Bearing in mind the substantial amount of taxable income lost to the revenue authorities from this source, it would be somewhat rash to predict that this double relief from taxation will be extended to the policy-holder indefinitely.

The fallacy of arriving at the net annual cost of a repayable mortgage by taking a simple average of the total net outlay over 20 years is clearly demonstrated by Table B, in which the actual net annual cost has been calculated for each of the 20 years. It will be seen that the net cost of a repayable mortgage is much lower in the earlier years of the mortgage than during the later years. (*See Table B.*)

£55.58 for the first year as against £72.31 for the twentieth year. On the other hand, the net cost of the "endowment plan" mortgage is a constant figure of £61.89 per annum, provided the rate of Income Tax remains unchanged at 9s. in the £ for the whole 20 years.

If cost were the only element to be considered by the prospective borrower in deciding which scheme is the most advantageous, the problem would resolve itself into a question of whether it would be worth his while to pay an additional £6.31 during the first year in order to secure a contingent profit of £10.42 during the 20th year.

The plain truth, however, is that the figures of £55.58 for year 1 and £72.31 for year 20 are not comparable as they stand. If we wish to make comparisons the two figures must be converted to *present values* by multiplying each item by the formula $\frac{1}{(1+i)^n}$ i.e. the reciprocal of the compound interest formula. Thus £55.58 must be multiplied by $\frac{1}{1+i}$, and £72.31 by $\frac{1}{(1+i)^{20}}$ in order to reduce the two figures to a common base. The respective figures in terms of present values then become £53.44 and £33.00 if the rate of interest used in the calculation is 4 per cent per annum, or £54.22 and £44.13 if the rate of interest used is 2½ per cent per annum. In either case the result confirms our intuitive reaction that £6.31 in one's pocket during the first year is better than a possible saving of £10.42 20 years hence, and similar arguments in favour of the repayable mortgage may be educed for each of the intervening years. The lure of a possible gain under the endowment plan during the later years of the mortgage is therefore less attractive than might appear at the first glance.

(To be concluded)

(With acknowledgements to *The Building Societies' Gazette.*)

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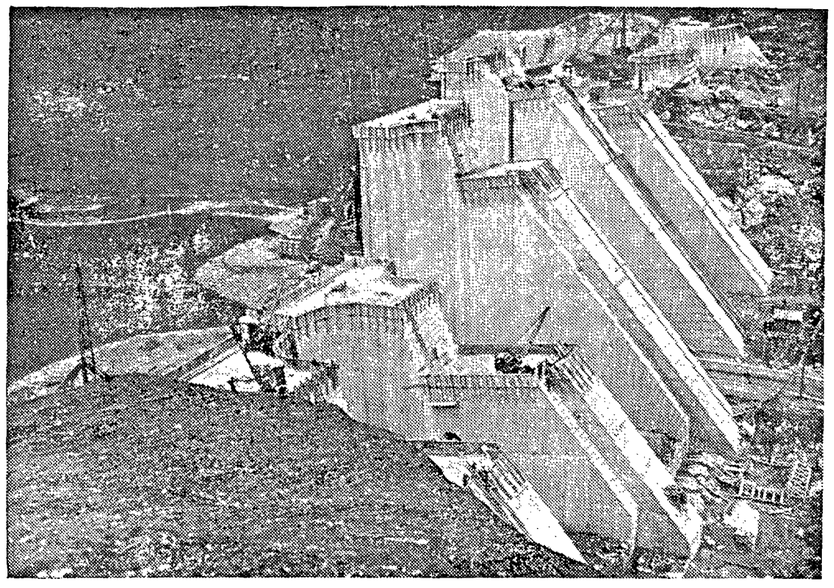

SCOTTISH HYDRO-ELECTRIC SCHEME

The Hydro-electric Scheme in the highlands of Scotland costing £80m. (Rs. 106.67 crores), and which when completed will have an output equal to nearly half of the present consumption for the whole of Scotland is well under way, and it is anticipated that the first turbines will be producing electricity by the end of this year. The Loch Sloy Group is part of this tremendous scheme. Great care and attention is being paid to the design and layout of the power stations, dams, etc., so that the natural beauty of the glens will not be harmed. It will open up vast hitherto remote areas to the tourist and will provide an attraction to the visitors to Scotland. A view of the dam at Loch Sloy, showing the buttress formation of the dam which will be 160 feet high when completed and 1,200 feet long. The reservoir formed by damming will hold 1,200 million gallons. The collection of water will be 6.5 sq. miles direct catchment and 26 square miles diverted catchment. It will be conveyed to the power station at Loch Lomond at the rate of 220,000 tons per hour by means of tunnel and pipes.

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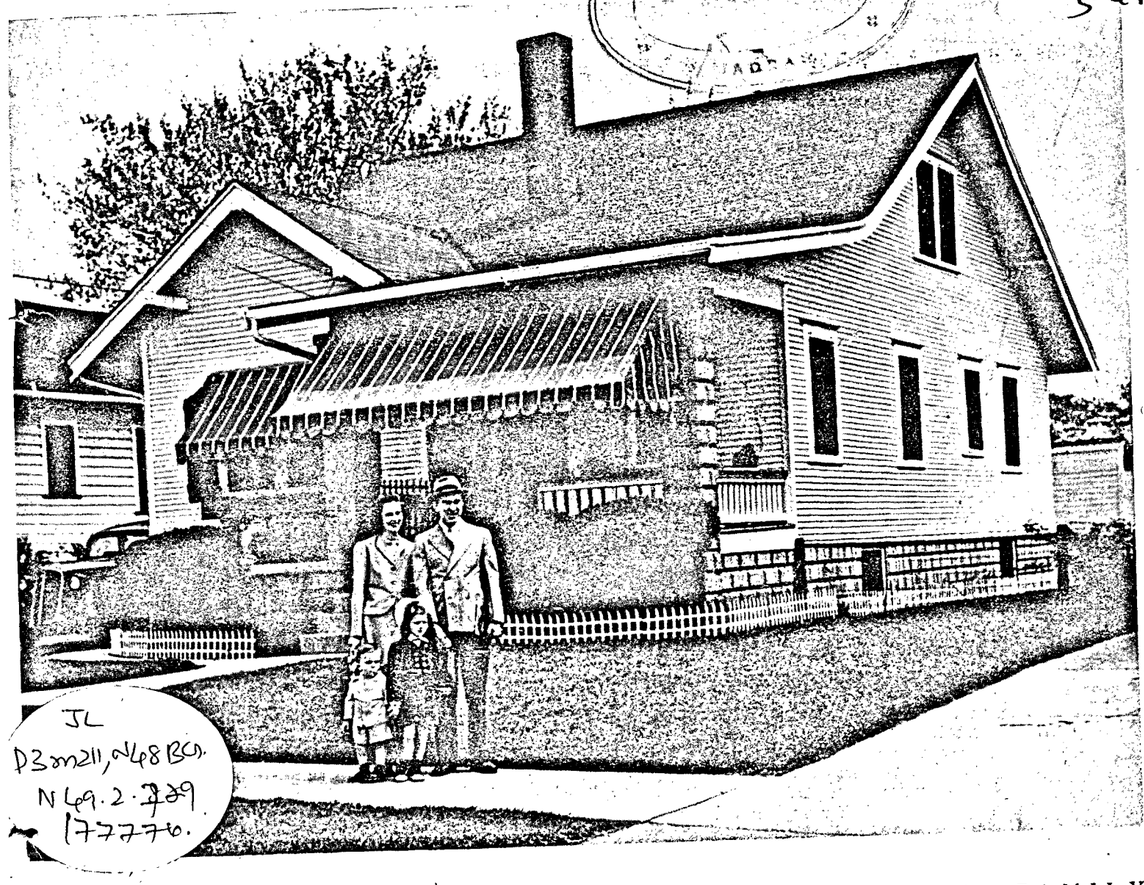

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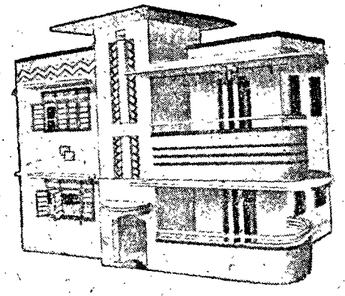

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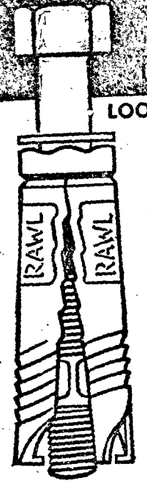

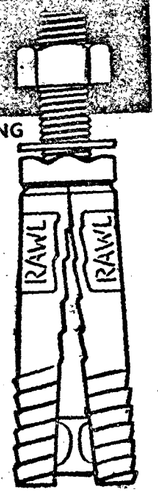

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AN INDEPENDENT MONTHLY JOURNAL DEVOTED TO THE INTERESTS OF BUILDING INDUSTRY

VOLUME II AUGUST 15, 1949 NUMBER 8

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EDITED BY T. N. SUBRAMANIAM
Associate, Faculty of Surveyors of England

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PRINCIPAL CONTENTS

BUYERS' GUIDE

THE MEMORABLE DAY

Today we celebrate the Day of our Independence. We pay our tribute to our revered Prime Minister, Pandit Jawaharlal Nehru. We offer our Readers our humble Greetings.

And now after a transition period of two years we can definitely look forward. We can now plan or revise our plan with a new conviction and a new hope for the future. We can look round and take stock with a happy heartening feeling that before long our country will be putting up a new appearance. This job wants doing and that wants doing. There are jobs to be done and we are in good heart.

Then let us plan in the midst of our rejoicings, plan to make our homes the focus of everything that is gracious and true. We may admit that we have often fallen far below our own ideals, that good standards in life and living have not always been given the first place, in spite of the lip service that has been paid to them. And therefore we may take this era of beginning with the home, which we can lovingly build and cherish and make it the centre of simple things, the good things, the true and lovely things which, in life, as in craftsmanship, alone are worth the having.

Thus Housing covers a vast range of human needs, both actual and potential. The financing of houses through Co-operative House Building Societies represents only a single aspect of the housing problem. In other words, it is imperative we must immediately draw out means and methods to build at a more rapid rate than in the past.

To recapitulate, a vast field opens out, in the long run, for future building activities whose problems will increase in number, range and complexity, and thus call increasingly for collective counsel. Hence an All-India Builders' Association is badly needed at the moment, at least for the future. It will have to develop an effective instrument in shaping policy and establishing closer contact with members of the building industry. When such a body is evolved, we are sure, it will be a guiding force for building movement and eliminate unworthy jealousies.

NOTES & TOPICS

Building Today.

India's Health Minister has been very much impressed by the prefabricated houses in Britain and is recommending them to the Government for erection in India. Economically speaking, opinion is unanimous to restrict imports and increase exports. Veterans of building industry know it only too well that the war-time Government of India housed millions of local and foreign troops under buildings erected out of indigenous materials only; and that too with the most minimum of notice to engineers. If the same method is not practical now for housing our dear and helpless refugees, it is apparent her advisers are not practical.

"Do as I say: But don't do as I do."

The Madras Government's Press Note offering suggestions to the public for economical use of steel is more patriarchal than practical. It goes on pointing out scope for improvements in the design of railway waggons and motor cars! Only very recently the Madras P.W.D. after a series of tests has brought forth type designs in which steel is to be used 500 per cent more for temporary huts. Have the authors of this Note considered for a moment what a great saving could be made if M.S. rods are supplied in 30—40 feet lengths instead of delivering it to consumers of small quantities in so short as 12 feet lengths? An easier way of ensuring economy in the use of steel might be by employment of competent engineers at the Steel Distribution Offices of the Provincial Government and effect suitable emergency measures through local authorities to curtail use of steel.

Destroying white ants: A new Technique.

According to the Forest Research Institute, Dehra Dun, white ants can be destroyed at a cost of 2 annas a mound of average size. The technique for the destruction of this pest has been developed as a result of experiments at the institute. Half an ounce of any of the insecticides—DDT, gammexane or hexyclan—dissolved in a kerosene tin full of water will, within 3 days, completely destroy a colony of white ants living in an ant-hill of about 20 cubic feet volume. The institute advises that the solution should be well stirred and poured into holes made on the top and sides of the mound.

No-strike formula.

A novel no-strike formula for essential industries, painless to the general public but painful to the parties involved who may prove to have been wrong, is suggested in the May Issue of *The Harvard Business Review*. Apart from the inconvenience which the public suffers, the only direct result of a strike is to inflict an economic loss on both the employer and the workman. The Review, therefore, suggests that legislation should be devised to permit a union to inflict identical loss on the employer without a work stoppage, and *vice versa*. This could be done by a "statutory strike" under which work would continue but the employer would be required to pay for work performed at a rate so high that the economic hurt would be the same as if a strike had actually taken place; workers would be penalised by a heavy reduction of wages. The Review further suggests that special labour courts would determine the amount of the penalties, which would be paid to the Treasury. The money would be available for the general needs of Government or special services.

A Spring Cleaning.

The Commission set up by the Government of Bengal to investigate into the Calcutta Corporation affairs, have in their interim report scathingly indicted the councillors of the corporation. "The root cause of the malady," observes the Commission, "must ultimately be traced to the councillors, who exercised a most baneful influence over the executive." By way of remedy, the Commission suggests that "the first step must questionably be to secure the return of better councillors men with a genuine sense of civic responsibility who will not use their position merely as an instrument for the furtherance of party ends or personal interests." The responsibility to send honest men as councillors ultimately rested with the citizens themselves. "The first desideratum," says the Commission, "would seem to be the education of the electorate in the duties of citizenship and the larger and more broad-based the electorate, the more effectively would democracy work."

Water Supply in Cutch: New Inquiry Committee.

The Government of India have appointed a five-man committee to go into the question of water supply position in Cutch in view of the development of Kandla into a major port to take the place of Karachi. Meanwhile, officers of the Geological Survey of India have been studying rainfall data for Cutch over the last hundred years or so. In their opinion, the ground water resources of Cutch are not being utilized, at present, to the fullest extent. Such utilisation, it is pointed out, must take into account the required supply of 25 million gallons of water daily to Kandla port as also water supplies required for cultivation

ARE YOU A HARD-WORKING FAILURE?

LILLIAN D. MILNER.

You envy those with higher salaries and better conditions than yours. But have you stopped to think why others get promoted while you do the donkey-work? You need something more than hard work to reach and hold a top-grade post.

SOMETIMES the people who work the hardest are the biggest failures in life, and these are the very people who do not understand why anyone who works hard should be a failure.

The *untrained* worker resents the better working conditions and higher pay of the *trained* worker. The *inexperienced* trained worker, serving what is really an apprenticeship at low wages, resents the better working conditions and higher pay of the *experienced* trained worker.

When I was working in a very large office, some years ago, an efficiency expert was called in to supervise the reorganisation of the staff, and readjust the salary scale according to the duties performed by the various employees. A middle-aged man, a very conscientious worker, who had been in the employ of the firm for about twenty years, was very much disappointed when he did not receive an expected increase in salary, the reason being that his work—that of operating an addressograph machine—called for a minimum amount of responsibility, and salaries were being adjusted according to the amount of responsibility involved in the carrying out of an employee's duties, and not according to the length or faithfulness of service.

While this man was going around the office, in a condition bordering on hysteria, telling of his supposedly unjust treatment to anyone he could get to listen, the chief of his department—the publicity office—was lamenting his inability to obtain someone capable of revising, and adding to, his mailing list—the very mailing list which this man used on his addressograph machine! Right in his own office was an opportunity for him to achieve success, for the chief would gladly have paid almost twice the salary he was receiving to someone who could revise the list and do some similar administrative work.

Shirking Responsibility

When the proposition had been put up to him, he had said: "I've got all those stencils to look after and as much work as I can do now!" His chief naturally concluded that it was only wasting time to discuss with him *work of greater importance.*

People often grumble about their working conditions and their pay when they have only themselves to blame. The shirking of responsibility and the unwillingness to do more work until one is assured of more pay are perhaps the two greatest factors which make up the difference between failure and success, and responsibility is easily shirked because it is rarely thrust upon one but must generally be sought, and sometimes assumed voluntarily. Sometimes people who hold responsible positions do not realise just how much assistance a subordinate can render until this is actually demonstrated to them.

While I was working in this publicity office I learned that it didn't pay to shirk responsibility. The head executive stopped at my desk one day and said: "You have an article in this week's . . . I read it this morning. When you come back from your holiday we must see about your doing some similar work for us."

I looked up at him with an incredulous smile, thinking that he must be jesting. "I mean it!" he said; with a little frown of annoyance because I hadn't taken him at his word. "We've been planning a big publicity campaign for some time, and it seems to me you're just the person to handle it."

Take a Chance

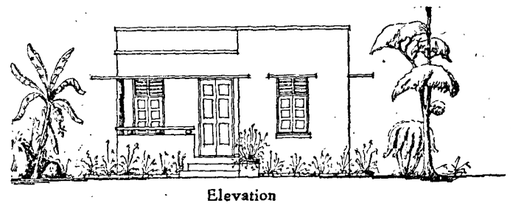
If I had been able to speak, I'd have cried out: "But I'm afraid I couldn't do those things! I've never done any of them before. And I'd make mistakes!" But I was too surprised to say anything except to stammer a "Thank you."

When I came back from my holiday nothing was done in the matter of the publicity campaign. The chief seemed to have dropped the idea, so I decided to remind him about it. When I talked with him, however, I learned that he had sensed my doubt of myself, and no longer felt I was capable of doing the work. He had lost his faith in my ability because I lacked belief in it. My apparent lack of enthusiasm had made him think that my fear of shouldering responsibilities was greater than it was. Don't let these things happen to you. If you think you've got a sporting chance to succeed when opportunities come along—well, take that chance. But back your decision with industry and determination.

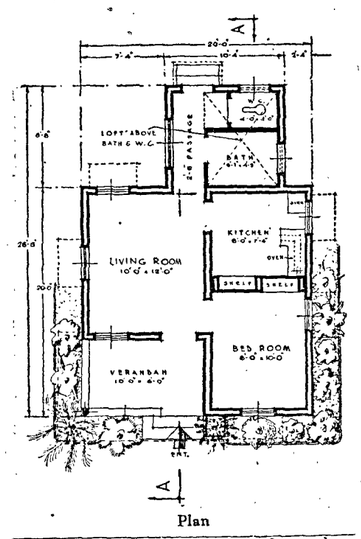
(*Adopted from The Psychology with acknowledgements*).

LOW-COST CONCRETE HOUSE

THIS model house is designed to serve the needs of a small lower middle class family. It is a self-contained house with the minimum standard accommodation, comprising a living room 10′ x 12′ with a 6′ sitting verandah in front, a bedroom 8′ x 10′, a kitchen 8′ x 7′ 4″ a bath and lavatory. It has enough windows and other openings which ensure adequate light and ventilation, and is provided with sufficient storage space by built-in cupboards in the bedroom and kitchen, and a loft over the bath and lavatory. A plan,* elevation and section, of the house are given below:



Elevation



Plan

* Demonstration house erected at the Chithirai Exhibition, Mathurai.

Apart from exhibiting a properly planned small house with simple architecture and attractive appearance, this concrete house has been put up to demonstrate a *cheaper, quicker* and more *durable* type of permanent construction than the traditional types.

It is cheaper because it adopts a very economical design of the structure which results in saving of both material and labour, as also uses mainly two materials *viz.*, cement and steel which are at present comparatively cheaper than the other building materials such as brick, stone, lime, timber etc. Cement and steel have increased in price over their pre-war rates by only about 100 per cent, while the prices of all other materials have gone up by 300 to 500 per cent.

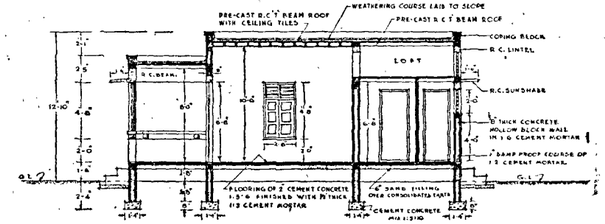
The demonstration house has actually cost Rs. 3,000 exclusive of water supply, sanitary and electric fittings. It has a plinth area of 489.5 sq. ft. and its cost works out to approximately Rs. 6-2-0 per sq. ft. comparad to Rs. 9-4-0 per sq. ft. of the conventional brick masonry and Madras terrace house, which shows that this type of construction is roughly 33% cheaper than the latter.

Only a very small quantity of mild steel bars, viz., 11 cwts. have been used in this construction, which at present may not perhaps be difficult to secure for house building purposes, while the total quantity of cement consumed is only 12 *tons*! Cement supply position has now considerably improved, and it is expected that in another three or four months, it will be freely available in any quantity in this Province.

It is quicker because it makes use of mostly precast concrete units of convenient sizes, which enable rapid erection. Also as these units are all cast in moulds to the required designed sizes, no time is wasted in cutting and adding, which incidentally saves labour and wastage of material. For example a concrete hollow block is equivalent to 12 common bricks (9″ x 4½″ x 2″).

Although the exhibition house has been completed in just over three weeks by doing work in the night sometimes, normally it should take about five to six weeks to build a small house compared to eight to ten weeks for an ordinary brick house.

It is more durable because cemen concrete plain or reinforced is very much stronger than other materials commonly used in constructing



SECTION A-A.

buildings, and is fireproof and weatherproof. It, therefore, requires practically no maintenance and is consequently the most economical construction.

The chief characteristics of the design of this house are that except for wooden door and window shutters, it is constructed entirely of cement concrete, and barring two or three items the whole house is built up of standardised precast concrete units. The latter feature renders this type of construction eminently suitable for mass building of houses economically and quickly, which can therefore with great advantage, be adopted by Co-operative House Building Societies, Government and Industries for constructing houses for their members, staff or the labour.

The interesting details of the construction of the house are:

Foundation Footings

These are of cement concrete comprising one part of cement, 5 parts of sand and 10 parts of broken bricks. But instead of broken bricks, any other available similar aggregate may be used.

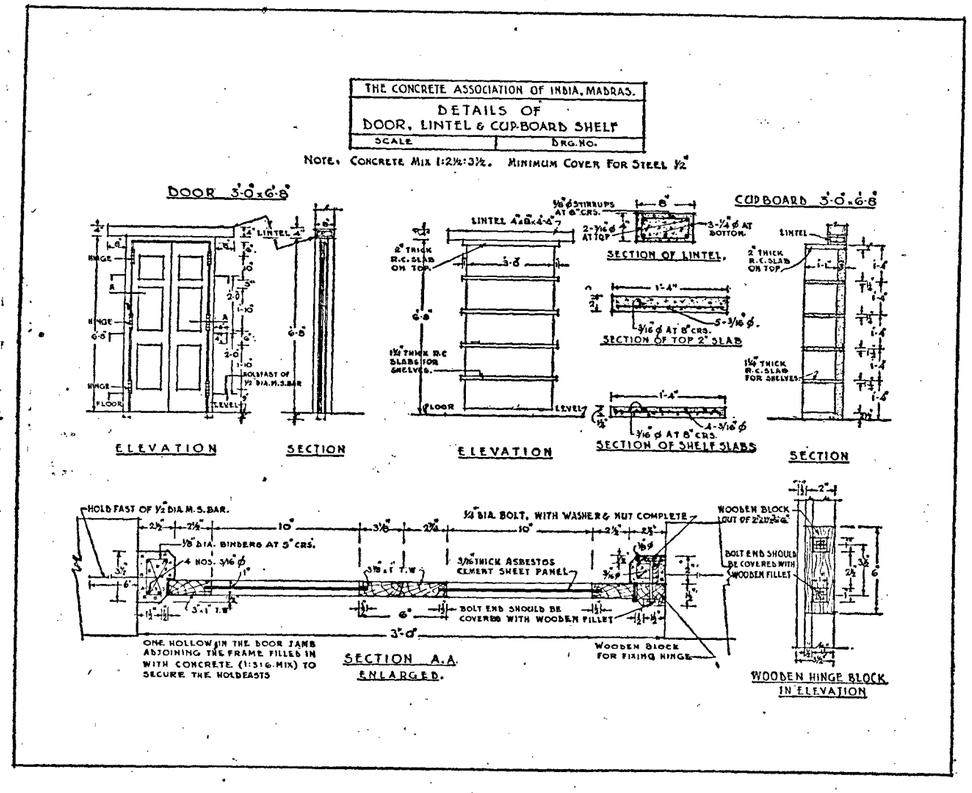
Walls

Both foundation and superstructure walls are built with concrete hollow blocks in 1:6 cement mortar.

The thickness of walls for foundation, basement and superstructure is only 8". But for a two-storeyed building the thickness of walls for the first and ground floor will be 8," while for the basement and foundation 12".

Concrete hollow blocks are of 8"×8"×16" standard size and are made of a mixture of one part of cement and 6 parts of sand. But where good clean cheap shingle is available, these can be made of one part of cement, 3 parts of sand and 5 parts of pea size shingle. Blocks for the exterior walls are made with a ½" facing of 1:3 mortar, which obviate the necessity of plaster.

Hollows in blocks in the foundation and basement masonry are



filled in with sand, which is thoroughly compacted. In the case of a two-storeyed structure, this should be filled in with 1:3:6 cement concrete.

One course of solid blocks is provided just below the floor level over which is laid a damp-proof course consisting of a 1" layer of 1:2 cement mortar. Another course of solid blocks is laid under the roof.

Concrete hollow blocks are two to three times stronger than country burnt clay bricks, therefore thinner thickness of walls can be used with concrete blocks, than with bricks. Apart from other advantages of heat and sound insulation, fire and weather resistance, and lighter weight, concrete-hollow block masonry is at present cheaper than brick masonry owing to the lower cost of blocks, smaller quantity of mortar, and lesser labour required in building walls. Actually the cost of laying 100 sq. ft. of concrete hollow block wall 8" thick including pointing on the exterior face works out to Rs. 63 compared to Rs. 90 for a brick wall of 9" thickness with plaster on *one* face.

Partition Walls.

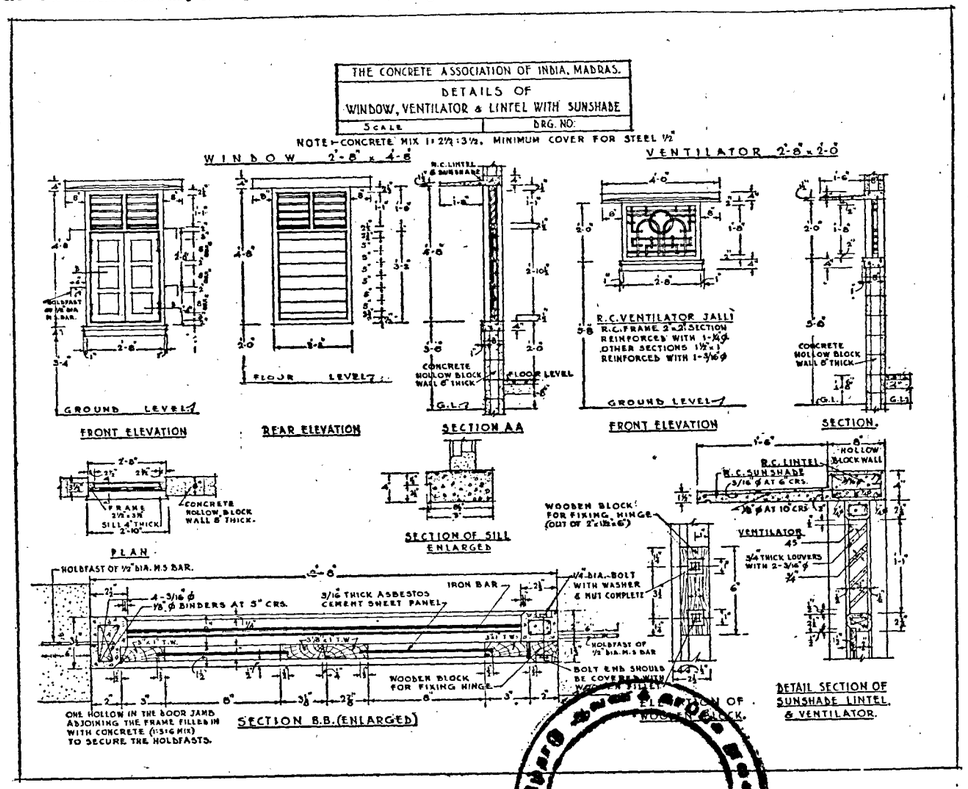
These are 3" thick built with precast concrete solid slabs of 8" x 3" x 16" size, made of 1:6 mix and laid in 1:5 cement mortar.

Doors and Windows.

The door and window frames are made of precast reinforced concrete instead of wood. Replacing wood by concrete for frames, a great deal of it is thus eliminated which results in substantial saving in the cost as the price of even countrywood is at present twice as much as that of reinforced concrete. These frames have the additional advantage that they are not affected by white ants and weather conditions as also do not require periodical maintenance. Only the shutters of doors and windows are made of wood. These are of 3" x 1" wooden frames with panels of Asbestos cement wood in place of the usual wooden panels.

The door and window shutters are painted with one coat of primer and two coats of good quality paint.

The top of the windows is provided with fixed concrete louvers, which ensure proper



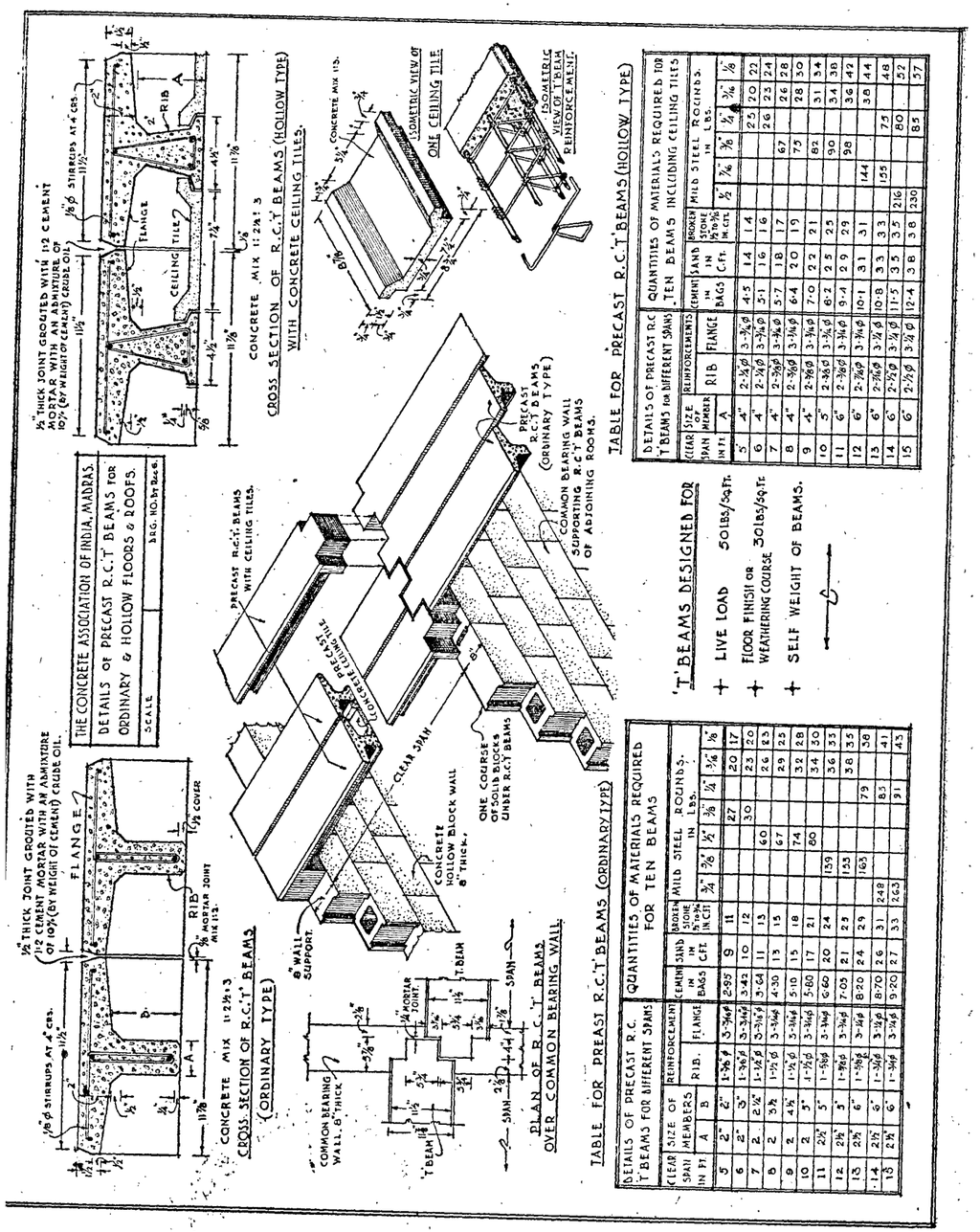


TABLE FOR PRECAST R.C.T BEAMS (HOLLOW TYPE)

DETAILS OF PRECAST R.C.T BEAMS FOR DIFFERENT SPANS			QUANTITIES OF MATERIALS REQUIRED FOR TEN BEAMS INCLUDING CEILING TILES											
CLEAR SPAN IN FT	SIZE OF MEMBERS IN INCHES A	REINFORCEMENTS RIB	FLANGE	CEMENT IN BAGS	SAND IN CFT.	BROKEN STONE ½" TO ⅝" IN CFT.	MILD STEEL ROUNDS IN LBS. ½"	⅜"	½"	⅝"	¾"	¾"	⅞"
5'	4"	2-¼ϕ	3-⅜ϕ	4·5	14	1·4					25	20	22
6	4"	2-¼ϕ	3-⅜ϕ	5·1	16	16					26	23	24
7	4"	2-⅜ϕ	3-⅜ϕ	5·7	18	1·7			67		26	26	28
8	4"	2-⅜ϕ	3-⅜ϕ	6·4	20	1·9			75		28	30	
9	4"	2-⅜ϕ	3-⅜ϕ	7·0	22	2·1			82		31	34	
10	5"	2-⅜ϕ	3-⅜ϕ	8·2	25	2·5			90		34	36	
11	6"	2-⅜ϕ	3-⅜ϕ	9·4	29	2·9			98		36	42	
12	6"	2-⅞ϕ	3-⅜ϕ	10·1	31	3·1		144			36	44	
13	6"	2-⅞ϕ	3-½ϕ	10·8	33	3·3		155				48	
14	6"	2-½ϕ	3-½ϕ	11·5	35	3·5	216				75	52	
15	6"	2-½ϕ	3-½ϕ	12·4	38	3·8	230				80		
											85	57	

'T' BEAMS DESIGNED FOR
+ LIVE LOAD 50 LBS/SQ.FT.
+ FLOOR FINISH OR WEATHERING COURSE 30 LBS/SQ.FT.
+ SELF WEIGHT OF BEAMS.

DETAILS OF PRECAST R.C. T BEAMS FOR DIFFERENT SPANS			QUANTITIES OF MATERIALS REQUIRED FOR TEN BEAMS											
CLEAR SPAN IN FT	SIZE OF MEMBERS A	B	REINFORCEMENT RIB.	FLANGE	CEMENT IN BAGS	SAND IN CFT.	BROKEN STONE ½" TO ⅝" IN CFT.	MILD STEEL ROUNDS IN Lbs. ¾"	⅝"	½"	⅜"	¼"	¾"	⅛"
5	2"	2"	1-⅜ϕ	3-⅜ϕ	2·95	9	11		27			20	17	
6	2"	3"	1-⅜ϕ	3-⅜ϕ	3·42	10	12		30			23	20	
7	2"	2½"	1-½ϕ	3-⅜ϕ	3·64	11	13			60		26	23	
8	2"	3½"	1-½ϕ	3-⅜ϕ	4·30	13	15			67		29	25	
9	2"	4½"	1-½ϕ	3-⅜ϕ	5·10	15	18			74		32	28	
10	2"	5"	1-½ϕ	3-⅜ϕ	5·60	17	21			80		34	30	
11	2½"	5"	1-⅝ϕ	3-⅜ϕ	6·60	20	24		139			36	33	
12	2½"	5"	1-⅝ϕ	3-⅜ϕ	7·05	21	25		153			38	35	
13	2½"	6"	1-⅝ϕ	3-⅜ϕ	8·20	24	29		165			79	36	
14	2½"	6"	1-¾ϕ	3-½ϕ	8·70	26	31	248				83	41	
15	2½"	6"	1-¾ϕ	3-½ϕ	9·20	27	33	263				91	43	

ventilation even when the doors and windows are closed.

Lintels, Sunshades, Window-sills and Shelves.

The lintels and sunshades over door, window and ventilator openings, and shelves of cupboards are of precast reinforced concrete. The window-sills are of precast concrete. The mixture of concrete used for all these items is one part of cement, 2½ parts of sand and 3½ parts of broken granite stone.

Roof.

A novel but very satisfactory type of roof has been used in this house, which consists of precast reinforced concrete T-beams each of one foot width and length according to the span of rooms. These beams are made of concrete comprising one part of cement, 2½ parts of clean graded sand, and 3 parts of broken granite stone, graded from ¾" to $\frac{3}{16}$", and reinforced with suitable sizes of bars, full details of which are given on page 18.

The beams are cast in simple moulds at the site of the construction. When the walls are ready to receive the roof, these beams are just hoisted up, set in position and grouted with 1 : 2 cement mortar with an admixture of 10% of crude oil, and the whole operation of laying the roof takes only a fraction of the time required for an *in situ* construction.

Both the types of roof shown in the drawing have been used in this house, hollow roof for the living room and the ordinary type for all others. The hollow roof provides a greater degree of heat and sound insulation in addition to a flat ceiling.

This is a simple roof and is very easily constructed. It has several advantages over the reinforced concrete roof laid *in situ*, and other types such as Madras terrace, Mangalore tiled, etc. Besides being as strong, durable and fireproof as an *in situ* concrete roof, it is considerably cheaper as it involves the use of comparatively less quantities of concrete and steel, eliminates the necessity of an expensive and troublesome item of centering, and also provides efficient and speedier construction.

The cost of laying 100 sq. ft. of ordinary and hollow type reinforced concrete T-beam roof is Rs. 91 and Rs. 114 respectively, compared to Rs. 175 for cast 'in situ' reinforced concrete roof of 4½" thickness, and Rs. 200 for Madras terrace roof with teakwood joists.

Weathering Course over the Reinforced Concrete T-beam Roof.

This consists of two layers, one for providing heat insulation and necessary slopes for easy drainage of rain water, and the other for rendering the roof leakproof. The first layer comprises an average 2" thickness of cinder concrete 1 : 10 (or it can be brick lime concrete), which is laid to a slope 1 in 48. The second consists of spreading a waterproof paper over the cinder concrete and then laying 1½" thick layer of waterproof concrete topping in 2' square slabs in alternate bays with ¼" expansion joints left around.

Of the 1½" thick concrete topping, 1⅜" is concrete comprising one part of cement, 2½ parts of sand, $\frac{3}{16}$" down, and 2¾ parts of granite stone chips graded from ½" to $\frac{3}{16}$" which is thoroughly compacted, and the remaining ⅛" is of 1 : 2 cement mortar (sand $\frac{1}{16}$" down) finished monolithic with the concrete. This concrete topping is properly cured for at least two weeks, after which the joints between the slabs are filled in with a good bituminous mastic such as "Bitulac," "Valamoid," or "Everest," jointing compound.

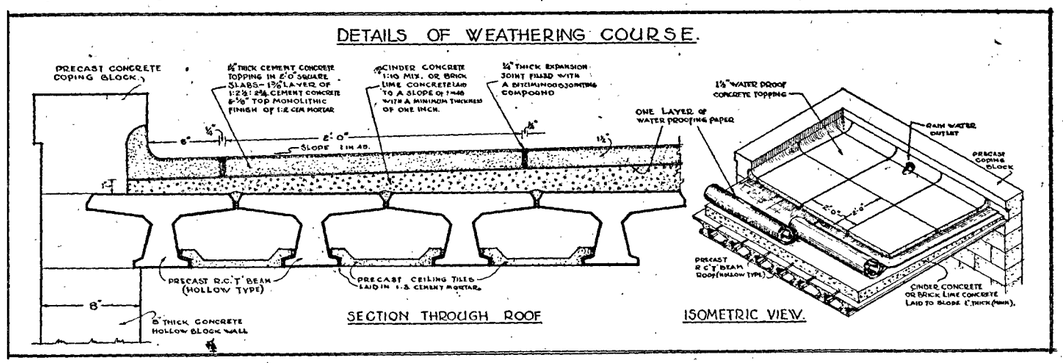
Plaster.

The walls in this house are not plastered on either side, but only pointed with 1 : 2 cement mortar. The plaster is not necessary because blocks used for the exterior walls are cast with a richer facing. If desired, the walls need only be plastered on the inside with a ¼" layer of 1 : 4 cement mortar to secure uniform, smooth and even finish.

Flooring.

The basement is filled in with good earth and thoroughly consolidated with a 6" layer of sand on top. Over this the flooring is laid which consists of a 2" base course of 1 : 3 : 6 concrete and a ½" monolithic finish of 1 : 3 cement mortar. The finished surface is lined into suitable sections by pressing a ⅛" diameter string with a trowel. In the case of bathroom and lavatory, the finish consists of 1 : 2 cement mortar.

(*By courtesy: Concrete Association of India.*)



WELLPOINT PUMPING

We feel sure that the following article on the system known as "Wellpoint Pumping" should prove of considerable interest to Engineers and afford valuable reading for Engineering students.

THE system known as Wellpoint pumping has been adopted over a period of years in various countries for the reduction of standing water below ground, as well as for the procuring of supplies of water for irrigation and other purposes.

Wellpoint pumping equipment is employed principally for the lowering of the water table in waterlogged ground to enable excavation work to be carried out expeditiously. It is this aspect of the subject, therefore, that is treated here first. Its application to water supply follows as a natural corollary.

In America it has been employed for several years with signal success on both small and major works of public works construction.

In England the system has been used on many important contracts, resulting in an earlier completion of the work, and a considerable saving in cost as compared with sump pumping, which up till then has been the recognised method of dewatering the ground.

In this country this system was only recently used in connection with four major Railway bridges on the Jodhpur Railway.

The main application of Wellpoint dewatering is to foundation works for buildings, bridges, etc., and trenching work for pipe laying in ground such as running sand, ballast and sand, bog land and other types of soil which allow a flow of water through them in varying degrees.

Its main advantages lie in that :—

(1) Wellpoint pumping does not extract fine material from the ground thus :—

(*a*) Wear on pumping machinery, valves and other equipment used is kept to the minimum.

(*b*) There is no danger of subsidence in the neighbouring ground, a factor which, with sump pumping, often causes additional expense on the part of the controlling authority.

(2) Due to the downward flow of the water towards the Wellpoint, fine material in the ground is carried with it and produces a blanketing effect along the line of the Wellpoints, resulting in a tendency for the amount of water extracted from the ground to be consistently reduced. With sump pumping this fine material is drawn out of the ground into the excavation or sump hole with the

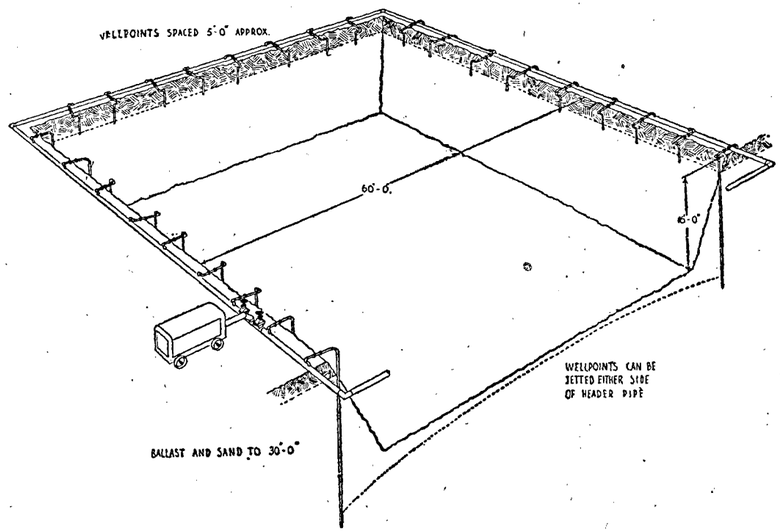
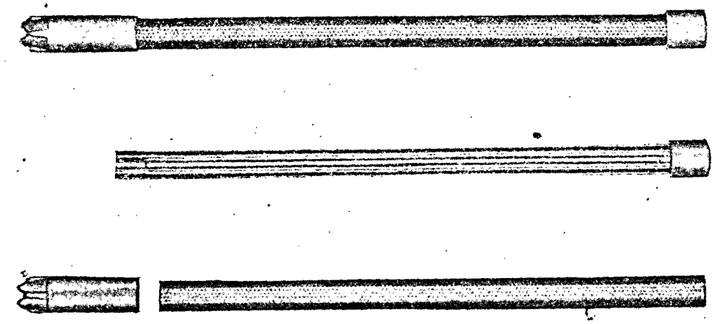


Diagram No. 1



water, thus allowing freer passage through which the water can flow, and continuous pumping is liable to show a consistent increase in the amount of water extracted from the ground, coupled with the possibility of subsidence in the neighbouring ground.

(3) The main purpose of Wellpoint pumping is to lower the water table to a point below excavation level, and this it readily achieves. With sump pumping this result is difficult to obtain owing to the slow lateral movement of the water through the ground.

Where concrete foundations are to be put down on sand or ballast, and drains have heretofore been employed to carry the water to a sump at one end of the excavation, but these are liable to silt up causing further delays in the completion of the work.

(4) With Wellpoint pumping the water table is lowered before excavation commences, and not afterwards as in sump pumping, and accordingly heavy excavating machinery can be put on the site, and the work speeded up with corresponding reductions in working costs, particularly as to labour and overheads on plant and supervision.

(5) The amount of timbering required to support the sides of any excavation is considerably reduced, or where space permits and the sides can be sloped back to the natural angle of repose of the dry material, timber false work can be dispensed with entirely.

(6) There is also a reduction in the loss of timber used, a not inconsiderable item of which contractors are well aware.

The "Complete" Wellpoint pumping equipment comprises the following :—

The Wellpoint itself, illustrated herewith, which is made up of—

(*a*) An outer protecting brass sheath with ¼ in. perforations.

(*b*) A fine gauze screen of 50 by 50 mesh through which the water in the ground percolates.

(*c*) A patented fluted tube 1½ in. internal diameter, down the flutes of which the water passes to inlet ports at the lower end.

(*d*) The jetting head containing a rubber ball valve which is kept off its seat during sinking operations, but during suction pumping closes to prevent the ingress of solid matter.

(*e*) These components are quickly dismantled for cleaning, and as quickly re-assembled for further use.

The riser pipes 1½ in. internal diameter, which are attached to the top of the Wellpoints and are of a length decided upon according to the depth to which the point is to be sunk in the ground.

The swing connectors which join the riser pipes to the 6 in. header pipe. These provide for flexibility in the position in which the point is sunk relative to its socket in the header pipe. Each connector is fitted with a valve to control the air and water flow through the point.

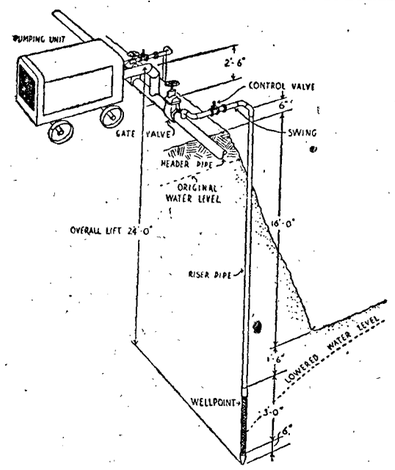
The 6 in. header pipe having screwed sockets for the Wellpoint connectors at 2 ft. 6 in. centres.

The 6 in. suction pump unit embodying a centrifugal water pump, a large capacity vacuum pump and a specially arranged tank into which the water is drawn, and from which air is exhausted before the water reaches the centrifugal pump. The standard power unit is a four-cylinder petrol engine, throttle controlled and with self-starter. The advantage of its use lies in its wide range of speed which can be controlled to suit the suction lift and quantity of water encountered in the ground.

Screw down valves to isolate any section of the lay-out.

6 in. bends, tee junctions, etc., as required by the conditions at site.

The jetting pump for sinking the points in the ground, capable of delivering 18,000 gallons of water per hour at 150 lb. pressure. Petrol-driven with throttle control to provide for the alternate bursts



This Diagram shows enlarged details of all the various items of Wellpoint equipment, but it is not referred to in text.

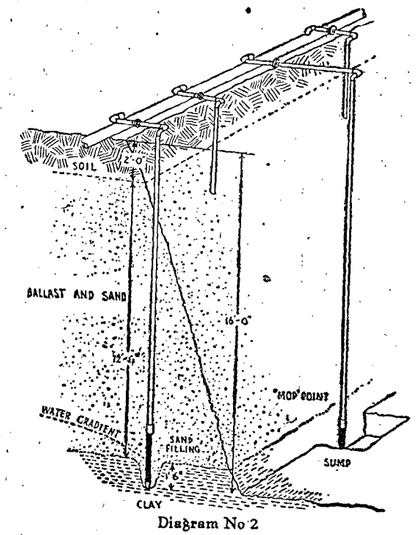


Diagram No 2

of high and low pressure feed to the points, which is required for jetting operations.

A typical set-up for an average-sized excavation is shown in diagram No. (1). The ground consists of ballast and sand in the rough proportions of one to one. The depth to which the points are sunk is fixed by the following :—

(*a*) The depth of excavation.
(*b*) The width of it.
(*c*) The hydraulic gradient expected in the particular soil encountered.

On the diagram an estimated hydraulic gradient has been indicated. This, of course, will vary according to the nature of the ballast, but with Wellpoint pumping a steeper angle must be allowed for than that which would be expected under sump pumping conditions owing to the blanketing effect already referred to.

It will be noted that at the line of Wellpoints the water level has been lowered to a point about half-way down the filter of the points, which result might be obtained after 24 to 48 hours' pumping.

It is desirable to hold the water at this level. If lowered still further an excess of air is likely to be drawn up through the points, possibly overloading the vacuum pump, and thus necessitating frequent adjustments to the control valves on the swing connectors.

Pumping considerable volumes of air is unavoidable even with the control provided, and for this reason the suction lift of the Wellpoint pumping system will not generally exceed 18 ft. to 20 ft. in sand, or 20 ft. to 22 ft. in coarser material.

Where excavations are taken to a greater depth, then stage pumping can readily be adopted, a second set being put in for the lower section of the work.

Diagram No. (2) shows an arrangement of similar character but with a variation in the strata. Here the excavation level runs into the clay bed. It will serve no useful purpose to sink the points below excavation level, but they should be jetted into the clay as near as possible to their full length, i.e., 3 feet 6 inches. The pressure of the jetting water creates a considerable hold round the point into which sand and ballast falls from above, and into which water will drain over the top of the clay bed to the Wellpoint filter.

Dependent on the spacing of the points and the "draw down," a certain quantity of water may percolate through into the excavation, but this can be easily drained into a sump or series of sumps and picked up by means of the "mop" points illustrated without losing any of the benefits of Wellpoint pumping previously stated, or in any way adding to the cost of operations.

A further variation to the above conditions would be where the ballast and sand are interspersed with one or more strata of clay through which the excavation passes. Such cases can be handled by jetting holes through the various strata which are impermeable to water and into which the loose material in the ground above will fall, or into which additional coarse sand can be projected from ground level during jetting operations.

The holes made by the Wellpoints themselves during jetting also form natural drains from one strata to the next below it.

Rectangular sites have been illustrated, but mention of trench work for pipe-laying should also be made. In such cases there may be a distance of only 6 feet to 10 feet measured horizontally from the line of Wellpoints which requires to be dewatered and, provided the excavation level is in the water-

bearing strata similarly to diagram No. (1), points on one side of the trench only will be sufficient.

Where excavation level finishes up in clay, such as in diagram No. (2), then a line of points will be necessary on both sides of the trench.

Installation of the System

Wellpoints are jetted into the ground and not driven. This is for two reasons :—

(1) During jetting operations a hole in the ground is created by the pressure of the jetting water, the hole being from four to six times the diameter of the Wellpoint itself, according to the compactness and size of the individual particles making up the ground. This provides—

(a) For ease of extraction.
(b) It prevents damage to the filter of the Wellpoint.
(c) It allows "sanding" of the points in such cases as already described.

(2) If the point is driven into the ground, the above conditions are not realised, and there is the possibility of the filter becoming clogged with clay or other adhering soil through which the point passes. By jetting, a portion of the jetting water is forced through the inlet ports at the bottom of the point, passes up the flutes of the inner tube and out through the mesh, thus ensuring that they are kept perfectly clear for when suction pumping commences.

The time occupied in jetting a point varies very considerably by reason of the variations in the nature of the ground. In sand deposits points can usually be sunk to a depth of 20 feet in less than a minute, whereas in ballast or stiff clay the time taken may be as much as 10 minutes, and in extreme cases as long as an hour.

Severe obstacles to jetting such as boulders in the ground may usually be circumvented by the latitude in the position of the point allowed by the swing connectors.

Extraction

The extraction of points usually occupies less time than that required for jetting.

The points are lifted without the use of a crane. A "runner puller" or long Stillson wrench in the hands of a couple of men is usually sufficient.

Where necessary the point can be loosened in the ground by coupling-up the jetting pump and pumping water through the point at high pressure.

Points require little, if any, cleaning after use in sand and ballast, and such can generally be done without even dismantling, but where they have been used in loamy sand Wellpoints can quickly be dismantled for cleaning on site.

Reduction in Working Costs

The savings secured by Wellpoint pumping can best be estimated by the prospective user, because in general terms the additional profit secured by adopting the system or the lower tendered price for a contract is the difference in cost between doing the same work in a perfectly dry site and in a wet one.

It is admitted that many items entailing extra cost on a wet contract cannot be foreseen at the commencement of the job, so that Wellpoint pumping can also be looked upon as an insurance against the unexpected delays consequent upon the presence of water in the ground.

On foundation works the amount of equipment required is generally fixed by the area to be ringed, and neither more nor less equipment will affect the rate of progress of the contract to any extent.

In trench work, however, the amount of equipment used can regulate the rate of progress very considerably. Since a dry site usually allows the use of a mechanical excavator, the maximum rate of progress is dependent on the speed of the excavator.

To achieve this it is essential to lower the water level in the ground well ahead of the machine. The practice adopted is, therefore, to divide the length of the trench into sections of equal length, each one of which represents the daily rate of progress which is desired.

It will be obvious that while No. (1) section is being excavated, pumping can be in progress in No. (2) section in order to lower the water table to the required level, and the points can simultaneously be jetted in No. (3) section. After the laying, jointing and testing of the pipes, the points in No. (1) section can be extracted while backfilling takes place and the set used for a further forward section of the trench.

By this arrangement continuous progress along the trench line can be maintained, and a definite programme adhered to, which will vary only in the event of very unexpected difficulties arising in jetting due to possible variations in ground conditions.

While it is not claimed that Wellpoint pumping has a universal application, the possibilities of its use are so wide that the fullest investigations by all contractors engaged on foundation and other work below ground level are well worth while.

It will be readily appreciated that where there is a continual flow of water through the ground at depths within reach of a Wellpoint pumping equipment, the system can be applied to the provision of water supplementary to the main supply or for emergency purposes in the event of failure of the main supply.

The arrangement of set up, number of points used, etc., will, of course, be governed by the area of the ground available for dewatering, direction of flow of water, and the amount of water required over any given period.

In the case of permanent installations, different sizes of suction pumps can be installed to suit individual requirements.

Water flow through the system can, of course, be controlled within very fine limits up to the maximum capacity of the set up, and this is a useful feature in cases where the amount of water taken from the ground needs to be restricted on account of outside considerations such as depletion of existing local wells.

(With acknowledgements to *The Contract Journal*.)

LETTERS TO THE EDITOR

Jack Arching with R.C.C. Joists

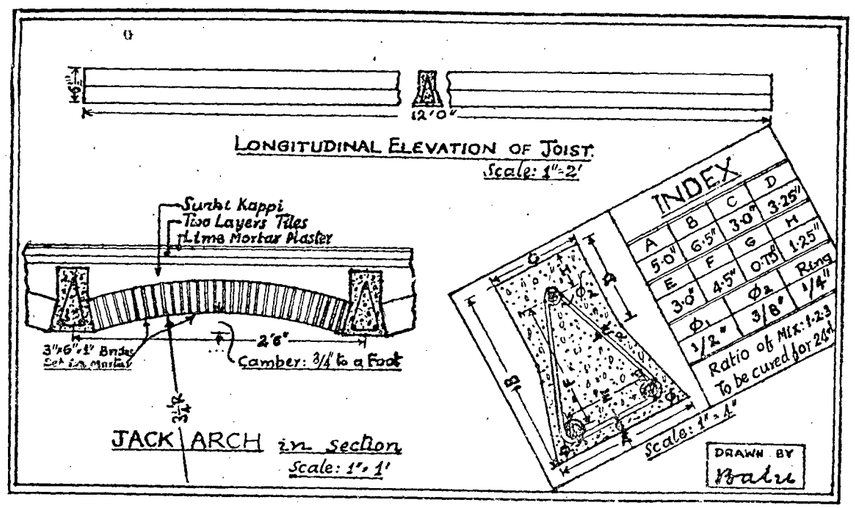
Sir,

Being one of the regular subscribers to *The Building Gazette*, I take the privelege to enclose herewith a short note relating to my experiment in the direction of using R.C.C. Joists in place of steel I section joists as an alternative for the Jack arch terrace. The experiment is being tried over a small construction at Nanjangud, where it is proposed to study the utility of this terrace. Any suggestions made by you or your readers will be received in a gratifying spirit.

R.C.C. Joists with suitable reinforcement are precast for spans not exceeding 10' (inner). These joists are cured under water or wet sand for a period of 24 days and then placed on the wall plate at distances of 2' 6" as shown in the sketch. The gap between joists is arch-bridged by terrace bricks set in mortar, in the usual way. Surki concrete is then spread on the top to a consolidated thickness of 3" and beaten with wooden knives until the knives leave no mark. This is covered by two layers of square flat tiles laid diagonally. A ½"–¾" lime plaster will render the terrace fairly impervious, but, if desired, complete water proofing may be attained by using special compounds.

Yours faithfully,

Bangalore. B. V. BALU.



Architectural Practice

Sir,

I wish to draw the attention of the Indian Institute of Architects through your valuable Journal to adopt ways and means of increasing the number of architects on its rolls, and thus assist its members to have scope for wider architectural practice.

I am convinced that the major reason for architects being so little employed is ignorance on the part of the public, and I feel it is an urgent and necessary task for the Indian Institute of Architects to enlighten it. I think it is absolutely essential that the prevalent idea that an architect is merely a person who puts art into buildings and thereby adds unnecessarily to their cost, should be dispelled, and that people should realize that more economic as well as "commodious, fit and delightful" buildings will be obtained by employing architects, in fact, that it "pays" in whatever sense the word is used, to do so.

The Indian Institute of Architects present strength of 319 members doubtless fill only a very small demand and as such much of the practice is snatched by those who are not its members. As such I wish that first and foremost, it ought to organize 'Licentiate' class of architects similar to that of the R.I.B.A. on practice-qualification. If this is done, the architectural practice could be uniformly and representatively distributed throughout the length and breadth of India.

Yours faithfully,

Madras. E. GANAPATHY.

THE LIFTING OF FLOOR TILES

CAUSES AND CURE

*The following are abstracts of notes received from the Building Research Station of England.**

A TYPE of flooring failure which has been reported to the Building Research Station on many occasions is the lifting of clay flooring tiles from a concrete sub-floor. The typical feature of this failure is the general loosening of an area of tiles (the area may be the whole room) from the bed on which they are laid, and the formation of either an arch as shown in Figure 1 or a ridge as shown in Figure 2. The arch may sometimes be strong enough to withstand the weight of traffic for some time without collapsing, but more often it collapses fairly quickly and the tiles are found lying loose and in disorder on the sub-floor.

In every failure of this kind reported the tiles have come away cleanly from the bed leaving the imprint of the pattern of the back of the tile in the bedding mortar. The effect is not confined to any one type of tile or form of concrete sub-floor construction. In all instances, however, it is noted that the tiles lift either fairly soon after laying, i.e., within the first nine months, or after having been subjected to a period of intense cold, a circumstance which may lead to failure at any time during the life of the floor, even 50 years after laying.

Cause of the Failure

When the failure occurs in the early stages it is probably due to shrinkage of the sub-floor and the bedding layer. Tiles are commonly laid in a very rich cement mortar on concrete bases finished with a levelling screed, and it is a fairly common practice to lay the tiles as soon as possible after the concrete sub-floor has been placed in position, in order to provide a good key. As the concrete dries and ages it shrinks, whereas the tiles themselves have little or no drying shrinkage. The movement of the mortar and the concrete thus produces a shearing force at the interface between mortar and tile and a compressive force on the tiles. The adhesion between tile and mortar is probably the weakest part of the floor construction, despite various keys in the back of the tiles and different methods of treatment before laying, and, if the shrinkage is sufficiently large, the bond is broken and an area of tiles becomes loose. The tiles in the loose area are still in compression

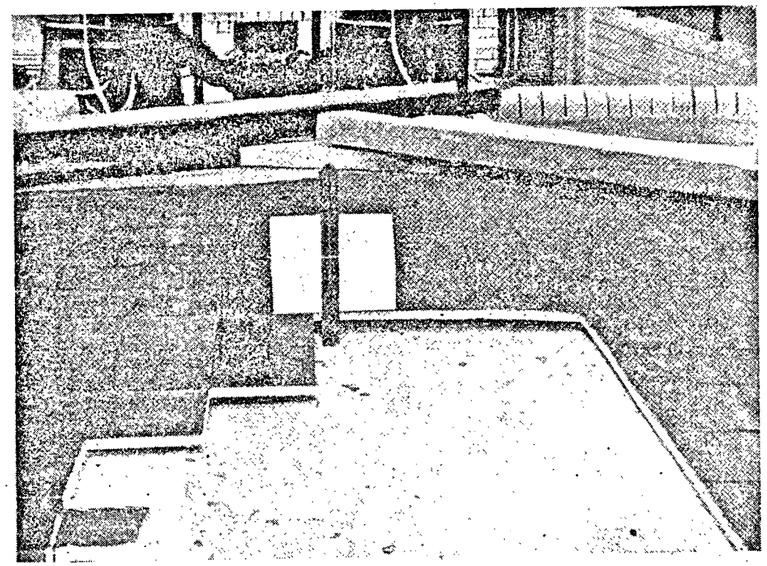


Fig. 1: Example of arching of floor tiles.

* Crown copyright reserved.

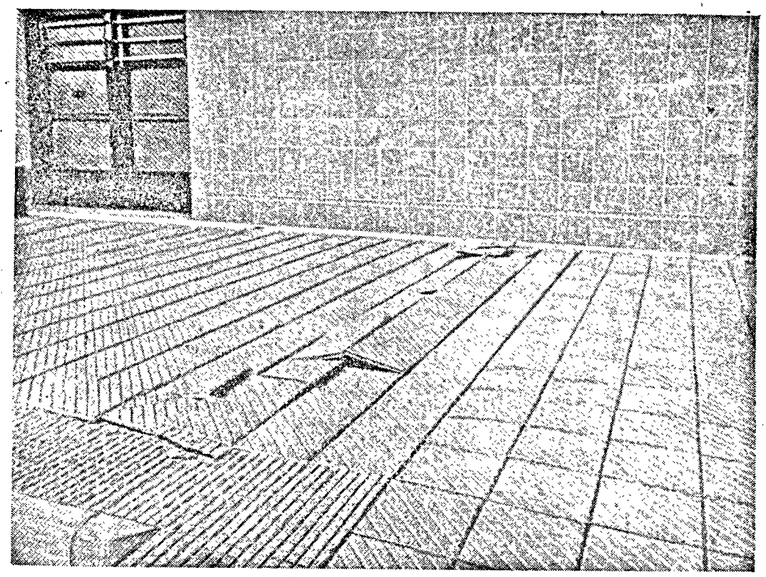


Fig. 2 : Typical example of failure of a tiled floor.

and, being held by the unaffected bedded tiles around them or by the walls, they tend to rise from the base. Many tiles are manufactured with a slight taper on the edges to allow for easy withdrawal from the mould and these tapers allow the tiles to lock into an arch which at the crown may be as much as 2 inches above the base floor, as in Figure 1. Sometimes the compressive forces are directed to the two middle courses of tiles in the loose area, and these rise in a ridge surrounded by tiles lying flat on the base but nevertheless loose, as in Figure 2.

Even when the drying-out stage is passed successfully or the tiles have been laid on an old dry floor, failure can sometimes be caused by severe cold. As the temperature falls concrete contracts two to three times as much as clay tiles, and a sufficiently low temperature may cause lifting. Unlike failures due to drying shrinkage, those due to low temperature may occur many years after laying.

The explanations given above relate only to clay tiles. Very few examples of the failure of concrete tiles have been reported, but this may be simply because concrete flooring tiles have been much less widely used than clay tiles. On theoretical grounds, however, lifting would be less likely to take place with concrete tiles, since their drying shrinkage is more comparable with that of the sub-floor and their thermal properties are also similar. Failures of this type can, however, occur with concrete tiles, since a high proportion of the shrinkage will have occurred during curing and before the tile is laid. Further, some of the aggregates used in concrete tiles have thermal movements much less than those of the usual gravel concrete of the sub-floor.

Despite the smaller chance of failure with concrete tiles it is

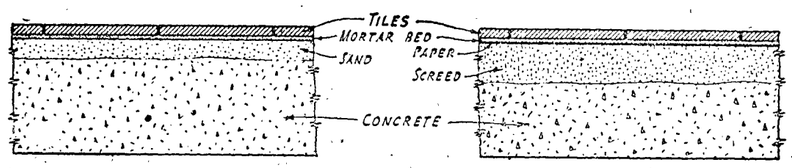


Fig. 3 : Typical form of construction using a sand separating layer.

Fig. 4 : Typical form of construction using a paper or felt separating layer.

desirable to adopt the same precautionary measures as with clay tiles.

Precautions to prevent Failure

Various expedients have been adopted in attempts to prevent the lifting of clay tiles, most of them being designed to increase the adhesion between tile and the bed, *e.g.*, by varying the pattern of the key on the underside of the tile and by adopting a particular procedure in soaking or slurrying the tiles. The methods, however, have not always been successful.

A more reliable method is to prevent the disruptive forces from developing, which can be done by separating the tiles from the concrete and thus allowing each free movement.

1. Sand layer method (*Fig. 3*)

Instead of applying a cement-mortar screed to the rough base-concrete, a layer of ordinary building sand should be used. This should be compacted either by rolling or tamping to a thickness of $\frac{3}{4}$ to 1 inch. Wooden fillets may be necessary to enclose the sand. On this layer the tiles are then bedded in cement mortar in the usual way, using only the minimum of mortar necessary to produce a level surface. Before the bedding mortar is placed, the sand should be damped to avoid drying out of the mortar, and it may be found more convenient to use slightly damp sand in the first instance.

This method is so widely used on the Continent as to be considered the normal method of laying.

2. Paper or felt layer method (*Fig. 4*)

In some situations the sand separating layer may be found to be unsuitable and a paper or felt layer more suitable. The concrete base should be finished with a cement-mortar screed in the usual way, care being taken to provide as level a finish as possible. Building paper or bitumen felt should then be laid flat as a continuous layer over the base and should not be stuck down. Adjacent sheets should be lapjointed so as to prevent any key between bed and base. The tiles are laid on this paper or felt in as thin a bedding layer of cement mortar as will produce a level floor.

Since the function of the paper or felt is merely to separate the bedding mortar from the concrete base, it is not necessary to use materials of high grade unless the separating layer is required to function as a damp-proof membrane as well as a separating layer. This method is fairly widely used in the U.S.A.

Method 1 has the advantage of requiring less careful levelling of the cement screed, but this is counterbalanced by the necessity to level the sand layer. It may be found to be more applicable to new construction than to reconstruction of floors which have failed, since it entails raising the finished floor or alternatively cutting out. Method 2 requires careful levelling of the screed but is suitable for both new and repair work.

It is recommended that a bituminous expansion joint should be provided between the wall and the tiles; this should be behind the skirting if possible.

BRICKS FOR BIHAR

The Director of Industries, Government of Bihar, Patna, has addressed the U.K. Trade Commissioner at Calcutta regarding the installation of a mechanical brick-manufacturing unit, including kilns. The bricks to be produced are of the usual building variety, not hollow, and the plant should have a capacity of burning approximately 100,000 bricks per day. The Director requires details of the lay-out and design of the units which can be offered, and these should include the essential features of operation. Special attention is directed to the difficulty normally experienced in keeping brick-making plants in operation during the Monsoon season and the consequent desirability of obtaining a plant which will have the minimum of inactivity in the adverse condition then experienced.

PERSONAL

Prof. Manek S. Thacker

Prof. Manek S. Thacker of the Indian Institute of Science, Bangalore, has been elected Fellow of the American Institute of Electrical Engineers. He is the first Indian to have been accorded the honour. Since 1947, Prof. Thacker has been the head of the Department of Power Engineering in the institute. He represented India at the International Conference on large electricity systems in Paris (1948) and at the Stockholm Conference on large dams.

Dr. M. S. Patel

Dr. M. S. Patel has accepted the post of an Adviser to the Government of Ceylon on industrial projects. He has been asked to report on the proposed cement and fertiliser factories and offer suggestions for improving production of acetic acid, caustic soda and salt.

Rai Bahadur P. B. Das

Rai Bahadur P. B. Das, the Trust Engineer, is the new Chairman of the Nagpur Improvement Trust. Mr. Das has a record of service of 30 years in C.P. and Berar P.W.D.

Dr. H. J. Nichols

Dr. H. J. Nichols, Member for Engineering, Railway Board, retires from service this month.

Rao Bahadur M. K. Ranganathan

Rao Bahadur M. K. Ranganathan, B.A., B.E., M.I.Mech.E., A.I.E.E., has been appointed the Principal of the Madras Institute of Technology, Chromepet. He retired from the Madras P.W.D. recently. He is 57.

WATER ENGINEERING

USE OF THE TERM "COLIFORM"

THE following statement has been issued by the Societies of General Microbiology and Applied Bacteriology :—

The term "coliform" has for some time had an obscure meaning and it has become increasingly clear that a definition is desirable. Those interested in medical and veterinary bacteriology have used it to embrace only the morphological characters of many species, not of Bacterium coli alone but of the dysentery bacteria, the salmonella and other Gram negative rods similar to Bacterium coli. On the other hand, the term "coliform" is restricted by many water and dairy bacteriologists to those organisms which are not only morphologically similar to Bacterium coli but which resemble it in its cultural and biochemical characteristics ; some have even regarded it as being synonymous with Bacterium coli of faecal origin. Because of this confusion, and also because there is now a closer liaison between all those who study bacteria from whatever aspect, a committee of nine representing this variety of interests was appointed by the Society for General Microbiology and by the Society for Applied Bacteriology. This committee met on several occasions and discussed the matter from wide angles, and the relevant portion of their report is herewith appended. It is hoped that it will be given wide publicity and that bacteriologists in general will understand and agree upon the meaning of the term "coliform."

(1) The term "Coliform" means "like Bacterium coli," or "coli-like."

(2) "Coliform" is an adjective and as such has no generic or ecological significance.

(3) It is proposed that the term "Coliform" should refer to Gram negative rods resembling Bacterium coli in morphology and staining reactions but not necessarily in cultural and biochemical characteristics.

(4) That the widest publicity should be given to this definition to prevent the term being employed to define different specific types by different workers, or to restrict the term to particular branches of bacteriology.

The committee are convinced that the proposed definition is the only one satisfactory to all interests in bacteriology and are opposed to any definiton based on ecology or biochemical reactions. Existing systems allow for classification of organisms grouped under the wide term now proposed.

The statement is signed by Reginald Lovell (Society for General Microbiology), Royal Veterinary College, London, N.W.1., and C. B. Taylor (Society for Applied Bacteriology), Butterwick Research Laboratories, Welwyn, Herts.

COLOURED ASPHALTS

Experiments carried out by the Road Research Laboratory (England) have produced asphalt in colours such as cream, yellow, red, green and blue, at a cost not very much greater than that of ordinary asphalt.

The new bright colours are made by using a proprietary brand of resinous binder known as "Cados". It is more translucent than albine bitumen and its cost compares favourably with that of ordinary bitumen. Using this binder and a clean white aggregate such as calcined flint it is possible to obtain a fine white asphalt which can be easily coloured with any desired pigment. The addition of four per cent of titanium oxide, for instance, gives a creamy white. Effective reds and yellows, greens and blues have been made with as little as two per cent of other pigments.

The materials, it is learnt, have not yet been tested under traffic, but a small area in four colours at the Laboratory is giving promising results. Trial areas on roads and foot paths are being planned and the results of large-scale trials on public roads should be available in a few months' time.

THE ENDOWMENT PLAN

An Enquiry into the Comparative Costs of Repayable and "Endowment Plan" Mortgages

* T. A. BAKER, A.C.A.,

Assistant Manager, Leicester Temperance and General Permanent Building Society

Reduced Rate of Income Tax

THE figures we have considered so far have been drafted on the most unlikely assumption that Income Tax will remain at the abnormal rate of 9s. in the £ for the full term of 20 years. We have not yet examined the effect of a reduced rate of taxation on the comparative costs of the two schemes. To do this, schedules have been prepared similar to that shown in Table B, but for lower scales of tax, which prove conclusively that the "endowment plan" mortgage becomes relatively more costly as the rate of Income Tax falls.

The vital question, as far as building societies are concerned, is "How can we 'put over' these fundamental truths to the man-in-the-street, who is neither an accountant nor an actuary?" A statement of average costs over a period of 20 years, as shown in Table A, hides more than it reveals, whereas to present a series of Tables similar to Table B would only tend to bewilder the prospective applicant, who is not likely to relish a feast of figures.

Perhaps a schedule of comparative costs on the lines shown in Table C, which has the advantage of being compact as well as comprehensive, might answer our purpose. Although the figures appearing in this statement are open to the same criticisms as those already levelled against Table A, the margin of error in using quinquennial averages is less, and in any case we have the consolation of knowing that we are deliberately under-stating the case for the repayable mortgage.

TABLE C

Quinquennial Comparative Table for a loan of £1,000 over a period of 20 years.

Average net annual cost of "Endowment Plan" mortgage (E.P.) and repayable mortgage (R.M.) during the:		Assuming Income Tax for the whole period to be at the rate of :				
		9s. in the £	8s. in the £	7s. in the £	6s. in the £	5s. in the £
		£	£	£	£	£
1st to 5th Years	E.P.	61.89	63.89	65.89	67.89	69.89
	R.M.	56.84	58.70	60.56	62.42	64.28
Annual excess cost of	E.P.	5.05	5.19	5.33	5.47	5.61
6th to 10th Years	E.P.	61.89	63.89	65.89	67.89	69.89
	R.M.	60.38	61.85	63.32	64.78	66.25
Annual excess cost of	E.P.	1.51	2.04	2.57	3.11	3.64
11th to 15th Years	E.P.	61.89	63.89	65.89	67.89	69.89
	R.M.	64.70	65.69	66.67	67.66	68.65
Annual excess cost of	E.P.	—2.81	—1.80	— .78	.23	1.24
16th to 20th Years	E.P.	61.89	63.89	65.89	67.89	69.89
	R.M.	69.95	70.35	70.76	71,16	71,56
Annual excess cost of	E.P.	—8.06	—6.46	—4.87	—3.27	—1.67

It will be seen that the average annual cost of the "endowment plan" mortgage does not show up to any advantage until the last 10 years for Income Tax rates ranging from 9s. to 7s. in the £ or until the last five years when the rate of tax falls as low as 6s. in the £.

Our conclusions may, however, be put in a more cogent form, if reference is made to the detailed schedules prepared when compiling Table C :—

If Income Tax for the whole period remains at 9s. in the £, then the "endowment plan" mortgage is the more expensive of the two schemes for the first nine years, by which time an additional £32·86 would have been paid under the scheme. The mortgage would still remain at the original figure of £1,000, but the endowment policy would have acquired a surrender value in the region of £270, whereas under a normal repayable mortgage the debt would have been reduced by no less than £355·39 during the same period.

Similarly for other scales of taxation :—

If Income Tax for the whole period is

8s. 7s. 6s. 5s. in the £ ;

the "endowment plan" mortgage would be the more expensive of the two schemes for the first

10 11 13 15 years ;

by which time the additional amount paid under the scheme would have totalled

£36·15 £40·18 £45·48 £52·46.

The mortgage would still remain

* Continued from *The Building Gazette July Issue*

at the original figure of £1,000, but the endowment policy would have acquired a surrender value in the region of

£313 £359 £461 £579;
whereas a repayable mortgage would have been reduced, during the same period, by
£403'19 £452'9 £558'37 £672'43.

This somewhat novel method of presenting the same figures as those appearing in Table A, has the advantage of disclosing the additional cost of the "endowment plan" mortgage during the earlier years, and what is more important, of stressing the substantial loss that would accrue to the borrower in the event of his discontinuing the scheme at any time before the expiration of the full term of 20 years.

These two points are of vital interest to the prospective borrower, but they are completely hidden when presenting the facts in the manner shown in Table A. Perhaps we ought, therefore, to include yet another fallacy in that Table:—that it presumes the continuance of "endowment plan" mortgage for the full 20 years. This might appear to be quite a rational presumption to make in compiling a statement of comparative costs, but when we consider the high proportion of endowment policies that are normally surrendered before the maturity date, we can readily appreciate that even if the fictitious profit of £21'58 could materialise at the end of 20 years, it would apply to a limited number only of the original borrowers under the scheme.

A rough estimate of the possible loss that the surrender of the endowment policy would entail, may be gathered from Table D in which the total additional cost at the end of 5, 10 and 15 years respectively has been calculated, and for rates of Income Tax of 9s. and 5s. in the £.

It will be seen that in every case the additional cost is quite considerable, but even these figures

TABLE D

Estimate of Total Additional Cost of Endowment Plan Mortgage if Policy is surrendered

	Estimate of total additional cost of "Endowment Plan" mortgage if policy is surrendered		
	At the end of 5 years	At the end of 10 years	At the end of 15 years
	£	£	£
Amount owing on "Endowment Plan" mortgage, *less* surrender value of policy ...	872. 5	687	421
Less amount owing on repayable mortgage ...	818.11	596.81	327.57
	54.39	90.19	93.43
Add total excess cost of E.P. mortgage if Income Tax for whole period is—			
(*a*) 9s. in the £	25.25	32.77	18.72
Total additional cost	79.64	122.96	112.15
(*b*) 5s. in the £	28.04	46.24	52.46
Total additional cost	82.43	136.43	145.89

grossly under-estimate the true loss to the borrower, as interest on the excess annual payments made under the "endowment plan" mortgage has been ignored in the Table for the sake of simplicity. The question as to whether or not interest ought to be charged in the computation might be regarded as a mere technical point which in any case would not appeal to the prospective borrower, but nevertheless, the issue is very real.

For instance, and by way of illustration, let us assume that compound interest at the rate of 4 per cent per annum was brought into charge in respect of the excess annual payments appearing in the last column of Table B. We should then find that the total excess payments for the first 15 years would read £36'39 and not £18.72 as shown in Table D. The total additional cost on surrendering the policy after 15 years, when the tax rate is 9s. in the £, would then read £129'82 instead of £112'15. By deliberately understating the case for the repayable mortgage we can at least escape any genuine criticism that Tables B, C or D have been "dressed" to serve our argument.

In short, we can state quite categorically, as far as the average borrower is concerned, that unless the endowment policy is terminated prematurely by his death, there can be no *real* saving under the "endowment plan" mortgage as compared with the normal building society repayable mortgage. Under all other circumstances any apparent gain under the former scheme is a pure illusion, whereas the substantial loss that would accrue to the borrower if the scheme is arbitrarily discontinued is very real indeed.

The main advantage of the schemes is that the mortgage debt would be automatically discharged if the borrower should die before the normal maturity date of the policy, but it is as well to note that the "endowment plan" mortgage is not the *only* scheme by which this end can be attained, and moreover, I am not prepared to admit that it is necessarily the most desirable, or even the cheapest method of securing this added protection.

(With grateful acknowledgements to *The Building Societies Gazette.*)

HOW WAS SEPTEMBER

For Building

A rainy day is one in which 10 cents or more rain is recorded. The following figures show the average rainfall in inches and the average number of rainy days in the month of September based on data up to 1940:—

	Rainfall in Inches	*Number of Rainy Days*
Agra	4.6	5.6
Ahmedabad	4.2	5.2
Allahabad	8.4	9.5
Ambala	5.1	4.7
Asansol	8.3	10.7
Aurangabad	6.7	9.0
Bangalore	6.7	8.9
Bellary	4.9	7.1
Bhopal	10.4	10.2
Bhuj	1.8	2.2
Bombay	10.4	12.7
Calcutta	9.9	13.2
Cawnpore	6.8	7.3
Chittagong	12.6	13.0
Cochin	7.7	13.7
Colombo	5.7	8.8
Dacca	9.8	12.1
Gaya	7.5	9.3
Hyderabad (Dn.)	6.5	9.5
Jamshedpur	7.1	11.2
Jhansi	5.9	7.0
Jiwani	0	0
Jodhpur	2.4	2.8
Jubbulpore	8.4	9.7
Lahore	2.2	2.3
Madras	4.7	7.0
Mangalore	10.5	15.5
Marmagoa	7.7	14.2
Masulipatam	6.4	9.9
Nagpur	8.0	10.6
New Delhi	4.8	4.6
Patna	8.6	9.2
Peshawar	0.8	1.5
Poona	5.3	7.6
Puri	9.1	12.1
Quetta	0	0.1
Rawalpindi	3.9	4.6
Sambalpur	9.1	11.4
Srinagar	1.5	3.5
Trichinopoly	4.7	6.0
Trincomalee	3.9	5.4
Trivandrum	4.5	8.1
Vizagapatam	6.5	9.1

FOR DISCUSSION

Nowadays the number of meetings addressed by various persons, the number of resolutions passed and the oratory displayed on these occasions are tremendous but if one asked as to what practical steps had been taken to implement the speeches he gets the answer "nothing practical had been done."

* *

Engineers who put up only "administrative shows" become merely "paper" engineers and their presidential addresses reveal the poverty of their engineering experience.

* *

For the first time in the history of Cochin Harbour, a non-engineer is being appointed as its Administrative Officer and he is Mr. G. Venkateswara Aiyer, I.C.S.

* *

In 1764, the Surveyor-General of Bengal was a youth of 21.

* *

The current building practice in Madras is such that a plan flows through the city corporation uninterruptedly if it is drawn by its own staff who is also a private practitioner.

* *

The power to do great things generally arises from the willingness to do small things.

* *

Unless those at the top set the example of having no truck whatever with anti-social elements, and repeatedly make their attitude clear, nothing worth while in the direction of progress will result.

* *

For Money is a bottomless sea in which honour, conscience and truth may be drowned.

PROPOSED NEW WORKS

Bombay.

The foundation-stone is laid recently of the new refugee township at Kalyan, proposed to be named 'Sindhoonagar'. Construction plans have been finalized and the work will start after the monsoons. The township, which is expected to be ready by 1952 will house about 200,000 displaced persons.

Barna.

The Ministry of Works, Mines and Power, Government of India, have started preliminary investigations for the construction of a dam across the Barna, near Bari Village, 56 miles from Bhopal. Barna is a tributory of the Narbada. The project will form part of the Narbada and Tapti Valley multi-purpose development scheme.

Bareilly.

The work in connection with the Hathras drainage scheme is expected to be started in the course of the next two months. The scheme provides for an underground system of drains and the utilization of sewage on an extensive sewage farm of about 300 acres. On the completion of this scheme, Hathras will present a neat and clean appearance. The scheme is estimated to cost Rs. 11 lakhs.

The Bareilly Municipal Board has taken up the question of establishing underground drains in the city. Since the scheme would cost about Rs. 50 lakhs it was totally beyond the means of the Board, hence it has decided to approach the Government to pay half the cost of the scheme, and advance a loan for the remaining half. The Board has also decided to prepare afresh the scheme for water works at Bareilly.

New Delhi.

The Government of India have decided to build a national museum of art, archaeology and anthropology in New Delhi at a cost of about Rs. 1 crore. One of the sites, the Kingsway-Queensway crossing, would be set apart to construct a modern building for the museum.

CONTRACTS OPEN

The dates at head of paragraphs are those for the submission of Tenders. Application for forms and particulars should be made to the address given at the end.

NEW DELHI : Quarters

August 18.—Constructing 612 quarters at Factory Road, New Delhi. Estimated cost Rs. 38,48,868. The Executive Engineer, Construction Division No. 111 C.P.W.D., Room No. 200, P-Block, Raisina Road, New Delhi.

GARHWAL : Road

August 19.—Constructing 7 miles of the Motor Road from Rudraprayag to Guptakashi in Garhwal District. Estimated cost Rs. 8 lakhs. The Assistant Engineer, Planning, P.W.D., Pauri, Garhwal.

MASULIPATAM : Building

August 20.—Construction of a two-storeyed building in the Head Office premises of the Andhra Insurance Co., Ltd. at Masulipatam. The Secretary, Andhra Insurance Co. Ltd. Masulipatam.

BOMBAY : Quarters

August 22.—Constructing 7 Blocks of Type C-1 residential buildings at Khar. Estimated cost Rs. 6,11,880. The Executive Engineer, Housing Suburbs West Division, Andheri, Bombay.

FARUKHABAD : Khattis and Culverts

August 23.—Construction of 50 R.C.C. Grain Khattis and 4 culverts at Farukhabad. Estimated cost Rs. 2,29,000. The Assistant Engineer, P.W.D., B/R, Fatehgarh.

SURI : Canal Excavation

August 23.—Excavating Mor Bakreswar Main and Branch Canals. Estimated cost Rs. 12,45,387. The Executive Engineer, Mor Construction Division No. 11, Suri, Birbhum.

COONDAPUR : Wharf

August 26.—Constructing a reinforced concrete wharf wall at the port of Coondapur, S.K. The Executive Engineer, Special Division, Presidency Port Office, First Line Beach, Madras.

MADRAS : R.C.C. Reservoir

August 26.—Construction of a reinforced concrete overhead tank of 60,000 gallons capacity in Gandhinagar, Adyar. The Commissioner, City Corporation Ripon Buildings, Madras.

BELLARY : Concrete Road

August 29.—Providing cement concrete surface to Nellore-Bombay Road in Bellary Municipality limits. The Divisional Engineer, Highways, Bellary.

BOMBAY : Transit Shed

August 29.—Construction of Transit shed, Alexandra Dock, Bombay, in two parts—Part I Piled Foundations and Part II Steelwork in superstructure. The Chief Engineer, Bombay Port Trust, Ballard Road, Fort Bombay.

POONA : Roads

August 30.—Provision of Roads and Area drainage in S.M.E. Kirkee, Phase III. Estimated cost Rs. 4.25 lakhs. The C.R.I.E., Ghorpuri Barracks (S.M.E.), Poona-1.

MANGALORE : Bridge

September 1.—Constructing a Bowstring girder bridge (5 span of 100 and 2 spans of 30') across Payaswami River at Thekkil at Mile 52/8 of Kalladka-Kanhangad Road. The Divisional Engineer, Highways, Mangalore.

BELGAUM : Culverts

September 1.—Constructing Masonry culverts No. 1 to 8 in the first 8 miles of the Ghataprabha Left Bank Canal. Estimated cost Rs. 2,24,400. The Executive Engineer, Ghataprabha Left Bank Canal Division, Ghataprabha, Belgaum.

COOCH BEHAR : Bridges

September 10.—Constructing road bridges over rivers Kaljani, Gadadhar and Raidak of 500 ft., 250 ft. and 500 ft. lengths respectively in Cooch Behar. The Consulting Engineer, Roads, Ministry of Transport, New Delhi.

RESULTS OF TENDERS

Closed April 19.—Construction of main Filter House for Loco Building Works Project at Mihijam :—*The work has been let out to All-India Labour Supply Corporation of Calcutta.*

Closed April 18.—Aerodrome Terminal Building at Ahmedabad :—*It has since been decided that the construction be deferred for some time.*

Closed April 4.—Service Reservoir at Saraswat Colony, Dharwar:—*The estimated cost of the work put to contract was Rs. 1,25,700. Seven tenders were received out of which D. R. Patravali of Dharwar was the lowest. The total cost of work as quoted by him is Rs. 1,20,605, i.e. about 4 per cent below the estimated cost. The period allowed to complete the work is 9 months.*

Closed March 25.—Cement concreting Trichy-Coimbatore Road :—*Tender of P. Ramaswamy & Co. accepted.*

Closed March 17.—Ten Staff Quarters for the Government Engineering College at Jubbulpore :—*Accepted at 6½ per cent above the current schedule of rates.*

Closed March 17.—Electrical communication block for the Government Engineering College at Jubbulpore :—*Rejected.*

*CURRENT MARKET PRICES OF MATERIALS

1. Prices vary according to quality and quantity ordered.
2. Those given below are average market prices in Madras.
3. Owing to the unsettled state of market most prices are liable to fluctuate.

		Rs.	A.	P.
CONCRETOR				
Portland Cement per bag (Upto 10 bags without permit)		4	11	3
Blue metal ½" gauge	per 100 c. ft.	56	0	0
,, 1½" ,,	,,	40	0	0
River sand	,,	15	0	0
Reinforcement M. S. Rods ⅝" dia.	per cwt.	18	15	0
,, ¾" ,,	,,	19	2	0
,, 1" ,,	,,	20	3	0
,, 1½" ,,	,,	22	11	0
Binding wire 16 gauge per lb.		0	12	0
Sealocrete Concrete Surface dressing per gal.		10	0	0
Pittsburg Reinforcements—Welded Fabric per sq. ft.		0	3	0
	to	0	6	6
BRICKLAYER				
Country bricks 2" G.M.	per 1000	26	0	0
Stock bricks 3" T.S.M.	,,	45	0	0
Shell lime	per 100 c. ft.	62	0	0
ROOFER				
Malabar Tiles	per 1000	185	0	0
Malabar Ridge Tiles	per 100	75	0	0
Terrace bricks	per 1000	14	0	0
Asbestos Corrugated Sheets	per sq. ft.	0	6	11
Asbestos Trafford Sheets	per sq. ft.	0	6	11
G. I. Corrugated sheets 24 gauge	per sq. ft.	0	4	3
CARPENTER				
Burma Teak scantlings	per c. ft.	20	0	0
,, boards	,,	25	0	0
Malabar Teak scantlings	,,	15	0	0
,, boards	,,	18	0	0
Mango planks	,,	4	8	0
Insulation boards ½"	per sq. ft.	0	8	0
Asbestos plain sheets	,,	0	5	1
Wirenails per lb.		0	9	0
Wire-screws ⅜" per gross		1	12	0
,, 1" ,,		2	0	0
,, 1½" ,,		2	4	0
Butt hinges cast brass	per pair	2	12	0
Cast brass Cabin hooks 6"	each	1	4	0
Barrel bolts cast brass	per r.ft.	4	8	0
All drop bolts cast brass	each	11	8	0
Plywood 3 mm.	per sq. ft.	0	4	3
GLAZIER				
Sheet glass 16 oz.	per sq. ft.	0	10	0
,, 3/16"	,,	1	2	0
Plate glass ¼"	,,	4	0	0
Figured glass white per sq. ft.		0	14	0
,, coloured ,,		1	6	0
IRONWORKER				
R.S. Js. 4" x 3"	per cwt.	18	14	0
,, 5" x 3" to 15" x 6"	,,	18	8	0
,, 18" x 6" and over	,,	18	14	0
Channels, angles and tees	,,	19	12	0
M.S. plates	,,	20	0	0
Black sheets 20 gauge	,,	22	10	0
G.I. plain sheets 24 gauge	,,	22	10	0
G.I. barbed wire, 2 ply, 12 gauge	,,	39	4	0
Rivets, flat or round head	,,	75	0	0
Steel Rolling Shutters (up to 120 sq. ft.)	per sq. ft.	5	4	0
PAVIOR				
White glazed tiles (English)	per doz.	6	8	0
,, (Japanese)	,,	4	8	0
Coloured ,, (English)	,,	8	0	0
Marble tiles ⅜" polished white or grey	per sq. ft.	4	0	0
Snowcrete white cement	per cwt.	22	3	0
Colorcrete	,,	29	8	0
Sealantone Liquid flooring green	per gal.	23	0	0
,, red or black	,,	19	0	0
PLUMBER				
Squatting pans, English 18"	each	54	0	0
Pedestal closets without seat	,,	45	0	0
W.W.P. Cisterns, 3 gal. (Elephant brand)	each	44	0	0
Sinks 30" x 18" x 10"	,,	158	0	0
W.H.B. 25" x 18" with waste and one tap	,,	118	0	0
Flat urinals, English	,,	56	0	0
PAINTER				
Himalayan Dry Distemper	per lb.	0	8	9
Turpentine	per gal.	8	8	0
Double-boiled linseed oil	,,	10	8	0
Raw linseed oil	,,	8	8	0
Copal varnish	,,	8	2	0
Black japan	,,	7	8	0
French polish	,,	11	10	0
Karoit Enamels (all colours)	,,	22	2	0
Goodlass wall paints	per lb.	0	10	9
Glue	,,	0	15	6
Putty	,,	0	12	0
Sandpaper	per doz.	1	4	0

* Readers are advised that enquiries addressed to the Journal will gladly be forwarded to the concerned suppliers of materials or equipments.

BOOK REVIEW

A TEXT-BOOK OF REINFORCED CONCRETE —by R. S. Deshpande and G. J. Kulkarni. Price Rs. 19-8-0.

This book is specially written for the needs of Engineering Students and fulfils a long felt need of a text-book. The examples worked out in the book will certainly be helpful to students.

Copies are available from the author at B. V. College of Engineering and Technology, Hubli.

தமிழ்நாடு ஆவணக்காப்பக நூலகம்,
எழும்பூர், சென்னை-600 008.

தவணைத்தாள்.

இசை எண் : 177776 ப. எண் :

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BUILDING TRADES EXHIBITION

ST. MARY'S HALL

JAN. 15TH, 16TH AND 17TH, 1950

MADRAS.

Every section of the Building Trades will be represented at this important Exhibition. It provides a splendid opportunity os getting in touch with the general advancement of the trade.

MODEL HOUSES

The architectural and engineering profession are very cordially invited to submit entries for Model Houses for which the management offer three awards to the competitors placed first, second and third respectively.

FILMS ON HOUSING

Mr. J. A. Borron Economic Adviser to the U.K. Dy. High Commissioner at Madras has kindly consented to exhibit films on Houses and Housing.

For full particulars and schedule of space for exhibits, apply to

THE BUILDING GAZETTE

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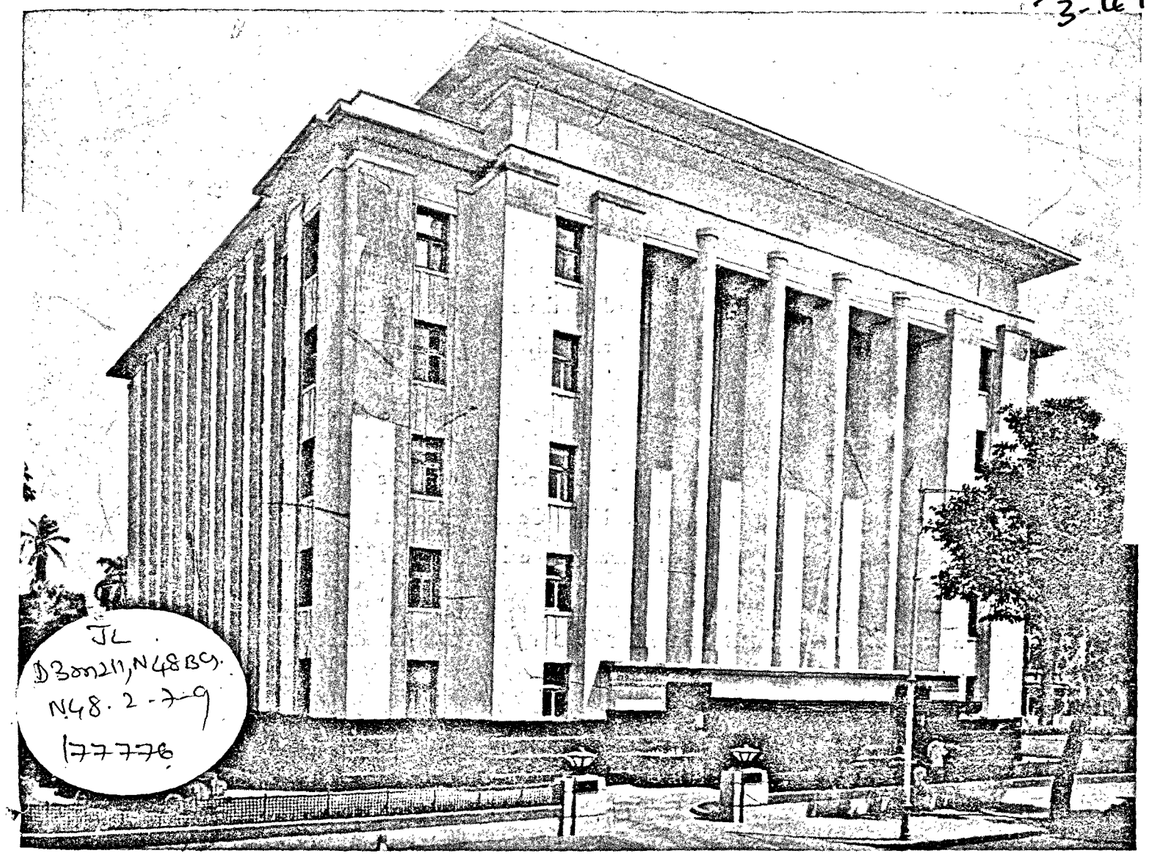

A. C. C. BUILDING AT BOMBAY

(Architects: Ballardie, Thompson and Mathews.)

THE BUILDING GAZETTE

AN INDEPENDENT MONTHLY JOURNAL DEVOTED TO THE INTERESTS OF BUILDING INDUSTRY

VOLUME II SEPTEMBER 15, 1949 NUMBER 9

Articles, photographs, and drawings with a view to publication will be carefully considered. All such articles and illustration should bear the name and address of the sender, and postage should be sent to cover their return if desired in the event of non-acceptance. All communications on Editorial matters should be addressed to the Editor, and all those pertaining to Advertisements to the Manager, THE BUILDING GAZETTE, 1/11, Mukker Nallamuthu Street, G.T., Madras.

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1/11, MUKKER NALLAMUTHU STREET
G.T., MADRAS.

EDITED BY T. N. SUBRAMANIAM
Associate, Faculty of Surveyors of England

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PRINCIPAL CONTENTS

BUYERS' GUIDE

ENGINEERING IN PRACTICE

If the steady stream of official announcements seeking the services of foreign engineering experts means that there are no experts at all in this country, it must be that the President of the Institution of Engineers (India), being the only professional Institution with Royal Charter in this country, has not appreciated the situation.

We make no apology for pointing out the consequences of ignoring the local talent and the laxity in mobilising the country's technical wealth.

The position of the engineer in the post-independence era is an especially important one; it devolves on him to provide all the material facilities enabling the people as a whole to wrest a satisfactory living from the natural products of the earth, while over and above this, engineering concerns itself with the demands of a high grade social life.

It is not to be imagined that the engineer and the building industry are alone in these aspirations; planning and building, as the first steps to reorganization, bring engineering profession to the fore-front.

The Institution of Engineers must have a list of engineers who are distinguished specialists in different lines and should have already brought the profession nearer the Government. It must meet more often than hitherto and discuss and formulate means to impress upon the Government the worth of collective counsel on every matter of reconstruction scheme. It is significant that instead of examining the usefulness of this Institution on a national basis today's President is keen on setting out an International Organization! Engineering is well-based in all foreign countries including New Zealand and if we are to share with the common progress we must put in order our own national Institution first.

It provides no difficult problem to form a panel of experts drafted out of members of this Institution (with International Experts co-opted) who are experienced in the various branches of construction work now being undertaken by the Government and capable of designing and supervising in liaison with the Government departments. If the advantage of inaugurating such a scheme appears clear-cut, the eventual consequences of failing so to do are equally evident and the President of the Institution would do well, in our opinion, to cease building up a machine which must eventually affect the mother-Institution, with accompanying disadvantages and ill-effects.

NOTES & TOPICS

Pre-fab. for Hospitals.

The Government of India has invited an expert of the British house building firm, Messrs. Reed and Mallik to visit this country and draw up concrete plans for hospitals within the budgeted provision. Rajkumari Amrit Kaur, India's Health Minister, who was recently away from this country, spent three and a half weeks in Britain studying the methods adopted by the British Government to grapple with housing shortage; and it was on her suggestion the Government has invited this expert. Should the negotiations succeed, the firm is likely to set up a factory in this country to manufacture these hospitals. After the needs of hospital expansions are met, the firm's manufacturing capacity would be utilized for constructing houses for refugee townships.

Meanwhile the Government's pre-fab. factory at Nizamuddin, near Delhi is expected to go into production by the first week of November.

Delhi Improvement Trust.

A proposal to have a separate engineering department under the direct control of the Delhi Improvement Trust to avoid delay in the execution of their work, which is at present being conducted by the Central Public Works Department, is under the consideration of the Government of India.

The Improvement Trust authorities, it is gathered, are of opinion that all their schemes, which are executed through the C.P.W.D. are delayed and prove uneconomical. Direct control and supervision of the execution of the various development schemes of the Improvement Trust by itself, it is felt, is likely to speed up operational work in hand, as well as prove economical.

Marine Engineering and Naval Architecture.

To serve on the committee set up by the West Bengal Government to consider details regarding the opening of courses in marine engineering and naval architecture in the Engineering College at Sibpur, Naval Headquarters has deputed Captain R. K. Hodgkins, R.N., Director of Naval Engineering, New Delhi.

Preliminary training is already available in Calcutta in a number of engineering workshops dealing with overall repairs and maintenance of river and ocean craft and with building of small river and ocean-going vessels. But advanced training for the construction of large-ocean-going vessels and for their maintenance is not at present obtainable. The expansion of the Bengal Engineering College as proposed will fulfil the need. Fifty-one candidates have been selected under the Marine Engineering Training Scheme for training in Bombay and Calcutta.

Bricks for Industrialists.

To help industrialists build their factories, the East Punjab Government has earmarked 5½ crores of bricks for distribution among them, it is learnt. The bricks will be sold to the industrialists at controlled rates at Jagadhri, Jullunder, Ludhiana, Panipet, Sonepet, Bahadurgurh and Faridabad.

Location of New Steel Plant.

The three foreign consultants of international repute, appointed by the Government of India to advise them on the location of Government's new steel plant and other technical matters, have unanimously recommended that of the two plants one should be located in the C.P. and the other in Orissa.

They have estimated that the capital cost for each plant of about 600,000-ton capacity will be between Rs. 50 crores and Rs. 60 crores.

They are of the opinion that India's reserves of iron ore, with careful utilization, are more than sufficient for the life of the existing and new steel plant up to 2m-ton capacity.

Recommending that the plant be located in the C.P. and Orissa, the consultants have taken into consideration the advantages and disadvantages of the various sites in the C.P., Orissa, Bihar, West Bengal and Madras. They have, in selecting these sites, confirmed that water-supply will be adequate, they lie in regions where the railway system will be expanded for reasons of public welfare, independently of the demands of the proposed steel plant, and that they possess definite advantages from the point of view of decentralization and strategic importance.

Digvijay Cement

An announcement that the cement plant of Shri Digvijay Cement Co., Ltd., has started work satisfactorily has been made by the directors of the company in their annual report. They, however, remark that the difficulty of transport of raw materials and finished products continues and the future depends "mostly on the availability of adequate transport."

The company's paid-up capital at the end of 1948 stood at Rs. 86,15,625, of which Rs. 76,53,008 were absorbed by fixed capital expenditure. It had an overdraft of Rs. 12,02,160 and cash on hand of Rs. 41,145 while the contingent liability on account of the dividend in arrears on preference shares amounted to Rs. 5,10,000.

Housing of Refugees.

The Rehabilitation Ministry of the Government of India has appointed three committees to go into the details of various questions connected with construction of houses for the refugees. The first committee would submit proposals for pooling and exchanging information and experiences relating to house construction in various parts of the country. The second committee would examine the question of reduction in the cost of building houses by the use of new materials, and fixing the minimum standard of comfort which should be adhered to throughout the country. The third committee would go into the problems relating to finance, agency of construction, technical man-power and the employment of displaced persons on construction work.

Building Code for Madras.

The Expert Panel for the revision of the Building Code for the city of Madras has, it is learnt, completed the revision of the Code prepared by Mr. K. K. Nambiar, Chairman, City Improvement Trust. The Panel has recommended a refresher course for building inspectors of the Madras Corporation. When the Government have approved of the revised draft of the Building Code, by-laws will have to be framed under the City Municipal Act in supersession of the existing by-laws governing building construction.

Underground Railway in Calcutta.

With the return of Dr. B. C. Roy from an inspection of various underground railways in the European capitals, it appears, the project for an underground railway in Calcutta has been shelved. This quiet exit presumably is the result of financial adjustments in New Delhi. But however it hardly requires foreign experts to assess present difficulties of finance or material shortage such as cement and steel. The true remedy would seem to be a proper scale of priorities for schemes, Central and Provincial; but of that there still appears little sign.

Stadia Schemes.

Many must have applauded at the report about New Sports Stadium in Delhi at a cost of Rs. 25 lakhs. There is no quarrel with the scheme as such but only when this Rs. 25 lakhs worth of building materials could be devoted to more human importance. The present stadium in Delhi as elsewhere remains empty most of the year and in Madras the city authorities have not even cared to keep their stadium clean. Housing schemes seem slow to materialise and till it does sports stadia, like cinemas, might tactfully wait.

OCEAN TERMINAL FOR THE "QUEENS."

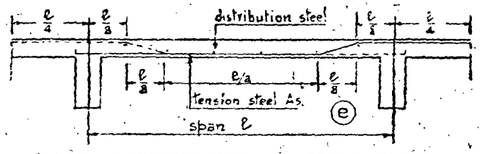
The construction in progress on the new landing pavilion at Southampton for the reception of passengers direct from the ships, under cover to the boat trains. The southern end of the new landing pavilion with the "Queen Mary" lying in the opposite berth.

ESTIMATING DATA FOR CONCRETE FLOORS

By W. SCOTT WILSON

Building projects usually call for several preliminary schemes and estimates before finality is reached. In the preliminary stages, therefore, most designers use short cut methods of calculating the quantities from which an approximate estimate of cost is obtained.

Consider a structure of several floors in which the column centres are 24 ft. by 24 ft., the live load being 200 lb. per sq. ft. Such an internal floor panel would have main beams 28 in. × 12 in. spanning 24 ft. and supporting secondary beams 22 in. × 8 in. at third points. The slab spans would then be 24/3 or 8 ft.

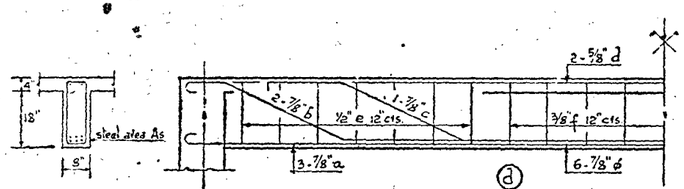


SLAB REINFORCEMENT : UNIFORM LOAD

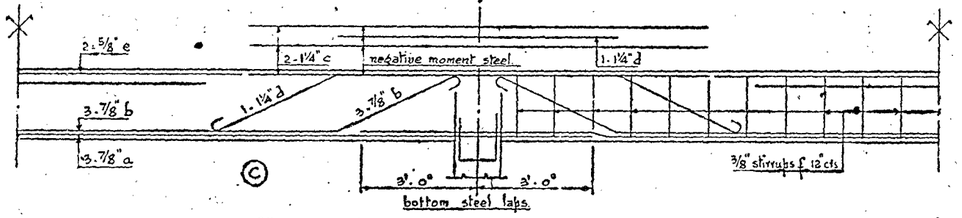
F.S. freely supported
C.O.E. continuous one end
C.B.E. continuous both ends

SLABS WITH UNIFORM SUPERLOAD.		
end condition	weight factor	steely wt. per sq yd
F.S.	42·0	As × 42
C.O.E.	46·0	As × 46
C.B.E.	50·0	As × 50

SEC. BEAMS WITH UNIFORM SUPERLOAD.		
end condition	weight factor	steel wt per foot.
F.S.	5·0	As × 5·0
C.O.E.	5·75	As × 5·75
C.B.E.	6·50	As × 6·50

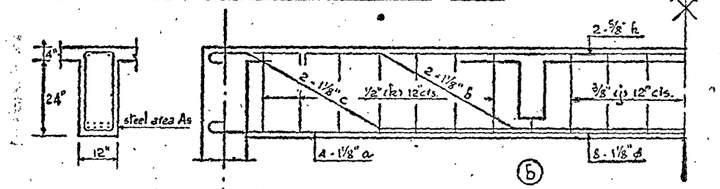


SECONDARY BEAM : UNIFORM LOAD OF 23 TONS : C.O.E.

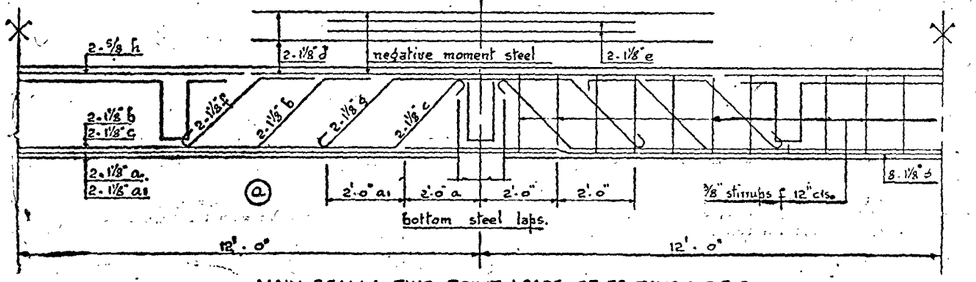


SECONDARY BEAM : UNIFORM LOAD OF 23 TONS : C.B.E.

MAIN BEAMS WITH LOADS AT THIRD POINTS.		
end condition	weight factor.	steel wt per foot.
F.S.	4·5	As × 4·5
C.O.E.	5·25	As × 5·25
C.B.E.	6·0	As × 6·0



MAIN BEAM : TWO POINT LOADS OF 23 TONS. C.O.E.



MAIN BEAM : TWO POINT LOADS OF 23 TONS : C.B.E.

Floor Slabs.

A good guide for the depth of a floor slab is : depth of slab in inches = half the span in feet. In this case therefore, depth of slab = 8/2 = 4 in.
Live load = 200 lb. per sq. ft.
dead load slab = 4 × 12 = 48 lb. per sq. ft.
design for 248 lb. per sq. ft.
Moment M = 248 × 8² × 12/12 = 15,800 in. lb.
steel area As = 15,800/18,000 × 2.83 = 0.31 sq. in.
and ratio r = 0.31/12 × 3.25 = 0.008
Use ⅜ in. dia. bars at 4 in. crs = 0.33 sq. in.
Adopting the arrangement of steel reinforcement for slabs shown on Fig. 1e, we have :—
Area of slab panel = 24 × 8/9 = 21.3 sq. yd.
Steel weight per slab panel = 348 lb.
Weight of steel per sq. yd. = 348/21.3 = 16.3 lb.
Weight factor in terms of steel area As : 16.3/0.33 = 50
Then, concrete = 48 × 9/144 = 3 cub. ft. per sq. yd.
and steel = 0.33 × 50 = 16.3 lb. per. sq. yd.

Secondary Beams ; Section 22 in. × 8 in. ; Span 24 ft.

Load from slab = 24 × 8 × 248 = 47,500 lb.
dead load beam = 24 × 1.0 × 144 = 3,450 lb.
Total load = 50,950 lb.
= 23 tons.
moment M = 23 × 24/12 = 46 ft. tons.
steel area As = 46/8 × 1.5 = 3.8 sq. in.
Breadth of slab in compression :
d = (4 × 12) × 8 = 56 in.
ratio r = 3.8/56 × 20 = 0.0034
ratio d1/d = 4/20 = 0.2
and from these conditions max. compressive stress :
c = 470 lb. per sq. in.
total shear S = 23/2 = 11.5 tons
unit shear s = 11.5 × 2240/18 × 8 = 180 lb. per sq. in.
value of concrete rib in shear :
18 × 8 × 75/2240 = 5 tons
distance of critical section from mid-span :
12 × 5/11.5 = 5 ft. 3 in.

1st panel	shear	= 11 tons
3 diag. ⅞ in. = 1.8 × 8 × 18/40	=	6.5 tons
diag. concrete	=	6.5 tons
⅜ in. stirrups = 0.22 × 8 × 18/12	=	2.6 tons
shear resistance provided	=	15.6 tons
2nd panel shear	=	8.0 tons
1 diag. 1¼ in. = 1.23 × 8 × 18/40	=	4.5 tons
diag. concrete	=	4.5 tons
⅜ in. stirrups = 0.22 × 8 × 18/12	=	2.6 tons
shear resistance provided	=	11.6 tons

Reinforcement for secondary beams as shown on Fig. 1C.
The above calculation has been worked out in detail in order to obtain a typical arrangement of steel reinforcement upon which the steel weight factor depends.
Note that at the estimating stage it is only necessary to :
(1) find the bending moment M.
(2) Find the steel area As.
(3) Check the max. compressive stress.
(4) see that the unit shear does not exceed 200 lb. per sq. in.

From these considerations the unit quantities of steel, concrete and shuttering required for estimating purposes can be obtained.
Total weight of steel as arranged in secondary beams shown on Fig. 1C (C.B.E.) = 567 lb.
Weight of steel per ft. run. = 567/24 = 23.6 lb.
Weight factor in terms of steel area As :
= 23.6/3.6 = 6.5
Weight factors for other end conditions are given in the table, Fig. 1.

Main beams; Section 28 in. × 12 in. ; Span 24 ft.

Loading : two concentrated loads of 23 tons at third points = 46 tons

dead load beam	= 24 × 2 × 144/2240 =	3 tons
moment M1	= 2/3 (23 × 8) =	123 ft. tons
moment M2	= 3 × 24/12 =	6 ft. tons
moment M	= M1 + M2 =	129 ft. tons
steel area As	= 129/8 × 2 =	8 sq. in.
breadth of slab in compression :		
b	= (4 × 12) + 12 =	60 in.
ratio r	= 8/60 × 24 =	0.0055
ratio d1/d	= 4/25 =	0.16

and from these conditions compressive stress
c = 770 lb. per sq. in.
which may be permitted.
Total shear S = 23 + 1.5 = 24.5 tons.
unit shear s = 24.5 × 2,240/24 × 12
= 190 lb. per sq. in.

max. shear		= 24.5 tons
2 diag. 1⅛ in.	= 2 × 8 × 24/32 =	12 ,,
diag. concrete		= 12 ,,
⅜ in. stirrups	= 0.22 × 8 × 24/12 =	3.5 ,,
shear resistance provided		= 27.5 tons.

Reinforcement for main beams as shown on Fig. 1a.
Total weight of steel in main beams (C.B.E.) = 1,146 lb.
Weight of steel per ft. run 1,46/24 = 48 lb.
Weight factor in terms of steel area As :—
= 48/8 = 6.0
Weight factors for other end conditions are given in the table, Fig. 1.

EXAMPLE OF ESTIMATE CALCULATIONS.

Estimate the total quantities of concrete steel and shuttering required for the construction of two floors in a building 100 ft. long by 48 ft. wide if the live load is 100 lb. per sq. ft.
Adopting panels 20 ft. × 24 ft. we have main beams 24 in. × 9 in. spanning 24 ft. and supporting secondary beams 16 in. × 6 in. at third points. Slab spans would be 24/3 = 8 ft.

Floor Slabs, 4 in thick.

live load = 100 lb.
dead load slab = 12 × 4 = 48 lb.
design for = 150 lb. per sq. ft.
moment M = 150 × 8² × 12/12 = 9,600 in. lb.
steel area As = 9,600/18,000 × 2.83 = 0.19 sq. in.
use ⅜ in. bars at 7 in. crs. = 0.19 sq. in.
Unit quantities :
Concrete = 48 × 9/144 = 3 cub. ft. per sq. yd.
Steel = 0.19 × 50 = 9.5 lb. per sq. yd.

Secondary Beams ; Section 16 in. × 6 in. ; Span 20 ft.

Design for a load of :—
20 × 8 × 150/2,240 = 10.7 tons.
moment M = 10.7 × 20/12 = 18 ft./tons.
steel area As = 18/8 × 1.0 = 2.25 sq. in.
Use 4 bars ⅞-in. diam. = 2.4 sq. in.
unit shear s. = 5.35 × 2,240/12 × 6 = 167 lb. per sq. in.
Unit quantities :
Concrete = 1.0 × 0.5 = 0.5 cub. ft. per ft.
Steel = 2.4 × 6.5 = 15.5 lb. per ft.
Shuttering = (12 in. + 12 in. + 6 in.) = 2.5 sq. ft. per ft.

Main Beams ; Section 24 in. × 9 in. ; Span 24 ft. 0 in.

design for two point loads of 10 tons at third points.
moment M = ⅔ (10 × 8) = 54 ft. tons.
steel area As = 54/8 × 1.5 = 4.5 sq. in.
Use 6 bars 1 in. diam. = 4.7 sq. in.
unit shear s = 10 × 2,240/18 × 9 = 138 lb. per sq. in.
Unit quantities :
Concrete = 1.67 × 075 = 1.25 cub. ft. per ft.
steel = 4.7 × 6.0 = 28.2 lb. per ft.
shuttering = (20 in. + 20 in. + 9 in.) = 4 sq. ft. per ft.
Floor slabs : total area = 2 × 100 × 48/9 = 1,070 sq. yd.
Sec. beams : total length = 2 × 100 × 7 = 1,400 lin. ft.
Main beams : total length = 2 × 48 × 6 = 576 lin. ft.

QUANTITIES

	Concrete cub. ft.	Steel lb.	Shuttering, sq. ft.
Floor slabs :			
1,070 × 3 ...	3,210		
1,070 × 9.5 ...		10,165	
1,070 × 1.0 ...			1,070
Secondary beams :			
1,400 × 0.5 ...	700		
1,400 × 15.5 ...		21,700	
1,400 × 2.5 ...			3,500
Main beams :			
576 × 1.25 ...	720		
576 × 28.2 ...		16,240	
576 × 4.0 ...			2,304

TOTAL QUANTITIES :
Concrete = 172 cub. yd.
Steel = 21.5 tons
Shuttering = 770 sq. yd.
And from these figures an estimate of cost can be obtained.

CORRECT POSITIONING OF CONCRETE REINFORCEMENT

THOMAS J. BRAY, M.I.Struct.E., M.Inst.B.E., M.A.M.C.I.

(Chief Engineer, The British Steel Reinforcement Company, Ltd., London.)

When considering any reinforced concrete member, whether it be a slab, wall, beam or column, the strength of such a member is obtained by calculating the moments of the stresses about its neutral axis. As all tension stresses are resisted by the steel reinforcement these stresses are concentrated on a relatively narrow plane. Any variation in the distance of this plane from the neutral axis will cause considerable variation in the strength of the member. Such strength will obviously increase, the farther the steel is from the neutral axis. The reinforcement cannot approach too near the surface of the member, however, as it must be surrounded by sufficient concrete to protect it from attack by external influences. Further, as the stress in the bars is transmitted to them by the bond or adhesion between the steel and the surrounding concrete, there must be sufficient concrete around all sides of the bars to enable this bond stress to be developed.

It can be seen, therefore, that the correct position of the reinforcement is of paramount importance in reinforced concrete construction. In order that the positions of the reinforcing bars may be accurately determined so as to provide maximum strength for the member under all considerations, the following clause is almost universal in current Specifications and Codes of Practice for Reinforced Concrete: "*Cover to Bars*: The cover of constructional concrete measured from the outside of *all* reinforcing bars must be ½ in. or the diameter of the bar, *whichever is the greater*. For the main reinforcing bars in beams and columns, such cover must be 1 in. or the diameter of the bar, *whichever is the greater*."

It is obvious, therefore, that, for correct positioning of the reinforcement, the concrete cover must vary with the differing bar diameters. Thus. in slabs, for a ½ in. or lesser diameter of bar the concrete cover must be ½ in., for a ⅝ in. diameter bar, it must be ⅝ in., for a ¾ in. diameter bar, it must be ¾ in., and so on.

The engineer designing his reinforcement can, and does, allow accurately for this varying cover in his design and always takes it into account when determining the effective depth of a member. The contractor, however, is faced with a much greater problem in actually providing this varying cover on the site. This will be realised more fully if the present primitive methods are considered.

For the support of bottom bars in a slab, the usual method is to slip small pieces of aggregate or concrete under the bars. These small pieces of concrete, which very often break or slip out from under the bars are usually obtained by casting a thin slab usually about ¾ in. thick, and breaking it into small pieces. This entails considerable waste and usually means that the one thickness of these pieces is used for all diameters of bars, otherwise the contractor would have to cast slabs of different thicknesses, ½ in., ⅝ in., ¾ in., etc., and choose the correct thickness for each different diameter of bar. This, of course, is seldom done. If the contractor could afford to take the necessary steps to achieve this, the men on the job could not be relied upon to measure, sort out and use the correct pieces in all cases.

The support of the bars in the top of a slab presents an even greater problem. Here the cover is measured from the top surface of the slab which, at the time of fixing the reinforcement, is only an "imaginary plane". Any form of support must be made from the shuttering or blinding to the underside of the slab. For a range of bar diameters from ½ in. to ¾ in. the distance from the bottom of the slab to the underside of the bar has a variation range of ¾ in. in steps of ⅛ in. for each different slab thickness. To obtain correct cover to the top bars by the usual methods would, therefore, entail a large range of different sizes of supports in order to cover the various combinations of slab thickness and bar diameters. The usual method is to strike an average and cast concrete blocks about 3 ins. square and of a height about 1 in. or 1½ ins. less than the slab thickness and to use these blocks for all diameters of bars. Such blocks are unstable, expensive to produce and are very heavy and bulky to handle on site. To cast them into the concrete is a bad practice and wasteful, but to remove them as the concreting proceeds allows the reinforcement to sink down through the concrete. Other alternative methods of supporting bars in the top of a slab consist of bending down the ends of bars or making "chairs" or "stools" from small diameter bars. Neither of these methods is sufficiently accurate and the small diameter bars for the stools or chairs are extremely difficult to obtain. Both methods are expensive.

The positioning of the vertical reinforcement in walls, columns and deep beams receives practically no attention on site. It is usually left to the concretor to see that the bars are pushed or pulled during concreting into what *appears to be* their correct position. In a few cases small concrete blocks are cast with protruding wires to enable them to be tied to the reinforcement, but they are extremely expensive to produce.

Having considered, criticised and condemned all existing methods of supporting reinforcing bars, the author decided to endeavour to improve the position. Three main requirements had to be met to produce the ideal form of support:—

(a) They must be so cheap that it would actually pay a contractor to use them in preference to his present primitive and inaccurate methods.

(b) They must be capable of being produced easily in large numbers from materials readily obtainable, and must be applicable to all types and conditions of reinforcement.

(c) They must effectively support the bars in their correct position and automatically regulate the cover according to the diameter of the bar.

After much experimenting, a series of Supports and Spacers was evolved, four types of which are shown below:—

All these supports are pressed from sheet steel and, due to the narrow widths, they can be made from off-cuts which would otherwise be wasted. The basis of the design of all types is the specially shaped slot which automatically adjusts the cover to suit the different bar diameters. Thus if ½ in. minimum cover is specified, the appropriate type will provide this cover for ½ in. bars and all bars and fabric below this size but will automatically increase the cover to ¾ in. for ¾ in. diameter bars, and so on. Thus, neither the contractor nor the man on the site need worry any more about varying bar diameters.

The four types shown cover practically all the conditions which are likely to occur in all average reinforced concrete work.

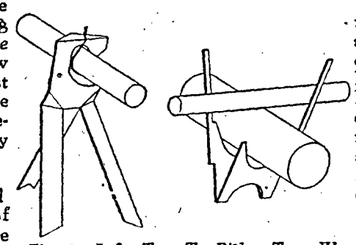


Fig. 1. Left: Type T. Right: Type W.

For supporting the bars in the bottom of a slab or beam, Type B (Fig. 2) is generally used. In use it is slipped under the bar, which rests in the slot provided, and prevents the support slipping out from beneath it. Two sizes are available, the smaller, generally for slabs, takes bars up to ⅞ in. diameter and gives a cover of ½ in. or the diameter of the bar, and the larger, generally for beams, takes bars up to 1½ in. diameter and gives a cover of 1 in. or the diameter of the bar, whichever is the greater. If for special reasons ¾ in. minimum cover is specified, the smaller type can be inverted whilst if 1½ in. cover is specified, the large type can be inverted to give this.

In cases where the reinforcement is prefabricated into mats as is done for multiple repetition bays as for Chicago Flat Slab design, it is a great advantage to have the supports fixed to the mats by the steel-fixer during fabrication. This achieves two objects: the mat can be placed in position all ready for concreting without further adjustment and the presence of the spacers will prevent its being placed upside-down. For such cases Supports Type W (Fig. 1) are used.

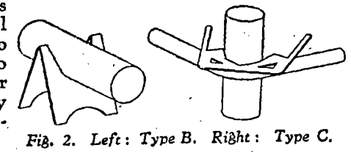


Fig. 2. Left: Type B. Right: Type C.

This type is similar to Type B inverted and is made in the same two sizes but is provided with two extended thongs on diagonally opposite legs for fixing. In use this type is placed over a main bar at its junction, with a secondary or distribution bar and with one leg on each side of this secondary bar. The two thongs are now easily bent by finger pressure round this bar, the support is securely fixed to the reinforcement and automatically regulates the cover to the main bars. As this type of support ties the main and secondary bars together, the usual wire ties can be omitted at all intersections at which these supports occur.

This type of support is also used for determining and maintaining the concrete cover to the vertical reinforcement in walls. The reinforcement, of course, must be prevented from moving away from the shuttering and this can be achieved by tying in the usual way through the shutters or by means of struts. A simple form of universal strut is available which has specially shaped ends so that one end can be placed against any horizontal or vertical bar and the other end strutted against the reinforcement or the shuttering on the opposite face of the wall.

For supporting the reinforcing bars in the top of a slab, Supports Type T (Fig. 1) are used. Different sizes are available for slab thicknesses from 5 in. to 12 in. in multiples of ½ in. All sizes are suitable for bars from ¾ in. diameter down to the lightest fabric and all automatically regulate the concrete cover, measured from the top of the slab, to ½ in. or the diameter of the bar, whichever is the greater. In use, the slot in the support is placed over a main reinforcing bar, a piece of tying wire is passed round the bar and the top of the support and the two are securely tied together in the usual manner. If 1 in. (or 1½ in.) is required, this can be obtained for bars of ½ in. diameter or less, by using the size for a slab ½ in.

(or 1 in.) less than the actual thickness.

For columns and beams the main bars are positioned relative to one another by the links or stirrups, the problem being to maintain the position of the reinforcement cage relative to the shuttering. For this purpose spacers Type C (Fig. 2) are used. In a column these are placed on a diagonal line around the main corner bars and just above a link, securely fixing the spacer to the reinforcement. If the spacers are fixed during fabrication, the reinforcement cage can then be placed in the shuttering and is automatically positioned without further adjustment. In order to allow for slight discrepancies in the dimensions of the links and/or shutters, $\frac{3}{8}$ in. tolerance is provided in these spacers. Two sizes are available giving $1\frac{1}{2}$ in. cover as required in the London County Council area, or 1 in. cover or the diameter of the bar, whichever is the greater. This type can also be used for maintaining the horizontal position of the reinforcement cage at the bottom of beams and is fixed in the same way as described for columns. For maintaining the horizontal position of the beam cage at the top of the beam, the Type W support can be used as for wall reinforcement if a longitudinal bar is provided just below the level of the slab soffit.

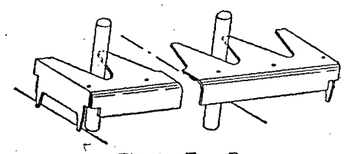


Fig. 3. Type R.

If such a bar is not provided, an alternative support Type R (Fig. 3) is used. This type differs from those previously described as it is not cast into the concrete and may be re-used many times. This type, illustrated above, has tapered slots along one edge and small spikes at each end for temporarily fixing it to the slab shuttering. The slots are so arranged that when the spacer is placed across the beam shuttering and pushed against one of the links, the opposing sides of two slots will always grip the link irrespective of its diameter or the width of the beam or link. Once the spacer is located and the link centred, the end spikes are tapped into the slab shuttering thus securely fixing the links in position. When the concrete is placed up to the level of the underside of the slab, a claw hammer is placed under the ends of the spacer to remove it.

With the exception of Type R. which is not cast in, all these spacers or supports make only line, or point, contact with the shuttering and are therefore invisible on the finished concrete surface. Where the concrete is to be plastered, painted or otherwise treated, no rust-proofing of the supports and spacers is necessary. Where the concrete surface is left untreated, however, rust-proofing of the spacers is advisable.

The spacing of such supports and spacers as have just been described will be governed largely by conditions on site. For slabs and walls with average conditions of reinforcement a spacing of 4 ft. 6 ins. in each direction is suggested. Light fabric, being very flexible, would probably necessitate closer spacing, as also would very heavy reinforcement, particularly in the case of Type T Supports. Movement of men and barrows over the reinforcement is usually prohibited, but where this is permitted over top bars in slabs, these supports would be closer spaced.

For columns it is suggested that Type C spacers should be placed at 1 ft. intervals and placed on each corner alternatively, i.e. at 4 ft. intervals on each corner. Where Type C spacers are used in beams, they should be used at 2 ft. intervals and placed on each side alternatively, i.e., at 4 ft. intervals on each side.

The use of the types of spacers described above not only solves the problems of concrete cover but is extremely economical. The smaller sizes of Types B and W cost approximately $\frac{1}{2}d.$ each, or $\frac{1}{4}d.$ per square yard of wall or slab, if used at the recommended spacing. Type C spacers cost approximately $\frac{1}{2}d.$ each or $\frac{1}{3}d.$ per foot of column or $\frac{1}{4}d.$ per foot of beam. These figures show a cost well below that of the inferior methods hitherto adopted. The material used is negligible, as one pound of supports Type B or W will cover approximately 100 square yards of slab.

The use of such spacers as have just been described will enable the reinforced concrete designer to specify his cover as usual and be quite confident that every bar will be in its correct position relative to the shuttering.

(With acknowledgements to "*Machinery Lloyd*").

PRE-STRESSED CONCRETE

A number of members of the Pre-stressed Concrete Development Group attended a congress on prestressed concrete organized by the Association Scientifique de la Precontrainte (A.S.P.) in Paris early in July. The administration of A.S.P. is at the moment being undertaken by the Institute Technique du Batiment et des Travaux Publiques (Technical Institute of Building and Public Works) and it hopes to co-operate with similar bodies outside France.

At the recent congress visits to pre-stressing work carried out in France were arranged under the guidance of the engineers responsible—notably Freyssinet, Lossier and Chalos—followed by free discussion.

* * *

C. P. CEMENT FACTORY TO BE WOUND UP.

The Directors of the New Hindustan Cements Ltd., have announced their decision to recommend to the shareholders of the company that it may be voluntarily wound up. The Company, incorporated over two years ago, had planned to set up a factory at Wun near Wardha. Its authorised capital was Rs. 2 crores, issued capital Rs. 1 crore, and subscribed and called up capital about Rs. 49,00,000. "Owing to the stringent money market conditions it has not been possible to raise further capital sufficient for the completion of the scheme," the announcement stated.

THE USE OF COPPER AND GALVANIZED STEEL IN THE SAME HOT WATER SYSTEM

The following are abstract of notes received from the Building Research Station of England.*

Hot water for domestic use is commonly provided by systems such as that shown diagrammatically in Fig. 1, in which the water is heated by an independent boiler or a back boiler and stored in a cylinder or tank. Various materials have been used successfully for the tanks, cylinders and pipes, the commonest being copper and galvanized steel for tanks and cylinders, and copper, galvanized steel, lead and lead alloys for piping.

Hot water tanks and cylinders of galvanized steel have in general shown satisfactory durability, but towards the end of the 1930's a number of failures of such tanks after short periods of use were being reported. The failures were not numerous considering the number of galvanized steel cylinders and tanks in use, but were found with unusual frequency in certain areas of the country.

Investigation of these failures by the British Non-Ferrous Metals Research Association led to some interesting conclusions. It was found that the failures occurred in such numbers in the same locality that they could not be attributed to faults in manufacture, damage in transit or defects in installation. In one locality of about 1,000 installations on an estate fitted with copper pipes, 50 per cent of the installations had failed in four years; whereas on another estate of 50 houses (fitted with galvanized steel pipes) no failures had occurred six years after the houses had been erected.

This and other similar observations led to the conclusion that the failures occurred in certain areas of the country when copper pipes were used in association with galvanized steel tanks. Moreover, the failures could not be ascribed to ordinary defects of manufacture or installation, such as defective galvanizing, to the presence of filings or borings left in the tanks by workmen, or to excessive softening of the water supply. It was also found that the cold water storage cisterns in the "areas of failure" gave satisfactory service.

Laboratory experiments simulating practical conditions were carried out by the British Non-Ferrous Metals Research Association, with the object of finding the cause and method of failure of the tanks in these "mixed metal" water systems.

The action was found to be as follows: Certain types of water, as supplied in the "areas of failure," are capable of dissolving minute amounts of copper from the pipes of a hot water system, though the loss in weight of the pipes would be very difficult to detect and the life of the pipes is not thereby impaired. When the water containing the copper comes into contact with the galvanizing of the tank, some of the copper is deposited on the zinc and an equivalent amount of zinc is dissolved. The copper tends to be deposited in small particles, and at these points electrolytic action between the adjacent copper and zinc causes rapid attack on the zinc coating, and its ultimate perforation. Rusting of the unprotected steel then proceeds and before long the tank leaks. The mode of attack is shown diagrammatically in Fig. 2.

The most significant feature of this action is the very small amount of copper which suffices to start it. Even one part in ten million in the water has been found to lead to serious attack.

In practice, the rate at which the action proceeds is determined by a number of factors, the most important of which is the ability of the water to dissolve copper. This is dependent on the composition of the water, mainly with regard to the content of carbon dioxide and the temporary hardness. Increase in carbon dioxide content increases cupro-solvency, while increase in temporary hardness tends to decrease it. Unless, however, a high temporary hardness is accompanied by very low carbon dioxide, a pitting type of attack may develop.

Scale formation in pipe line and tank (which occurs with hard water) may have a protective effect. However, it would appear that such scale needs to be formed fairly early to be effective in reducing attack; and that if the scale is not uniformly adherent over the surface of a tank or cylinder it may tend to concentrate the attack at bare places. To reduce hardness by the use of water softeners may slow up or stop scale formation and it is thus desirable, if a mixed system is used, not to carry the softening process too far.

An important local factor is the temperature of the water, because cupro-solvency increases with temperature. The temperature of the hot water in a system is partly dependent on the relative sizes of boiler and hot storage tank but it also depends (to some extent) on the rate at which the householder heats his boiler. In a mixed system it would be advisable, therefore, not to heat too vigorously—especially in the early life of the installation before a protective scale has

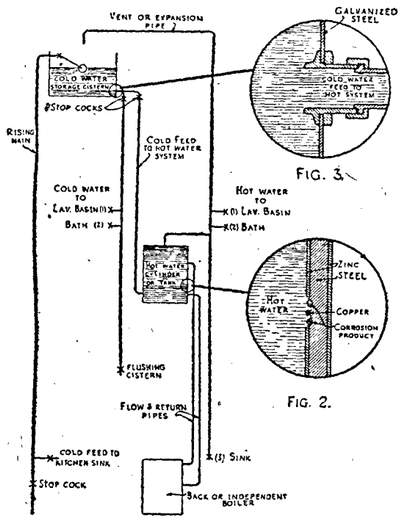


FIG. 1.

FIG. 3.

FIG. 2.

been given an opportunity to form. Scale formation is probably the reason why some galvanized tanks have been found to give satisfactory service in areas when many other tanks have failed.

Two materials used for domestic boilers are cast iron and copper. It may often be quite satisfactory to use cast iron boilers in conjunction with copper pipes and copper hot water tanks, but on the whole it is preferable to avoid this, as it constitutes a "mixed system." Boilers made of copper are commonly fitted in soft water areas (where cupro-solvency appears most likely to occur) and their use would be expected to give larger amounts of copper in solution, thus accelerating attack on any galvanized steel incorporated in the system.

There seems to be some evidence for regarding it as unwise to use copper for cold water rising mains and down feeds to hot water systems when the hot water tank and/or distributing pipework are of galvanized steel.

In general, the hot water system should be constructed throughout of copper (with copper boilers) or throughout of galvanized steel (with cast iron boilers) unless previous experience in the district shows it to be safe to use these materials together. The choice between copper and galvanized steel should be based on the nature of the water supply and, in particular, on the experience of the local supply authority. It should be noted, however, that an all-copper system is, in general, preferable to an all-galvanized system from the standpoint of resistance to corrosion.

Failures of galvanized steel cold water cisterns with copper pipes are rare, and these failures have been related to the effects of hot copper-bearing water being introduced by splashes from vent pipes or by expansion via the feed pipe. As precautions, the expansion pipe should not discharge against the side of the cistern and the draw-off for cold water feed to the hot water tank or cylinder should project slightly into the cistern (see Fig. 3). If there is any doubt about the cold cistern a paint treatment with a non-water-tainting bituminous paint should prevent trouble.

PERSONAL

Mr. P. H. Kutar

Mr. P. H. Kutar has been appointed General Manager of Tata Iron & Steel Co. Ltd., Jamshedpur.

Mr. Y. N. Sukthankar

Mr. Y. N. Sukthankar, Secretary at the Transport Ministry, New Delhi, is representing India at the Conference of 40 nations at Geneva to draft a new world road charter to simplify travel. The conference, expected to last a month, will be highly technical and its agenda includes creating a universal system of road signs and standardisation of commercial and touring formalities.

Mr. Bengt Ostnas

Mr. Bengt Ostnas, Norwegian Engineer and Town Planning Expert, has been engaged by the Pakistan Government, for the planning of her Federal Capital.

Mr. K. P. Mushran

Mr. K. P. Mushran, Director, Establishment, Railway Board, has been appointed to succeed Mr. N. S. Sen as the General Manager of the B.B. & C. I. Railway.

Sir Alexander Gibbs & Partners

Sir Alexander Gibbs & Partners, the firm, who built the Sydney and Singapore Dockyards, have been engaged by the Government of India to submit blue-prints for modernising Bombay docks.

Prof. H. Muller

Prof. H. Muller, the 54-year-old German Scientist, has taken over charge as Professor of High Tension Engineering at the Indian Institute of Science, Bangalore. He was previously Professor of Electrical Engineering in the Braunscheweig Technical University, North Germany.

OBITUARY

Mr. P. Venkatasubba Rao

We regret to record the death of Mr. P. Venkatasubba Rao, B.A., B.E., Executive Engineer, Buckingham Canal Division, on 28th August at the General Hospital, Madras.

USE OF RUBBER LATEX FOR BUILDING

CEMENT MIXTURE INNOVATION

The use of rubber latex in the preparation of materials for the building industry by mixing it with cement is not only new to the rubber industry, but to the building trade, stated F. G. Mottershaw, M.C., Managing Director of Semtex, Ltd., in an article prepared for the British Rubber Development Board.

He said:

In building, cement is one of the commonest materials. Its properties of rigidity and incompressibility are known, and it has been said that to introduce rubber into cement can only result in a lowering in value of the special properties of each material, since they are both different in fundamental characteristics. Yet when rubber latex is mixed with hydraulic cement the result is a useful product which has value in fields outside those of either cement or rubber.

Mixing with Cement

The action which takes place when rubber latex is mixed with cement is simple to understand.

Cement will take up water and re-crystallise to form a binder for stone and other hard substances. If water is replaced by an emulsion, the water in the emulsion is taken up by the cement and the substance from which the emulsion is formed is thus dispersed throughout the whole mass. In this way it is possible to confer upon cement some of the properties of the dispersed material, and it has been found that by following this technique properties result from the mixture which are not found either in the cement or in the emulsified material separately.

The mixtures so formed have three basic types of raw material: emulsion, cement and aggregate (filler). A diversity of products can be made up using different types of emulsion in different proportions, and these compounds have developed into a class of materials which are coming to be known as fleximers. They are, in effect, new building materials, since they find commercial application on a large scale in building and other industries. They are used primarily as floor coverings, deck coverings and mortars. They do not, however, constitute load-bearing or structural materials.

Synthetic rubber or resin emulsions have a behaviour similar to that of natural rubber latex except, of course that they convey to the mixture some of the properties inherent in synthetic rubber or resin. For instance, some synthetic rubbers are resistant to oil and by reason of their use the final compound will itself be resistant to oil.

Natural rubber possesses a definite tensile strength and compounds made from it and cement themselves possess quite appreciable strengths. The mixtures are, in fact, stronger than the cement alone; they are also stronger than similar compounds prepared from synthetic rubber latices.

Whichever type of emulsion is used, there is generally, by reason of casein and similar materials employed as stabilisers, some interference with the setting of the cement. This presents a very real problem and steps must be taken to correct such effect on the cement set.

There are two cements in common use, namely, portland cement and aluminous cement (*ciment fondu*). Both cements can be used in the type of mixtures under discussion.

Of the two, aluminous cement is much more useful. It gives the stronger product; it is characterised by a slow initial set and rapid hardening; it contains very little free calcium salts and so in use with rubber latex its coagulating effect is not so great as that of portland cement. Natural rubber latex therefore, does not require to be so heavily stabilised when used with aluminous cement. Setting is affected by rubber latex but can be corrected by adding a little caustic alkali to the latex or a small amount of lime to the cement which acts as a caustic alkali in promoting the set of the cement, and if a small amount only is added it will not generally affect the stability of the latex.

Portland cement, however, has its own advantages. It is cheaper than aluminous cement and is obtainable in lighter colours. It will be understood that the blackness of aluminous cement is a disadvantage in making up coloured products. Portland cement, moreover, is a very cheap and uniform material. There are, therefore, good reasons for using it, although aluminous cement makes stronger products.

If portland cement is used, the latex or emulsion needs extra stabilisation. There exists always some free lime and the fact that this cement is ground more finely than aluminous cement causes it to be a more troublesome material to mix with delicate emulsions. In rubber latex technique the stirring of powders into latex is considered to be very poor practice. It is to be avoided and the stirring of fine powder containing lime, gypsum and other divalent ions necessitates an extra stable latex. Extra stability is gained by using an increased proportion of casein in the emulsion, but, on the other hand, this procedure tends to slow up setting.

In order to compromise on all the abovementioned advantages and disadvantages, mixtures of the two

cements are commonly used. The rate of set is increased and some of the properties of both types of cement are given to the mixtures. Three types of powder may be employed, according to the result desired : (1) portland cement, which is cheap but slow setting, (2) aluminous cement, which gives strong products but is more expensive and black, and (3) a mixture of the two cements, which gives a result which compromises between the two as described. The rubber latex cement mixture can, therefore, be one of three different types, depending on the cement or cement blend used.

Cement Powder as Adhesive

The matrix of cement powder and latex is not usually employed on its own, except, in some cases, as an adhesive. Generally it is mixed with an aggregate or filler to produce a commercial compound. In this way the properties of the mixtures can be modified still further by varying the aggregate or filler. The number of materials which can be so used is very wide. There are, however, about four types of graded filler which find common use. They are sand, crushed granite (or other stone), wood chipping and granulated cork.

Dry and graded sand is used to bulk the mixture only where a really cheap filler is required. It does not give very good properties to the mixture because of its tendency to rub out under traffic. Sand is used in adhesive compositions, grouts, mortars and so on, but it is not used in compositions required to stand up to foot traffic. Crushed granite is a good filler. It gives strength and wear resistance to the composition ; it is cheap and it is easily obtainable. Wood chippings are also useful. The matrix has a good bond to wood and compositions using wood filler possess the toughness usually associated with wood, along with flexibility from the emulsion binder. It is cheap, durable and light in weight. Cork is especially light in weight, as well as being hard wearing, but it makes the compositions soft and easily indented.

It will be understood that with three possible matrices or binders and several different aggregates a variety of mixtures may be produced. All of these compositions can be varied by changing the ratios of the various ingredients, but the desire, on the one hand, for good properties and the commercial possibilities, on the other, generally decide the proportions, and useful compounds fall within fairly close limits in terms of make-up whatever the material used.

The greater the proportion of binder—that is cement/emulsion matrix—the better the final product. The binder is the most expensive ingredient so that commercially it should be kept to a minimum. Common usage brings the content of rubber to between 6 and 15 per cent. by weight of the mix. The amount of cement used is roughly two or three times the amount of rubber latex, and the filler three to four times that of latex.

Since the specific gravities of the materials vary widely (for example, the value for cork is 0.2, but for cement it is 3.0), the proportions by weight may appear to vary a great deal, but the proportions by bulk are not very different from mix to mix.

The preparation of the mixture is merely a matter of bringing together the powders, the liquid, the aggregate and such colour pigments as are desired. In some cases the cements, aggregates and pigments are pre-mixed in the factory or store and are sent in bags to the job. In other cases only the stabilised latex is sent to the site of work, the cement and aggregate being obtained locally and the entire mix proportioned on the job.

Mixing is a cold process and follows exactly that of mixing cement mortar. A hoe and a box can be used or a mixing machine, but in most cases hand mixing is preferable.

Once the two materials have been mixed together the setting action of the cement commences and the compound must be used forthwith. Setting and hardening are controlled by the adding of various agents, either to the cement or to the liquid, and a working time of about half an hour is allowed. At normal temperatures the compositions set in a few hours and can be lightly trafficked the following day. It is usual to allow them one week in order to develop their full strength.

The majority of these products find application as floorings, decking materials, mortars and so on. During the war years there was a big demand for a material which could be applied to the weather-decks of destroyers and other fighting ships to provide a non-slip walking surface. This surface had to stand up to sea water, to the movement of the ship, the flexing of the plates ; it had to be laid thinly so that no top weight was added to the vessel, and finally it had to adhere firmly to the steel deck without deck anchors or other fittings and to protect the steel from corrosion. A composition meeting all the aforementioned requirements, prepared from rubber latex cement and wood chip filler, was widely used.

Application in Building

In the building industry as such the materials find application as floor coverings. Of recent years over half a million yards of this type of flooring have been used in flats, schools, and houses. In general, the emulsion cement matrix used in this work is best compounded with crushed granite or crushed stone, which supplies most of the wearing properties of the material. They are cheap and readily available. Other types of filler have been used, but crushed granite or stone appear to give the best results. Such a floor would be laid at a thickness of ¼ in. on to an approved concrete base. It is laid by craftsmen and a float-finished surface is obtained similar to that obtained by means of the granolithic surfacing technique.

Cement emulsion mixtures not only form floor covering materials but are used as mortars for brick work. As such they have special

(Continued on page 29)

BETTER HOMES AT LOWER COST

British Effort to Overcome Shortages

GORDON CUMMINGS

Vital factors have contributed to the success of Britain's housing programme.

In the four years to the end of June 1949, Britain provided almost 1,000,000 new houses, flats and other forms of family accommodation for her people. This is an achievement which is the more remarkable when account is taken of the many difficulties which have had to be overcome, and the shortages which remain.

When the war ended Britain's housing programme had to be fitted in with many other urgent needs. Labour was needed everywhere, there were urgent calls for industrial building and reconstruction; 750,000 bomb-damaged homes had to be repaired, and there were great shortages of bricks, timber, steel, fittings and other materials.

The First Million

Four years ago it was reckoned that at least 7,50,000 new homes were wanted to cover urgent needs such as complete bomb destruction, overcrowding and essential replacements. Details of how the first 1,000,000 homes were provided show how the challenge has been met. More than half—5,27,000—were new permanent type houses and flats, while 1,57,000 were temporary prefabricated bungalows. In addition, 1,40,000 unoccupied war damaged dwellings had been repaired.

To meet pressing needs a further 1,19,000 homes were provided by covering or adapting large houses into flats and smaller family units. Requisitioning of empty properties gave another 29,000 homes, and the temporary use of empty Service camps and temporary huts added a final 28,000.

Provision of new permanent homes has been accelerated by the development of over 30 types of "non-traditional" houses, made wholly or partially in factories, or by new methods. Down to the end of June more than 1,20,000 of the permanent houses had been provided in this way ; over 15,000 of them were made of aluminium, and slightly more than 30,000 of steel.

Leaving out of account accommodation provided in Service camps and so on, it is reckoned that between April, 1945, and the end of June, 1949, some 9,75,000 families had been rehoused, which represented a very measurable proportion of Britain's 49,000,000 population.

Decisive Criterion

This, however, is only one side of the story. Other vital factors besides speed of building and quantity—have entered into the United Kingdom's post-war housing effort. Personal need and not money is the decisive criterion for securing a house. The great bulk of the new homes are let at rents which the average family can afford to pay—National and local government subsidies help to keep rents at cheap levels. Speculative building has been kept out by licensing all private construction.

The national productive effort is being helped by priority building of houses for coal miners, agricultural workers and key workers in industries taking part in the export drive. Home ownership is not, however, being discouraged ; in fact, local governments have just been given much wider powers to lend money at cheap rates tor buying or building a home.

Improved Types

Planning and design have not been sacrificed to the urgency of the problem. Quality has been maintained at high levels, and many improvements have been made to the house of average pre-war type. Family needs have also been taken into account. In many parts of Britain today there are new housing estates which provide houses of two to four and more bedrooms for different size families, small flats or bungalows for old or single folks, and the facilities—in the way of schools, shops, churches, communal buildings and recreational resources—required by a modern community.

Though many shortages have been overcome and there is sufficient labour for the current programme, there is not enough steel and timber to hope for any early expansion. Almost all Britain's timber has to be imported—shortage of dollars is a restrictive factor here—and steel is urgently wanted for making exportable goods and building new factories, electricity stations and other necessary plant.

A simple comparison in relation to number of rooms only shows that the cost of new permanent houses is about three times pre-war rates. This does not, however, take account of the fact that many of the post-war houses have bigger rooms and are far better equipped. As prices of some materials have fallen recently, and there are signs of increasing productivity, it is believed that costs have touched their peak and may now tend to fall.

(Continued on page 29)

LAW REPORT

Lucknow High Court

Before Mr. Justice L. S. Misra and Mr. Justice S. B. Chandiramani.

The Municipal Board of Lucknow (Defendant—Appellant) *v.* MST. Kallo and another (Plaintiffs—Respondents).

Ruling was given in this case that if a Municipal Board looses its right in any portion of a street by adverse possession for the requisite period that portion ceased to be a street.

Delivering the judgment Misra and Chandiramani JJ. observed that the plaintiff Karim Ullah, now represented by the two respondents MST. Kallo and Hamidullah filed a suit for declaration that a certain portion of land situated in Terhi Bazar, Lashkari Rakabganj, was his property and not that of the defendant, the Municipal Board of Lucknow. It was alleged for the plaintiff that he had bought a plot of land on 23rd September, 1901, from Lal Khan and with the permission of the Municipal Board obtained in 1904 he had made certain constructions thereon; that in 1935 as these constructions had become dilapidated he applied again for permission to make new constructions on the same piece of land; that permission was given to him but in September 1936, the Municipal Board served him with a notice under section 211 of the Municipalities Act calling upon him to demolish the construction he had already made on the disputed portion of the land, alleging that the land was part of a street which belonged to the Municipal Board. He served a notice on the Municipal Board under section 326 of the Municipalities Act and in due course he filed a suit. Several objections were raised by the Municipal Board. One of the objections was that the suit in the Civil Court was not maintainable as the only remedy open to the plaintiff was to go up in appeal to the District Magistrate under section 318 of the Municipalities Act and, as he had not done so, the suit was barred under section 321 of the Municipalities Act. In the course of the pleadings the plaintiff claimed that even if he had no legal title to the property in dispute he had perfected his title by adverse possession for more than 30 years. In this connection the objection of the Municipal Board was—apart from denying the adverse possession—that neither in the plaint nor in the notice under section 326 of the Municipalities Act was it mentioned that the plaintiff had title to the disputed land by adverse possession.

The trial court held that the land was purchased by the plaintiff from Lal Khan, that even if Lal Khan had no title to the land the plaintiff had perfected his title by being in adverse possession for more than 30 years, that the disputed portion of land was really a part of a street or a road which belonged to the Municipal Board, and that the rights of the Municipal Board had been extinguished by adverse possession. It held that the plaintiff could not challenge the order of the Municipal Board under section 211 in contravention of section 321 of the Act, but the plaintiff had not challenged that order under section 211 and had merely asked for a declaration of title to the property in dispute and so the suit was maintainable. It further held that it was entirely unnecessary to state in the notice under section 326 the grounds upon which the title in the land was claimed by the plaintiff as section 326 of the Municipalities Act did not require any such grounds to be stated.

The Municipal Board went up in appeal and the lower appellate court agreed with the trial court. In this second appeal the same questions of law have been raised (1) whether the motion to raise the plea of adverse possession in the notice or in the plaint affects the suit in any way, and (2) whether in the circumstances of this case it was open to the Civil Court to maintain the suit in view of the provisions of section 321 of the Municipalities Act?

Although section 321 explicitly excluded the jurisdiction of the Civil Court the Civil Court will have jurisdiction to examine into cases where the provisions of the Municipalities Act have not been complied with. The plaintiff contended that the provisions of section 211 have not been complied with in as much as the land in respect of which the notice was given is not a street or a part of a street. It is the case of the plaintiff respondents, and their point of view has been accepted by the lower courts, that although the land in dispute was a part of the street belonging to the Municipal Board yet by adverse possession for over 30 years the portion encroached upon has ceased to be a street and therefore the Municipal Board had no jurisdiction to issue the notice in the present case. The contention of the learned counsel for the appellant is that in section 211 the question of limitation does not arise if it is proved that the land encroached upon was at one time a street within the definition of the Municipalities Act. This contention of the appellant cannot be accepted. If the encroachment desired to be removed is on a part of a street then the notice of the Board under section 211 would be perfectly legal.

"Our considered view therefore is that if the Municpal Board looses its right in any portion of a street by adverse possession for the requisite period, that portion ceased to be a street and to direct a person, who has perfected his title by adverse possession, to remove his possession therefrom is not warranted by section 211 of the Municipalities Act. The order of the Municipal Board under section 211 U.P. Municipalities Act of 1916, in the present case is therefore *Ultra Vires* and the suit is maintainable in the Civil Court for a declaration as prayed in the present case. Accordingly the appeal fails and is hereby dismissed with costs.

REFRIGERATION

E. H. BERRY

Refrigeration is the storage of perishable food-stuffs at temperatures which prevent the multiplication of bacteria which cause putrefaction. It has been proved that temperatures between 40 and 50 deg. Fahr. prevent the growth of bacteria, and are satisfactory for the storage of food in ordinary circumstances.

Today, food travels thousands of miles to markets, and refrigeration is called in to preserve it during the journey, in the wholesale store and at the retail shop before purchase. Obviously, the next step is for every home to be equipped with refrigeration, so that food may be kept in perfect condition until it is eaten. Moreover refrigerators are now within the reach of those who can afford a wireless set.

Commercial and Domestic Refrigeration.

Refrigeration may, roughly, be divided up into two classes commercial and domestic. Commercial refrigeration includes the large-scale plant installed in the ships which bring meat from abroad, in the large cold stores and so on down to the smaller plants which the dairyman and restaurants employ.

Commercial refrigeration has been developed to a fine art. The subject has been investigated so thoroughly that it is now known how to store and keep practically every kind of perishable food in good condition.

All this development has taken place in the science of refrigeration, yet the public in general still ignores the fact that this protection ceases as soon as the food reaches the larder.

The Use of Preservatives.

Formerly the retailer used certain preservatives, such as benzoic acid and sulphur di-oxide, but these are now limited.

Refrigeration has superseded these added preservatives; keeping the temperature of the food store below 50 deg. F.—above which putrefaction begins—arrests food decay and makes the storage of most food-stuffs possible for any length of time.

As a general rule, the architect is not worried to any extent with problems connected with large cold storage plants, and at any rate experts are available should the need for their advice arise.

Freezing Foods not Necessary.

It must be realised that a refrigerator need not, and in most cases should not, freeze the food to be preserved. It must be emphasized that in most cases the freezing of foods is definitely deleterious. The freezing chamber is provided for the convenience of the user who desires to make ice or ice cream. A temperature of about 40 deg. to 50 deg. F. is sufficient to retard the growth of harmful bacteria.

Small Scale Types.

Small-scale refrigeration falls into two types, the self-contained cabinet, and the centrally-operated unit. The latter, of course, is used in blocks of flats, while the self-contained unit, by far the more common, is the type installed in private houses.

The understanding of the complete theory of refrigeration is complex. If, however, we invert the general conception of what is meant by refrigeration, an understanding of its principles is simple.

Principles of Refrigeration.

The principle of refrigeration is the same for all types of plant or installation, and consists of the removal of heat from the storage chamber and the goods stored therein. It is better to regard refrigeration in this way than to picture it as the production of cold. For instance, if you abstract heat from water it changes from the liquid state to its solid state—ice. A large and constant quantity of heat must be abstracted to bring this change about. Having abstracted this large quantity of heat from the water and made ice, if we wish to reverse the process we must give back a large quantity of heat to the ice to change it back to water. If now we have a cabinet containing foods we must abstract heat from it and its contents to make it sufficiently cool. If we introduce a lump of ice into this cabinet, the cabinet and its contents will gradually part with their heat to the ice which will be changed from its solid state to its liquid state—water. Basically, refrigeration depends upon a change of state of some substance from one state to another. This change, which requires the abstraction of heat, takes place at some convenient point. The substance, in a form which requires heat to regain its original form, is then supplied to the space it is required to use for refrigeration purposes. Ice was used for many years and is still quite extensively employed as a refrigerant in the ordinary ice-box. Ice has, however, certain disadvantages. It is bulky for a given quantity of cooling. You cannot produce ice by surrounding a vessel of water with ice.

There are available for this purpose certain salts which, when dissolved in water, produce a

temperature sufficiently low to make ice. Equal parts of sal ammoniac and saltpetre dissolved in 2½ times the same weight of water will produce a mixture some 12 degs. below freezing point. The "freezing mixtures" and ice are, however, expensive, bulky, messy and, incidentally, not always easily obtainable. Eliminating these methods as not having the advantages of self-contained refrigerators, self-contained types available can be considered.

Motor-Operated Types.

All self-contained self-cooling refrigerating machines operate by compressing some gas and removing the heat produced in the process. The compressed gas, which when cooled is usually in a liquid state, is then allowed to expand back to its gaseous condition in some chamber situated in the space it is desired to cool. It requires to take in heat to become a gas again and absorbs this from its surroundings.

The most generally used is the mechanical compressor type. In this type some non-inflammable gas is compressed by means of an electric motor driving a compressor until the pressure is such that when passed through a condenser it is liquefied. This liquefaction is usually brought about by the electric motor which drives the compressor also driving a fan to assist the dissipation of the heat from the condenser. This liquid gas is then permitted to flow through a chilling unit, in which the pressure is low. The liquid gas changes back into its gaseous form and, requiring heat to do so, abstracts it from the space it is required to cool. The following sketch shows in a diagrammatic form the operation of the self-cooled compressor unit. In the sketch, "A" is the compressor, which may be of the piston type as shown, or of a more complex form. "B" is a valve which opens outwards from the cylinder, and "C" a valve opening inwards. "D" is the condenser in which the compressed gaseous refrigerant is cooled by a stream of air from a fan, or by water in some larger types. "E" is the valve which permits of a quantity of the refrigerant in pipe "G" to enter pipe "H".

"F" is the chilling unit in the cold chamber.

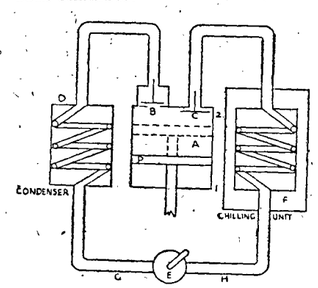


Diagram illustrating the operation of the compression type of refrigerator.

Before this apparatus can work, it must be charged with the selected refrigerant. The refrigerants most commonly used are sulphur dioxide ammonia or methyl-chloride.

During manufacture the system is charged with a quantity of the gas in liquid form sufficient to fill "D" and most of "F" with liquid, the remainder of the space then being occupied by gas. All the air is expelled by the gas, and the whole is then hermetically sealed.

On starting the motor the compressor begins to operate. The piston "P", on moving from position 1 to 2, compresses the gas in "A", valve "C" closes, and valve "B" does not open until the pressure in "A" is greater than that in "D". On the pressure rising, valve "B" opens and the compressed gas, which cannot liquefy because of the heat generated during compression, flows into the condenser "D". Here the stream of cool air or water causes it to liquefy, and it flows through "G" and "E". The valve "E" opens and permits some of the liquid gas to flow through "H" to "F". "F" is filled partly with the refrigerant in liquid form and partly gaseous. On the piston moving from position 2 to position 1 the pressure is reduced in "A" and valve "C" opens with the pressure of the gas produced in "F" from the heat taken in from the cold chamber. When valve "C" opens the cylinder "A" fills with gaseous refrigerant ready to be compressed once again.

This process of compressing the gas, cooling to liquid, reducing pressure and taking in heat, expanding to gas again is repeated time after time until the cool chamber is sufficiently cold to cause the thermostat to shut off the electric motor which drives the compressor.

Principle of the Absorption Type.

The other main type of small refrigerator is known as the absorption type. The working principle is exactly the same as in the compressor, but more difficult for the layman to understand, and the construction is entirely different.

While nearly all the mechanical compressor type use sulphur dioxide or methyl chloride as the refrigerant because of the relatively low pressures at which they liquefy, the reduced tendency to leakage at joints and the ease with which they liquefy by air cooling, the absorption type use ammonia. This medium is selected for the peculiarity that water at a low temperature dissolves several hundred times its volume of this ga which can then be almost completely expelled on boiling the solution. This simplifies the apparatus. Instead of the mechanically operated compressor, we have a boiler containing a strong solution of ammonia gas in water. On applying heat, the gas is driven out of the water and collects in the cooling coils. As the system is sealed, the pressure rises sufficiently to bring about liquefaction of the ammonia gas. The coils are cooled by free air circulation in the smallest models or by water in the largest. The liquid gas then passes to the evaporation or chilling unit where, owing to the absorption of heat by the evaporator, it changes into its gaseous form again. It then comes into contact with a weak solution of ammonia which is kept cool, is reabsorbed, forms a strong solution, and is returned to

the boiler. It is then ready to be driven off once again. Thus the cycle is complete.

In the Electrolux, which is manufactured by Electrolux, Ltd., the action is made continuous by an ingenious system of circulation. A stream of strong solution is constantly flowing into the top of the boiler, while the weak solution after the gas has been boiled off leaves the boiler at the bottom. It then passes into the absorbing vessel, where it is cooled, strengthened and then returned to the top of the boiler. In the Electrolux a small gas flame is used to heat the boiler. Any other source of heat is equally suitable, however, whether derived from an electric heating element or a small oil flame.

The Intermittent Absorption Type.

While the Electrolux unit is of the continuous absorption type there are available other intermittent absorption types.

Such a one is the Zeros, a product of Ismay Zeros, Ltd., Dagenham. In this type, employing the Normelli system, a sealed cylinder is filled with calcium chloride impregnated with ammonia. This hollow cylinder contains an electric heating element. The element is automatically switched on for 1½ hours in each eight hours by means of a time clock actuated by the electric supply. It will be seen that the current is only on for 4½ hours of the 24 hours in any day.

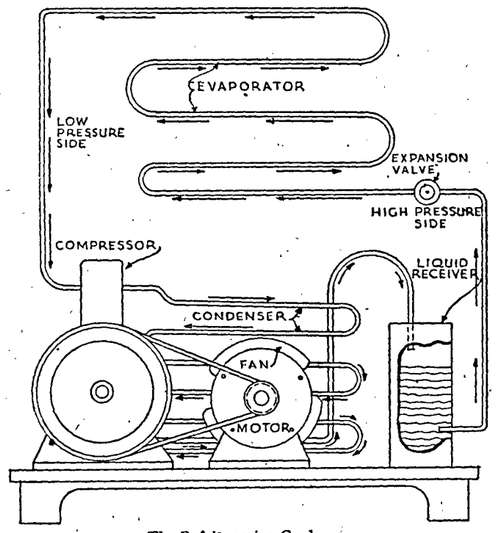
On the application of heat the ammonia is liberated from the calcium chloride in gaseous form. It then passes through the air-cooled condenser, where it is cooled and liquefied. It flows by gravity to the storage container, which holds sufficient liquid ammonia to serve the evaporation coils for 6½ hours cooling. On abstracting heat from the cooling cabinet the ammonia vapourizes, bubbles back through the liquid ammonia and is immediately reabsorbed by the calcium chloride. A constant temperature is maintained in the cabinet by means of a tank holding a liquid which surrounds the evaporator coils.

After the heating period is terminated by the automatic time switch, the temperature of the absorber-generator drops as the warm absorber is able to re-absorb the refrigerant, which now evaporates and produces cold. This cold producing takes place for 6½ hours and is concentrated in the cold storage box, which becomes a solid and permanent ice block and thus acts as a reserve of cold storage which ensures a constant temperature in the cabinet at all times.

Solid Carbon Dioxide Types.

One other method which is being used to some extent and which is virtually a development of the old ice-box, is the cold box using solid carbon dioxide. This medium vaporizes immediately from solid to gas without going through a messy liquid intermediate stage as is the case with ice. This medium is sold in England principally to travelling ice cream vendors. It is, however, popular and reasonably cheap where a large quantity is produced and efficient distribution arranged. No fine control is possible, however, as is maintained by the thermostat in the self-cooled models. The cooling effect of the medium, which has a temperature of minus 110 degs. F. is much greater than that of ice. A smaller cabinet is therefore possible. A block of some 20 lbs. is placed in a vacuum vessel with a metal plate at one end. A vent is provided to allow the carbon dioxide gas to escape as it is formed. The plate, which is intensely cold, sets up a downward current of cold air, which abstracts heat from the commodities to be cooled. As the air is then warmer, it gradually rises, again comes in contact with the cold plate and falls again. Ice cream can be made by putting a container as nearly as possible under the contact plate. A block of 20 lbs. will provide about a week's cooling.

The term cold is purely relative and is used to express in a comparative way a degree of heat. Cold cannot be created and a refrigerating system does not produce cold, but is a method of extracting heat.



The Refrigeration Cycle.

In mechanical refrigeration use is made of the fact that when a substance changes from a liquid state to a gaseous state, heat is absorbed, and vice versa.

The substance used in refrigeration is called the refrigerant, and is one that has a relatively low boiling or evaporating point. In most cases this point is so low that at normal atmospheric temperatures the refrigerant exists as a gas. When a gas is compressed, it gets hot, and if the compressed gas is cooled it turns into a liquid.

The complete cycle is as follows: The liquid refrigerant is circulated through a coil which is located in the space to be cooled. Although the temperature of this space is low it is greater than the boiling point of the refrigerant. The refrigerant boils and changes into a gas, and in so doing absorbs heat from the space to be cooled. This coil is usually called the evaporator. The gas is next passed through a compressor, where it is compressed and where the temperature inevitably rises through the action of compression, just as the end of a bicycle pump gets hot when in use. The hot gas is passed through another coil, which is cooled either by air or water, and, being cooled, it condenses into a liquid. This second coil is usually called the condenser. The liquid is then circulated to the evaporator and the cycle begins again. The refrigerator thus consists of three essential parts, the evaporator, the compressor and the condenser.

Defrosting.

All refrigerators should be defrosted every one, two or three weeks, depending upon the type of freezing units and kind of use, for the following reason. As the temperature of the cabinet is lowered, a critical point is reached —known as dew point—when moisture in the air inside the cabinet is condensed. As the freezer is the coldest part of the cabinet, condensation takes place at this position and later on the moisture is frozen. From time to time as fresh food is put into the cabinet and fresh moisture-laden air is admitted the frost gets thicker and thicker. Frost, however, acts as a heat-insulator and gradually restricts the amount of heat which can be abstracted from the cabinet. When the frost is about ¼-in. thick it becomes necessary periodically to clean the frost from the freezer. This is known as "defrosting". By turning the control switch to the slowest freezing speed, or in many cases, to the special position marked "defrost" the temperature of the freezer is allowed to rise. As soon as it gets about freezing point the frost melts and drips as water into the tray below. The freezer is then ready to be lowered to its normal working temperature and in some models is done automatically.

Capacity Required Per Person.

How to estimate the possible requirements of cooled space, and some details of costs and efficiencies should form a suitable conclusion to this article.

The most general figure, operating satisfactorily in practice, is to estimate at the rate of 1 c. ft. per person. If the family is four (children count as half) then 4 c. ft. is adequate capacity for the suggested refrigerator.

Comparing the absorption type with the compressor type, it is reasonable to assume that the absorption type will require from two to three times the energy that the compressor type does in the ordinary domestic sizes. This means to say that the running cost—other factors being equal—will be at least double. This applies to the absorption type generally, whether the medium of heating be gas, oil or electricity.

Twice or three times the energy must be supplied to refrigerate the same space. In general also, the speed of freezing is longer, usually three times as long being required to produce a given volume of ice. Nor can the speed of freezing be accelerated over such a wide range, and with such close control. In the smallest sizes the absorption type is also more expensive initially for the same internal volume as a mechanical compressor type.

While some mechanically operated types claim to use some half unit of electricity per 24 hours, it is more usual to assume that up to 6 c. ft. the mean average consumption is one unit per 24 hours. This figure can be accepted and is, if anything, on the high side. The absorption type takes some 2-3 units per day, depending upon the external temperature.

Refrigerator Types.

The following are some of the makes usually available in the market.

Make	*Refrigerant*
Aerofrige	SO_2
Apex-Vactric	SO_2
B.T.H.	SO_2
Century	Methyl. chlor.
Chillaire	SO_2
Coldair	SO_2
Coldspot	SO_2
Crosley Shelvador	SO_3
Electrolux	Ammonia
Express	SO_2
Frigidaire	Freen 114 and Freen 12
Grunow	Carrene.
H.M.V.	SO_2
Kelvinator	Methyl chlor.
Leda	SO_2
Marco	Methyl chlor.
Moffat	Methyl chlor.
Prestcold	SO_2
Savoy	SO_2
Sparton	SO_2
Sternette	Methyl chlor.
Stewart-Warner	SO_2
Universal	SO_2
Westinghouse	SO_2
Zeros	NH_3
Zerozone	Not spec.

Planning the Kitchen.

It should be remarked that while the refrigerator supersedes the larder, which must be located on and ventilated to an outside wall, space is still required for the storage of dry, non-perishable goods. These are usually stored in a cupboard or one of the kitchen cabinet type of units. This allows of a more logical and systematic

(*Continued on page 27*)

HOW WAS OCTOBER

For Building

A rainy day is one in which 10 cents or more rain is recorded. The following figures show the average rainfall in inches and the average number of rainy days in the month of October based on data up to 1940:—

	Rainfall in Inches	*Number of Rainy Days*
Agra	0.7	0.8
Ahmedabad	0.3	0.7
Allahabad	2.3	2.5
Ambala	0.9	0.9
Asansol	4.3	5.5
Aurangabad	1.8	2.8
Bangalore	5.9	8.5
Bellary	4.2	5.9
Bhopal	1.7	2.4
Bhuj	0.3	0.5
Bombay	2.5	3.1
Calcutta	4.5	6.2
Cawnpore	1.3	1.5
Chittagong	7.1	7.0
Cochin	13.4	14.2
Colombo	14.5	16.1
Dacca	5.3	6.0
Gaya	1.9	2.9
Hyderabad (Dn.)	2.5	4.3
Jamshedpur	2.7	4.2
Jhansi	1.0	1.1
Jiwani	0	0
Jodhpur	0.3	0.5
Jubbulpore	1.9	2.3
Lahore	0.2	0.5
Madras	12.0	10.7
Mangalore	8.1	10.4
Marmagoa	6.5	7.9
Masulipatam	8.6	8.5
Nagpur	2.2	3.1
New Delhi	0.4	0.6
Patna	2.3	2.9
Peshawar	0.2	0.6
Poona	3.5	5.1
Puri	7.2	7.3
Quetta	0.1	0.3
Rawalpindi	0.6	1.4
Sambalpur	2.1	3.5
Srinagar	1.2	2.8
Trichinopoly	7.2	9.5
Trincomalee	8.3	10.9
Trivandrum	10.7	12.2
Vizapagatam	7.8	8.3

FOR DISCUSSION

The essence of management is the art of getting things done through the agency of other human beings, and technicians cannot manage human beings by technology alone.

* *

The first factory for the manufacture of expanded metal in this country was set up in Calcutta in 1938; there are now three such firms.

* *

Industrially India does not need such advice as how to draw up factory legislation or how to prepare labour statistics. What is needed is facilities for the acquisition of technical skill and technical knowledge.

* *

India's Health Minister says that the hospital expansions are held up for want of building materials and West Bengal Irrigation Minister says that because of the dearth of labour, execution of many irrigation schemes are delayed.

* *

On a series of interviews with several technicians, it was found, that every one was grousing about the general conditions.

* *

Everyone is responsible for building the nation and everyone has to subscribe to building the national character.

* *

Local bodies are still not sufficiently alive to the fact that provision of houses is one of their basic civic duties.

* *

It is mistake to imagine that 'practical engineers' can be produced by sending scholars overseas for a few months to go about works and factories with a notebook in hand.

* *

The need of the day is the introduction of apprenticeship schemes with proper facilities for theoretical training.

PROPOSED NEW WORKS

Bombay.

A network of about 200 village godowns for storage of agricultural produce, on the lines of the American field warehouses will shortly be established in Bombay Province. The Bombay Government have, it is learnt, asked the Registrar of Co-operative Societies to recommend societies in the province to open such warehouses in their areas.

Berhampur.

The Government of India has accepted the road development and sewerage schemes of Berhampore Municipality.

Preparatory work on the construction of the Plassey-Berhampore and Kandi-Panchtopi roads is expected to begin early in autumn. The project will cost Rs. 4 lakhs.

Delhi.

The Delhi Municipal Committee has applied for a loan of Rs. 1 crore from the Government of India to improve the city's sewage system.

Dholpur.

The Government of India have decided to construct a high-level bridge over the Chambal river on the Agra-Bombay road near Dholpur. It is estimated that the cost of construction will be in the neighbourhood of Rs. 1 crore.

Eluru.

The Government of Madras have taken up for investigation the Thimmieleru Project in West Godavari. The project contemplates the construction of a dam across Thimmieleru, a hill stream at Yedavalli and construction of a reservoir to store water. It is expected to cost Rs. 40 lakhs. The investigation is expected to be completed within six months.

Jaipur.

The Rajasthan Government has appointed a committee to draw up a scheme for the development of "Greater Jaipur".

(*Continued on page 29*)

EDUCATIONAL

THE BUILDING SOCIETIES INSTITUTE

THE Building Societies Institute was founded in 1934 as a result of a general desire to put on a more formal basis efforts which had from time to time been made to provide facilities for training the staffs of building societies. Although it has other activities, the institute is first and foremost an educational body. It is, under its constitution, expressly debarred from acting as a trade union.

The Institute is governed by a Council of 36 members, divided almost equally between chief officers and subordinate officers of building societies. One-third of the Council retires each year. The Council elects the President and Vice-Presidents of the Institute.

The Institute itself meets once a year, but carries on an active existence through its five Groups, which in turn control 28 Centres. The groups and centres meet monthly and carry out their own programmes of lectures, discussions, visits and social meetings.

The Institute is an examining body, and has held annual examinations continuously since 1936. Special arrangements have been made for candidates who have served or are still serving in H.M. Forces, including postal tuition courses under a War Office Scheme and full time "refresher" courses on demobilisation.

Week-end Schools and Study groups are held by the Groups of the Institute or are directly organised by the Institute headquarters.

The Institute publishes its own journal, B.S.I. Quarterly, and has also published a series of educational booklet dealing with various aspects of building society law and practice and housing.

The Institute maintains an Education Fund which enables increased educational facilities to be provided for the younger members of the staffs of building societies. There is also an Institute Benevolent Fund.

The Address of the Institute is : 14, Park Street, London W. 1.

(*Continued from 3rd column*)

He remarked to him that his taxi number was 1729 adding that it seemed a dull figure.

"No," said Ramanujan quickly : "It is a very interesting figure. It is the smallest number expressable as a sum of two cubes in two different ways."

The cubes are 12^3 plus 1^3 and 10^3 plus 9^3.

MATHEMATICAL PRODIGY

Dr. Ramanujan to whom reference was made in Dr. S. Radhakrishnan's press conference on the University Commission's recommendations, is often cited as a tragic victim of an unimaginative educational system.

The college career of this mathematical prodigy was a record of unrelieved failure, and had it not been for Prof. G. H. Hardy, then Sadleirian Professor of Pure Mathematics of Cambridge, it is possible that the genius of this man might never have been revealed. In a biography of his distinguished pupil Prof. Hardy refers to Ramanujan's academic frustration. "There was no gain at all," he says, "when the college at Kumbakonam rejected the one great man they had ever possessed and the loss was irreparable. It is the worst instance that I know of the damage that can be done by an inefficient and inelastic educational system."

Ramanujan was working as a clerk in the office of the Madras Port Trust on a monthly salary of Rs. 30 when Hardy discovered him. Certain articles he had contributed to some mathematical journals in England attracted attention and Prof. Hardy succeeded in getting Ramanujan to Cambridge where he was elected Fellow of Trinity College. Later he was elected a Fellow of the Royal Society. He died in 1920 at the early age of 33.

It is however strange to recall that until he was 16 Ramanujan never saw any advanced mathematical book. Soon after he began a study of trigonometry, he discovered Euler's theorems for the sine and cosine and was greatly disappointed when he found later that they were already known.

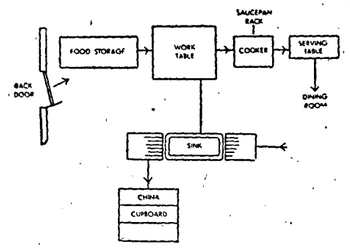
Ramanujan had an uncanny "feel" for figures. Prof. Hardy relates an incident when he visited Ramanujan who was then convalescing after an illness.

(*Continued on 2nd column*)

REFRIGERATION

(*Continued from page 24*)

layout in the kitchen planning. A sequence can be followed in design, for the refrigerator can be located in any desired position. The sequence accepted by many architects is as shown in the plan.



It is quite usual nowadays for units comprising cooker-refrigerator combinations or cooker-sink to be incorporated in the planning. Quite a number of manufacturers produce "outline" or building-in models. These are usually appreciably cheaper, for with the exception of the front the remainder is rough finish as it will be hidden when framed up. The tendency will be for refrigerator prices to fall as the quantities absorbed by the market increase and the specifying of built-in models will assist in this. The tendency to plan a logical sequence in the kitchen and visualize the provision of complete service is obvious and no kitchen can be regarded as complete without some refrigerator. It appears probable that units comprising refrigerators will become increasingly common in the well-planned home.

Work-Table.

The work-table is, in effect, the focal point of all the important kitchen operations. It should be of adequate area, say not less than 8 sq. ft., at a height convenient for standing or sitting, say 35 ins., knee space being provided under part, if not all, of it. It should be situated in a good light and within easy reach of the cooker and sink.

Food Storage.

A small refrigerator can be economically justified and may have built round it a cupboard for non-perishable food and a drawer or bin for vegetables. These three units can be built up together, ventilating bricks being provided for air circulation. Alternatively, a small larder may be provided in the usual manner and the refrigerator placed alongside. A sliding shelf can be provided over the refrigerator to facilitate the handling of food.

SPECIFICATION

British Standard for Terms and definitions applicable to timber, plywood and joinery. B.S. 565 : 1949)

The B.S.I. have announced that B.S. 565 'Terms and definitions applicable to hardwoods and softwoods : 1938', has recently been re-issued under the new title given above. The standard has been considerably extended and now contains classified lists of terms in general use relating to forestry, structure, defects, sizes and quantities of timber and commercial abbreviations. Additional sections deal with terms relating to plywood and similar types of boards and to joinery. In the joinery section, the alternative terms used in Scotland and certain parts of the North of England are included where those differ from the terms in more general use. In addition to the terms which it is recommended should be adopted as standard terms, glossary includes a number of alternative terms which are also in use in the timber industry. The standard is arranged in sections so that related terms appear together as this is thought to be a more convenient method than a strict alphabetical arrangement. A comprehensive index is included to facilitate reference to any particular term.

Copies of this Standard may be obtained from the British Standards Institution, Sales Department. 24, Victoria Street, London, S.W.L. Price 5/- post free.

LETTER TO THE EDITOR

Contractors' Association

Sir,

Having been in the building trade possessing an experience of nearly 30 years and coming from a family of contractors, I would like to bring to your kind notice certain facts which I feel will be in the interest of the building industry and hence shall be pleased if you will kindly give publicity if you concur with my ideas in your valuable journal.

To begin with I am really sorry to find that we, as contractors, have no Association of ours through which we can all be brought together and united. More things could be achieved by coming closer together and discussing matters of common interest. Even hotels in rural areas are having their own Association and so I feel it is most imperative that we form a Contractors' Association at the earliest.

If we succeed in establishing such an Association we can put a stop to so many malpractices in the trade such as giving very low tenders, not having proper check over workmen and ever so many other things.

I would, therefore, like to suggest the following to be the Aims and Objects of the proposed Association :—

(i) It should safeguard the interests of the Contractors and the Employers and settle differences by arbitration.

(ii) It must be able to offer proper advice and encourage artisans.

(iii) It must promote establishing a Scale of Wages to be paid to labour, and

(iv) Some provision must be made for promoting good workmanship by giving the workmen a small share in the profits.

Yours faithfully,

T. N. ALWAR CHETTY,
MADRAS, *Contractor.*

CONTRACTS OPEN

The dates at head of paragraphs are those for the submission of tenders. Application for forms and particulars should be made to the address given at the end.

MADRAS : Bridge.

Sep. 16.—Construction of a Bridge across The Buckingham Canal at mile 2/2 of Madras-Tiruporur Road, approximate cost Rs. 45,000. The Divisional Engineer Highways, Saidapet.

NEW DELHI : Reservoir.

Sep. 20.—Constructing a Filtered Water Reservoir at Ridge Road near Flagstaff, New Delhi. Capacity 25,00,000 gallons. The Executive Engineer, Water Works Division, C.P.W.D., B. Barracks, Queensway Road, New Delhi.

CUTTACK : Road metal Supply.

Sep .20.—Supply of metal for the proposed National Highway No. 5 from Cuttack to Bhubaneswar costing Rs. 1,62,047. The Executive Engineer, Cuttack Bridges Division Central P.W.D., Cuttack.

NEW DELHI : Factory.

Sep. 20.—Special Repairs to American Warehouse at Factory Road, New Delhi. Estimated cost Rs. 74,824. The Executive Engineer, Central Stores Division, C.P.W.D., American Barracks, Queensway, New Delhi.

NEW DELHI : Roads.

Sep. 20.—Widening roadway of Motor Road portion of G.T. Road to Meerut from Jumna Bridge to Shahdra, Delhi. Estimated cost Rs. 67,317. The Executive Engineer, Provincial Division, Central P.W.D., New Delhi.

LUCKNOW : Institute.

Sep. 24.—Construction of new buildings of the Institute of Palaeobotany on University Road, Lucknow. The work is estimated to cost Rs. 5½ lakhs. The Director, Institute of Palaeobotany, 53, University Road, Lucknow.

NEW DELHI : Peons' Quarters.

Sep. 24.—Constructing 112 Peons' Quarters for Reserve Bank of India at New Delhi. Estimated cost Rs. 2,49,670. The Executive Engineer, Construction Division No. 11, Room No. 175, P-Block, Raisina Road, New Delhi.

NEW DELHI : Clerks' Quarters.

Sep. 24.—Constructing 320 Clerks' Quarters at Factory Road, New Delhi. Estimated cost Rs. 20,29,555. The Executive Engineer, Construction Division No. 11 New Delhi.

BANGALORE : Hangar.

Sep. 26.—Fabricating and erecting S.W.P. Hangar. The Production Engineer, Hindustan Aircraft Ltd., Bangalore.

GONDAL : Railway work

Sep. 26.—Earthwork of Jasdan-Rajkot Railway Extension. The Special Engineer, Construction, Sourashtra Railway, Gondal.

TANJORE : Asphalting

Sep. 26.—Providing Asphaltic Concrete 2½ inches thick 1/3-100 to 3/1-160 of Tanjore-Tiruvadi Road in Tanjore Municipal limits. The Divisional Engineer, Highways, West Division, Tanjore.

KURNOOL : Bridge

Sep. 26.—Construction of a Bridge across the Paleru in 7/1 of Koilkuntla-Nossam Road. The Divisional Engineer, Highways, Kurnool.

ANANTAPUR : Bridge

Sep. 29.—Constructing a stone masonry semi-circular arched Bridge of 12 spans of 36 ft. each across the river Pennar near Kalvapalli village in mile 19/8 of Anantapur-Kalyandrug Road. The Divisional Engineer, Highways, Anantapur.

MADRAS : Factory

Oct. 3.—Construction of the main and tannery and administrative buildings of the Central Leather Research Institute, at Guindy, Madras. Estimated cost Rs. 5 lakhs. The Assistant Director, Planning, Central Leather Research Institute, 71, Coral Merchant Street, G.T., Madras.

KASARGOD : Roads

Oct. 3.—Opening a road from Chervathur to Chimini via Thimmari and other improvements The Divisional Engineer, Highways, South Kanara Division, Mangalore.

BARAKOT : Bridge

Oct. 5.—Construction of a Road Bridge about 1,800 ft ,long on the Brahmani River at Barakot. Estimated cost Rs. 14 lakhs. The Additional Chief Engineer, Central P.W.D,, New Delhi.

CALCUTTA : Air-conditioning

Oct 10.—Air-conditioning Installation for the Central Glass and Ceramic Research Institute, Jadavpur, Calcutta. Architects : Ballardie, Thompson and Mathews 7, Wellesley Place, Calcutta.

DHANBAD : Air-conditioning

Oct. 10.—Air-conditioning Installation for the Fuel Research Institute, Dhanbad ; Architects : Ballardie, Thompson and Mathews, 7, Wellesley Place, Calcutta.

NELLORE : Bridge

Oct. 10.—Constructing a Bridge over the river Pennar near Nellore in mile 109/1-4 of Madras-Calcutta Road of 23 spans of 71 ft. and 10 spans of 61 ft. Reinforced Concrete T-beam type. The Superintending Engineer, Highways, II Circle, Madras 4.

MADRAS : Harbour Warehouse

Oct. 12.—Construction of a new warehouse 60,000 ft in Harbour area, Madras Port Trust. The Port Engineer, Port Trust, Madras.

ROORKEE : Electrical Grid

Oct. 24.—Supply and Erection of 66,000 volt, 3 phase, double circuit transmission line between Sumera-Chamdausi-Moradabad sub-stations of the Ganga grid, a distance of approximately 84 miles. The Project Officer, Irrigation (Hydro-Electric) Branch, P.W.D., Roorkee,

REGISTRATION OF ENGINEERS

A draft bill for the Registration of Engineers in India, has, it is understood, been circulated to Provincial Governments for opinion and is expected to be brought before the Indian Parliament as a Government measure in the next session at the same time as the bill for the Registration of Architects. Messrs. J. Ganguly and T. R. Mahendra attended the conference convened by the Government of India to discuss the bill for Registration of Architects.

INSTITUTE OF BUILDERS

An All-India Association of Builders is being formed with its Headquarters at Madras. The organizers hope, it is learnt, to have their inauguration meeting some time in October 1949.

USE OF RUBBER LATEX FOR BUILDING

(Continued from page 18)

properties and find application in industry where dilute acid, along with alkalis and other chemical liquors, are present. Structures built in good non-porous engineering bricks with cement formed from rubber latex, aluminous cement and sand can be used as neutralising pits, tan pits, dye, liquor tanks, brewing liquor tanks, and so on. This type of construction is especially strong, as the cement possesses so powerful an adhesion to bricks. Adhesives of this kind are also excellent for fixing glass and glass bricks, etc. Surfaces of all kinds can be cemented together with such a mixture.

The material possesses remarkable adhesion to metal surfaces, and resists chlorine and many other destructive gases. For this reason it is used for the lining of metal tanks and metal flues which come into contact with corrosive vapour.

Thus rubber latex finds its way into the building industry. The proportion of rubber in the composition is low but the bulk quantity of material used is big and many thousands of gallons of latex are used each week in these new and interesting processes.

BETTER HOMES AT LOWER COST

(Continued from page 17)

Research Schemes

Considerable research into ways of reducing costs, new methods of building, thermal efficiency and many other angles of house construction are being carried out by the Government, universities, industrial bodies and others at a present cost which has been unofficially estimated at about £1,000,000 (Rs. 1.33 crores) a year.

Experiments already carried out will form the basis of a scheme—the first of its kind—to find out by observation of family behaviour the types of house design, services and equipment likely to ensure the best living conditions in low cost houses. The idea is to build 10 houses on each of 15 sites in different parts of Britain. Each house is to be different so as to give a good cross section of "behaviour" under ordinary living conditions. This, and other important experiments, are the type of work which will help Britain to build still better homes at lower cost.

PROPOSED NEW WORKS

(Continued from page 25)

Mercara.

The construction of a bloc of 72 beds in the Women's Hospital and the construction of a Tuberculosis Sanatorium costing Rs. 10,40,000 at Mercara have been sanctioned by the Government of India.

Rajpura.

The Rajpura Development Board has decided to provide land, water-supply and electricity facilities to the Batas (of Calcutta) to start a shoe factory at Rajpura where the Government of India is building a township for 60,000 refugees.

Mr. Harihar Bannerji, Housing Research Officer of the Railway Board, is the administrator of the Rajpura Township Scheme.

Somnath.

The scheme for the restoration of the famous Somnath temple, destroyed by Mohammed Ghazni over 900 years ago, includes a new township, an All-India Sanskrit University, an arts and sculpture gallery and a centre for the regeneration of Hindu culture. The ruins are of the Chalukyan style of architecture and it is hoped, it will be possible to enlist 'Sompurias' descendants of the famous temple-builders of the past to rebuild the temple.

Tirupathi.

The Government of Madras have sanctioned under the five-year plan the drainage and additional water-supply schemes of the Tirupathi Municipality. The cost of the drainage is estimated at a lakh of rupees and that of the additional water-supply scheme comes to about Rs. 3 lakhs.

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*CURRENT MARKET PRICES OF MATERIALS

1. Prices vary according to quality and quantity ordered.
2. Those given below are average market prices in Madras.
3. Owing to the unsettled state of market most prices are liable to fluctuate.

CONCRETOR		Rs.	A.	P.
Portland Cement per bag (Upto 10 bags without permit)		4	11	3
Blue metal ½" gauge	per 100 c. ft.	56	0	0
,, 1½" ,,	,,	40	0	0
River sand	,,	18	0	0
Reinforcement M. S. Rods ⅜" dia.	per cwt.	18	15	0
,, ½" ,,	,,	19	2	0
,, ⅝" ,,	,,	20	3	0
,, ¾" ,,	,,	22	11	0
Binding wire 16 gauge per lb.		0	12	0
Sealocrete Concrete Surface dressing per gal.		10	0	0
Pittsburg Reinforcements—Welded Fabric per sq. ft.		0	3	0
	to	0	6	6

BRICKLAYER				
Country bricks 2" G.M.	per 1000	28	0	0
Stock bricks 3" T.S.M.	,,	50	0	0
Shell lime	per 100 c. ft.	66	0	0

ROOFER				
Malabar Tiles	per 1000	185	0	0
Malabar Ridge Tiles	per 100	75	0	0
Terrace bricks	per 1000	18	0	0
Asbestos Corrugated Sheets	per sq. ft.	0	6	11
Asbestos Trafford Sheets	per sq. ft.	0	6	11
G. I. Corrugated sheets 24 gauge	per sq. ft.	0	4	3

CARPENTER				
Burma Teak scantlings	per c. ft.	20	0	0
,, boards	,,	25	0	0
Malabar Teak scantlings	,,	15	0	0
,, boards	,,	18	0	0
Mango planks	,,	4	8	0
Insulation boards ½"	per sq. ft.	0	8	0
Asbestos plain sheets	,,	0	5	1
Wirenails per lb.		0	9	0
Wire-screws ¾" per gross		1	12	0
,, 1" ,,		2	0	0
,, 1½" ,,		2	4	0
Butt hinges cast brass	per pair	2	12	0
Cast brass Cabin hooks 6"	each	1	4	0
Barrel bolts cast brass	per r.ft.	4	8	0
All drop bolts cast brass	each	11	8	0
Plywood 3 mm.	per sq. ft	0	4	3

GLAZIER				
Sheet glass 16 oz.	per sq. ft.	0	10	0
,, ½"	,,	1	2	0
Plate glass ¼"	,,	4	0	0
Figured glass white per sq. ft.		0	14	0
,, coloured ,,		1	6	0

IRONWORKER				
R.S. Js. 4" x 3" (Controlled rate)	per cwt.	18	14	0
,, 5" x 3" to 15" x 6"	,,	18	8	0
,, 18" x 6" and over	,,	18	14	0
Channels, angles and tees	,,	19	12	0
M.S. plates	,,	20	0	0
Black sheets 20 gauge	,,	22	10	0
G.I. plain sheets 24 gauge	,,	22	10	0
G.I. barbed wire, 2 ply, 12 gauge	,,	39	4	0
Rivets, flat or round head	,,	75	0	0
Steel Rolling Shutters (up to 120 sq. ft.)	per sq. ft.	5	4	0

PAVIOR				
White glazed tiles (English)	per doz.	6	8	0
,, (Japanese)	,,	4	8	0
Coloured ,, (English)	,,	8	0	0
Marble tiles ¾" polished white or grey	per sq. ft.	4	0	0
Snowcrete white cement	per cwt.	22	3	0
Colorcrete	,,	29	8	0
Sealantone Liquid flooring green	per gal.	23	0	0
,, red or black	,,	19	0	0

PLUMBER				
Squatting pans, English 18"	each	54	0	0
Pedestal closets without seat	,,	45	0	0
W.W.P. Cisterns, 3 gal. (Elephant brand)	each	44	0	0
Sinks 30" x 18" x 10"	,,	158	0	0
W.H.B. 25" x 18" with waste and one tap	,,	118	0	0
Flat urinals, English	,,	56	0	0

PAINTER				
Himalayan Dry Distemper	per lb.	0	8	9
Turpentine	per gal.	8	8	0
Double-boiled linseed oil	,,	10	8	0
Raw linseed oil	,,	8	8	0
Copal varnish	,,	8	2	0
Black japan	,,	7	8	0
French polish	,,	11	10	0
Karoit Enamels (all colours)	,,	22	2	0
Goodlass wall paints	per lb.	0	10	9
Glue	,,	0	15	6
Putty	,,	0	12	0
Sandpaper	per doz.	1	4	0

* Readers are advised that enquiries addressed to the Journal will gladly be forwarded to the concerned suppliers of materials or equipments.