PAPER No. 29

FIBROUS PLASTER

This is the best known and most widespread phase of the plasterer's trade in modern building. It could reasonably be regarded as "prefabricated plastering" - thus following the general trend of all trades towards increased workshop manufacture and reduced site operations.

USE OF FIBROUS PLASTER

Fibrous plaster is used for lining internal walls and ceilings of all types of buildings, and may have a plain or decorated finish to form architectural features. The number of forms in which fibrous plaster may be, is almost unlimited, but the following are some of the purposes for which fibrous plaster is used:

- Plain flat wall and ceiling sheets.
- Ornamental sheets and panels.
- Cornices, both plain and ornamental.
- Cover strips.
- Beam and column casings.
- Ventilators and ventilating grilles.
- Curved sheets.
- Reinforced sheets.
- Window pelmets.
- Fireplace surrounds.
- Lighting troughs.

ADVANTAGES OF FIBROUS PLASTER

The following are the main advantages of using fibrous plaster:

(a) It may be moulded into any shape.
(b) Designs may be easily repeated.
(c) It may be had in a large range of sizes.
(d) Joints can be made invisible.

(e) It may be prepared in advance in the workshops.
(f) It does not expand or contract with weather changes.
(g) It is not affected by dry rot or similar defects.
(h) It is not subject to attack by borers, or other insect pests.
(i) It resists fire.
(j) It may be repaired easily.
(k) It can take water paint or oil paint, wall paper, or textured plaster finishes.

MATERIALS USED IN MANUFACTURE OF FIBROUS PLASTER

Fibrous plaster consists of plaster of Paris, reinforced with a fibrous material to form a homogeneous composition. Wooden laths are often added to give extra strength and stiffness.

(i) Plaster of Paris. This should conform to the requirements of the Australian Standards Association.

(ii) Water. The water used should be fresh and clean.

(iii) Laths. The laths for incorporating in cornices should be well seasoned, straight grained, and cut from oregon or other light non-staining timber to a section not less than 19 x 3.

(iv) Sisal Hemp. This is the fibrous material generally used. It is obtained from the long fleshy leaves of a plant which is cultivated in central America, Kenya and the East Indies.

(v) Coir. Coir, which is the fibre from the outside of cocanuts, is also used as a fibrous reinforcement.

(vi) Rope. Old rope, cut into short lengths, and well teased is another material used for reinforcement.

(vii) Scrim. Scrim is also used as a reinforcement.

PROCEDURE FOR FIXING FIBROUS PLASTER SHEETS

Fixing is the final stage of the fibrous plasterer's work, and includes battening, fixing sheets and mouldings, and stopping. The bulk of fixing work is on internal walls and ceilings. Wall sheets are usually nailed directly onto the studs. Reinforced sheets are nailed to purlins or other supporting timber.

On arrival at the job the fixer should inspect the building to see that the structural timbers such as the studs, joists, and noggings are securely fixed.

Alternating current may be divided further into single or polyphase systems. The single phase system is that which has just been described. In systems of more than one phase, the reversals of current take place in turn, depending on the number of phases employed. It is sufficient to know that the number of wires in any system is one more than the number of phases, one for each phase and a "neutral" wire. Thus a single-phase supply has, as we all know, two wires - one active - and one neutral. A three phase system has four wires - three active wires and one common neutral wire.

3. Substations.

In many areas, where a building is to consume large quantities of electricity, it is necessary for a substation to be provided with that building. This is normally required for large factories, blocks of flats, department stores, etc.

A substation is primarily a housing for a heavy-duty transformer and its associated switchgear and other equipment, and is usually located adjacent to the building's own switch room. Substations may be located outside or within the building as convenient. It must be planned, constructed and ventilated in accordance with the regulations of the local Supply Authority.

The heavy electric loads required by such large structures as those mentioned above cannot be taken from the normal low-tension (230 volt) supply. It is thus necessary to supply high-tension power separately, with a transformer as described. The entire unit is known as the Substation.

4. Wiring Systems:

(a) The main electric supply to a building is connected by overhead cable from the Electric Supply Authority's service to the "point of entry" as the connection to a building is known. Alternatively, underground cable may be used. Fuses known as Service Fuses are located externally adjacent to the point of entry. The wiring from here to the switchboard is known as the "Consumer's Mains". These cables must be of sufficient capacity to carry the initial electrical loading and any possible future additions to the system. The point of entry is connected by cable first to the Meter board which is usually outside the building and from there to the Switchboard which is preferably located as close to the heavier electrical loads as possible (electric range, hotwater service and washing machine, for example)

The wiring throughout the house (or other building) is broken up into a number of sub-circuits, each connected to its own fuse at the switchboard. The number of light and power outlets which may be connected to any one circuit is laid down in the wiring regulations applicable to that particular area.

Wiring may be done by the use of V.I.R. cables in steel conduits or, as is now more common, by T.R.S. or T.P.S. wiring run in the walls and ceilings, etc., as applicable. Every power point must be provided with an "earth" connection, which is a stranded copper wire of specified size connected to a suitable water pipe or buried metal plate.

(b) Earthing. Usually, the metal frames of all portable appliances are connected to the "earth" pin of the standard 3 pin power plug. In this way, the metal frames are "connected to earth" when the appliances are plugged into the power socket. This also applies to metal conduits, junction boxes and the metal casings, etc. of ranges, motors, transformers and other fixed equipment, except that these items are permanently earthed. In the "multiple earthed neutral" (or M.E.N.) system of wiring the actual neutral wire of the system is connected direct to the earthing point.

In either case, earthing of metalwork is a safety measure - ensuring that all exposed metal is at the same potential. Any "short-circuits" or accidental contact of live wires with earthed metalwork will result in the fuse being blown - thus breaking the dangerous contact.

5. Switching.

The main switch of a building is always situated at the main switchboard. Individual light and power points are controlled by their own switches. In the case of lights, these are usually located just inside the door of the room or at the fitting. "Two-way" switching may be provided to allow a light (or a power outlet) to be controlled from either of two positions. A switch should, wherever possible, be placed in the "active" line, not the neutral. In this way the light or power outlet is safer, as the neutral wire is usually at or near "earth" potential while the active wire is 230 volts or so from this.

6. Power Distribution in Buildings.

The distribution of electric power throughout a building is a simple matter in a small house or similar structure. In the case of large and multi-storey buildings wiring becomes much more complex. This is particularly so when large open areas of floors - such as in Office or Factory buildings - require to be serviced with electric power. Broadly, the main methods of providing power outlets are as follows: -

(a) Power outlets recessed into skirtings or walls (as with domestic buildings) or columns, etc.

(b) Permanent connection between the electric wiring and the electric device. (As with large electric ranges, hotwater services and mechanical equipment).

(c) Floor outlets. Often used in large office areas, where desks and smaller offices are subject to change of position. These consist of special raised units containing a power outlet and switch connected to a cable tray or metal conduit set into the floor construction. The raised units can be connected to the concealed floor grid at any of the pre-determined outlet positions.

Similar floor outlets can also be used to connect telephone points.

(d) Overhead ducting. Most commonly used in industrial type buildings where moving machinery or other factors make a floor or wall system of outlets undesirable.

Two types of overhead power reticulation are in use. The first provides a system of cabling, terminating in pre-determined points by outlet boxes to which are connected the flexible cables which in turn connect to the power using devices below. The second system provides a similar overhead "loop" or ring of electrical conductors, to which sliding trolleys are connected. The trolleys have flexible cables connecting to the tools or machinery which require electricity. By this method, a semi-movable source of power is available. This method is particularly useful over factory assembly lines, where portable tools are frequently used. Electric hoists, workshop cranes and similar plant are also easier to serve by means of a sliding power source such as this.

The overhead ducting system, suitably protected and insulated, is suspended at a suitable height from the roof in positions which have been planned to service the plant, tools, etc. requiring power. Single phase or 3 phase power is distributed in this way.

7. **Electrical Plans**

The locations of light and power outlets and switching positions within a building are usually shown on a separate Electrical Plan. Further details of fittings are sometimes included in a schedule, as required by the type and scale of the work. A typical house plan showing the electrical layout is included as Plate 1 at the end of this Paper. Note carefully the standard symbols used on the plan to indicate :

- Light outlets (ceiling)
- Bracket lights
- Directly-connected power outlet
- Power outlet
- Fan outlet
- Switch.

8. **Electric Lighting** can be of two main types, incandescent and fluorescent.

(i) Incandescent lights are the familiar bulbs made with a screw cap for special applications, and the normal bayonet cap for domestic use and most other uses. Globes are made in clear, frosted or pearl glass and the most usual stock sizes are 15, 25, 40, 60, 75, 100 and 150 watts.

(ii) Fluorescent lighting has two main applications - "neon" type lighting signs and straight tubular glass fittings for internal use. Neon lighting requires a high voltage to operate it, and is normally provided with its own transformer. Fluorescent light tubes as used for internal illumination are of the "hot cathode" type; that is, they are provided with a filament sealed in at each end. When the lamp is switched on, the filaments become heated and strike an electric arc through the gas contained in the tube, causing the fluorescent coating on the inside of the glass to become luminous and so radiate visible light. Hot-cathode tubes operate from the domestic 230 volt supply and are of 40 mm diameter. The most common sizes and ratings are as listed below:

Watts	Length
20	600 mm
40	1200 mm
80	1500 mm

9. **Light fittings** are made in many different patterns - in metal, glass and plastic, and as ceiling lights, bracket lights and standard lights. Special external light fittings are manufactured for lighting of streets, sporting areas, gardens, etc.

Light from a fitting may be classified into one (or more) of three groups, namely:

(a) Direct
(b) Indirect
(c) Diffused

Direct light comes straight from the lamp without passing through any diffusing surface, and is used with open type reflectors. It results in the greatest intensity of light being received, but is accompanied by glare. The use of louvres greatly assists to reduce glare while retaining direct lighting.

Indirect uses an open type reflector which directs all the light up to the ceiling. The ceiling thus acts as the source of light for the room, and completely eliminates direct glare.

Diffused light is that light which is "evened out" by a diffusing material. This may be a bowl of diffusing glass or a sheet of plastic.

BUILDING CONSTRUCTION

PAPER No. 25

GENERAL PLUMBER (Part 1)

The trade "General Plumber" usually covers the installation of sanitary and cold water plumbing and the fixtures and fittings associated with those trades. In this Paper we are concerned with sanitary installations, and in the following paper with cold water installation, also referred to as Water Supply.

Sanitary Plumbing

This Paper is to be read in conjunction with the reference textbooks, "Sanitary Plumbing"

Vol. 1. Introduction 10-1
Vol. 2. Drainage Pipes and Vents 10-2
Vol. 3. Installing Fixtures and Vents 10-3

The student is advised to read the entire three volumes through and to make himself reasonably familiar with the contents.

Vol. 1. Introduction 10-1

Take particular note of the introduction that with regard to local customs and statutory rules differences occur in some applications of sanitary plumbing and drainage.

Acquaint yourself with the different type of fixtures, tools of trade and most important the terminology.

All as referred to in Sections 1, 2, 3, 4.

Section 5 deals with basics of pipes, their variety and properties with particular emphasis on the fixture trap and the syphon principle.

Section 6 describes the sewerage disposal system and sewage treatment.

Section 7 is a comprehensive study of sewer and stormwater drain construction with Section 8 dealing with drainage design and plan work.

Vol. 2. Drainage Pipes and Vents 10-2

This volume deals with the actual laying of the house drain and installation of the waste discharge pipes.

Section 2 explains basic tools with Section 3 dealing specifically with levelling instruments and their use.

Section 4 describes trenches, grading and shoring.

Section 5, Laying the Pipes - take particular note of this section and pipe jointing.

Section 6, Inspection Openings with Section 7 and its various descriptions of drain testing.

Section 8, Drain venting, its location and size.

Vol. 3. Installing Fixtures and Vents 10-3

Section 2 explains in detail sanitary fixture installation.

Section 3 Fixture waste discharge pipes - Section 4 Fixture waste discharge pipe venting.

Section 5 deals with more joints in sanitary plumbing.

****

QUESTION PAPER No. 25

1. Define the following terms:

   (a) Ablutionary fixture
   (b) Boundary trap
   (c) I.O.
   (d) Invert
   (e) Floor waste.

2. Sketch a P-trap, name its parts and explain its function.

3. A property drain is shown on plan to be 85 metres long and is to be laid to a 1:60 gradient.

   (a) Give a fall between the highest and lowest point of the trench.
   (b) If the fall given as 1062 mm what would the gradient be?

4. Draw a diagram of a modern cistern and explain its operation.

5. List the types of vents that may be included in a domestic sanitary plumbing installation and give their location.

****

Stott's Correspondence College

BUILDING CONSTRUCTION

PAPER No. 25

GENERAL PLUMBER (Part 1)

The trade "General Plumber" usually covers the installation of sanitary and cold water plumbing and the fixtures and fittings associated with those trades. In this Paper we are concerned with sanitary installations, and in the following paper with cold water installation, also referred to as Water Supply.

Sanitary Plumbing

This Paper is to be read in conjunction with the reference textbooks, "Sanitary Plumbing"

Vol. 1. Introduction 10-1
Vol. 2. Drainage Pipes and Vents 10-2
Vol. 3. Installing Fixtures and Vents 10-3

The student is advised to read the entire three volumes through and to make himself reasonably familiar with the contents.

Vol. 1. Introduction 10-1

Take particular note of the introduction that with regard to local customs and statutory rules differences occur in some applications of sanitary plumbing and drainage.

Acquaint yourself with the different type of fixtures, tools of trade and most important the terminology.

All as referred to in Sections 1, 2, 3, 4.

Section 5 deals with basics of pipes, their variety and properties with particular emphasis on the fixture trap and the syphon principle.

Section 6 describes the severage disposal system and sewage treatment.

Section 7 is a comprehensive study of sewer and stormwater drain construction with Section 8 dealing with drainage design and plan work.

Vol. 2. Drainage Pipes and Vents 10-2

This volume deals with the actual laying of the house drain and installation of the waste discharge pipes.

Section 2 explains basic tools with Section 3 dealing specifically with levelling instruments and their use.

Section 4 describes trenches, grading and shoring.

Section 5, Laying the Pipes - take particular note of this section and pipe jointing.

Section 6, Inspection Openings with Section 7 and its various descriptions of drain testing.

Section 8, Drain venting, its location and size.

Vol. 3. Installing Fixtures and Vents 10-3

Section 2 explains in detail sanitary fixture installation.

Section 3 Fixture waste discharge pipes - Section 4 Fixture waste discharge pipe venting.

Section 5 deals with more joints in sanitary plumbing.

****

Electricians' conduits and wires and any other services within the walls should be in position before the sheets are fixed. Handle all sheets with care.

SIZES OF WALL SHEETS

In a timber framed building, such as a dwelling, fibrous plaster wall sheets are usually continuous, extending from the skirting to the picture rail or to ceiling. They can be made long enough for the full length of an average room. Sheets below the picture rail are often made 11 mm thick, although in some cases 10 mm sheets are used.

PREPARATION OF WALLS FOR FIXING SHEETS

(i) Fixing Nogging Nogging is the name given to timbers fixed between studs and joists, and is usually flush with the face of such members.

To provide a firm bearing for the bottom of the wall sheet, a row of nogging is provided.

A strip of plaster for packing is nailed to the plate at the bottom to keep the skirting in the correct position.

Nogging is also necessary at the door head height and a row of nogging one metre above the floor is desirable for additional support.

(ii) Internal Wall Angles The internal angles between walls are apt to cause trouble at a later stage, owing to timber movement, unless the walls are securely tied together. One method of tying them is to use sheet angle pieces, the full height of the room, securely nailed to the studs. 38 x 38 x 26 gauge galvanised iron angles are used.

FIXING THE WALL SHEETS

(i) Fixing Large sheets are fixed first as there is more room to manipulate them. Window openings should be accurately marked and cut out of the wall sheets before final nailing is done.

One method of treating external angles is to run the saw partly through the sheet so that it can be bent squarely around the angle, but leaving sufficient fibre to strengthen it. Another method is the adoption of external metal angles as for internal angles.

(ii) Nailing Galvanised clout nails with large heads are used for nailing sheets. The nails should be punched about 1.5mm below the face after the architrave, skirting and other finishings have been fixed.

QUESTION PAPER No. 25

1. Define the following terms:

   (a) Ablutionary fixture
   (b) Boundary trap
   (c) I.O.
   (d) Invert
   (e) Floor waste.

2. Sketch a P-trap, name its parts and explain its function.

3. A property drain is shown on plan to be 85 metres long and is to be laid to a 1:60 gradient.

   (a) Give a fall between the highest and lowest point of the trench.
   (b) If the fall given as 1062 mm what would the gradient be?

4. Draw a diagram of a modern cistern and explain its operation.

5. List the types of vents that may be included in a domestic sanitary plumbing installation and give their location.

****

Stott's Correspondence College

BUILDING CONSTRUCTION

Paper No. 26

GENERAL PLUMBING (Part 2)

Cold Water Supply

This Paper is concerned mainly with cold water supply, and should be read in conjunction with the reference textbooks as follows:

Vol.1. Water Supply 1 11-1
Vol.2. Water Supply 2 11-2
Vol.3. Water Supply 3 11-3

The student is advised to read the entire three volumes and to make himself reasonably familiar with the contents.

Vol.1. Water Supply 1 11-1

Take particular note of Section 2, Terminology, as these terms are used extensively throughout the course.

Section 3, Basic principles and quality of water supply.

Section 4, Composition of water, purification, pressure, distribution and storage.

Section 5, Water services, tapping and connection.

Section 6, Materials used for water services (pipes and fittings) copper, galvanised, steel, UPVC and polyethylene pipes.
The properties of each type and methods of jointing.

Section 7, Fittings for service pipes.
Section 8, Assembling pipes.
Section 9, Laying service pipes.
Section 10, Distribution pipes.
Section 11, Collection of roof water, storage of rainwater and tanks.

Vol.2. Water Supply 2 11-2

This volume deals with more specific details of cold water plumbing. Section 2. Taps and valves, the various types and how they operate.

Section 3, Water hammer, a common complaint and how to arrest it.

Section 4, The principle of cistern operations and applications.

Section 5, Defects and repairs to water services.

Section 6, Catchment of rainwater, basic calculation of catchment area and tank sizing.

Vol.3. Water Supply 3 11-3

Section 2, Water purification involves aeration and filtration.

Section 3, Water softening, the causes of water hardness and softening process.

Section 4, Sterilisation of water by various methods.

Section 5, Appliances for raising water, more commonly known as pumps, the various types of pumps and their action and installation.

Section 6, Fixed garden sprinklers.

Section 7, Fire protection services such as fire sprinklers and hydrants.

Specification

The specification for the water supply to a building would describe the supply system to be adopted (galv. Wrought iron or copper, etc.) the types of taps and other fittings to be used, and the finishes required (e.g. exposed piping inside the building to be chrome-plated and where exposed externally to be painted). Tanks, stop taps, etc. would all be described in detail.

A typical description of the General Instructions for water supply to a house may be as follows:

> "Carry out the whole of the water supply to the building in strict accordance with the requirements of the M.M.B.W. Tap the street main and lay on water to the building with 20mm diameter G.W.I. supply pipe to rear of house.
> Provide for and install 20mm water meter and cover as required by the M.M.B.W.; seat on a suitable concrete or brick base.
> From the 20mm supply line carry 12mm branches to bath heater, bath, shower, basin, sink, wash boiler, two troughs, gully, W.C. cistern and external standpipe in front and rear.
> Provide all necessary elbows, tees, junctions, sockets, etc., jointed in accordance with regulations. Service pipes must be kept clear of buildings and all pipes on walls shall be secured with sturdy clips and holdfasts.

Water pipes are to be concealed wherever possible.

Exposed piping in kitchen and bathroom to be chrome-plated, and elsewhere to be painted to match walls. Taps to be supplied by hotwater contractor."

****

QUESTION PAPER No.26

1. Explain the following terms:

   (a) Static head
   (b) Hard water
   (c) Trunk service
   (d) Stop tap
   (e) Sedimentation
   (f) Breeching piece

2. What is a thermostatic mixing valve? How does it work?

3. What is water hammer, and how cam you prevent it?

4. What is the purpose of a fire sprinkler system and how does it operate?

****

Paper No. 27

HOT WATER SUPPLY

Hot water can be produced by a wide variety of appliances involving the whole range of available fuels. The methods can most usefully be classified into central and local systems and instantaneous and thermal storage appliances. In central systems water is heated usually in the boiler room by a cheap fuel which is also being used for space heating and distributed to taps throughout the building; in local systems the water is heated (often by electricity or gas) adjacent to particular appliances and to groups of appliances. One of the main criteria of choice between these systems is comparative economy of the installation and running costs. In order to keep water consumntion within a reasonable limit 'dead legs' of pipework serving hot water taps are governed to maximum lengths.

12m for pipes not exceeding 20mm diameter
7.6m for pipes not exceeding 25mm diameter
3m for pipes exceeding 25mm diameter
1m for pipes serving spray taps.

This limits the amount of cold water which has to be run to waste before hot water is delivered. The reason for the length limit is water saving, but it also serves to keep within bounds the time delay and consequent inconvenience which would result from the use of very long pipes. Where, in central systems individual appliances are too far from the central plant to allow the use of single pipes to serve the taps, a circuit of pipe-work (called a secondary circulation) with either gravity or pumped flow can be used to maintain a constant flow of hot water which can be quickly drained off through a short length of delivery pipe serving taps.

It will be readily appreciated that a central system which has to have a secondary circulation will require a substantial pipe installation and that the heat losses from the pipework, even where reduced by lagging, will be continuous, including the summer months. Local systems, while they save pipework, usually being served by the cold water pipe system, and eliminate heat losses from distributing pipes, require a number of heaters, which often use a more expensive fuel than a central system.

It is apparent therefore, that large and continuous hot water demands, particularly if they are close to the central plant, are best dealt with by central installation, while scattered hot water points, particularly if the use is very intermittent, can often be more economically served by local water heaters. In many cases it will be difficult to decide which method is more economical.

Instantaneous Water Heaters are normally restricted to use as local heaters because of the limited flow of hot water which can be produced. The thermal capacity of water is high to raise 8 litres of water per minute $55^{\circ}C$ (flow for a lavatory basin tap and the usual temperature increase required) requires a heat input of 17kW. This is a rate equivalent to the full space heating requirement of a small house. The output which can be achieved from an appliance of reasonable size is, therefore, very limited. A large gas instantaneous heater may deliver a flow from between 10 to 20 litres per minute, while the flow from a 3kW electric spray tap may be only 1 or 2 litres per minute. Gas instantaneous heaters are used for the whole hot water supply of small dwellings but apart from this, instantaneous water heaters are used locally for the specific appliances that they serve.

Electric Storage Heaters use a vessel to accumulate hot water. It is possible with this form of heater to use a modest heat input,, while sudden heavy draw-off can be catered for by the stored hot water. It is necessary to balance the capacity of the heater and the heat input (recovery rate) so that the likely demands can be met. The water is heated in a boiler on the ground floor or roof space and the hot water accumulates by thermo-syphon action in the cylinder. Fresh cold water is introduced into the cylinder from a cistern at higher levels and makes up any water drawn off from hot taps. This system is shown by the diagram on Plate 1.

At one time a decision had to be taken whether the system should be 'direct' (water passing through the boiler can also be drawn off from the taps) or indirect (water circulating through the boiler and heating the cylinder as a separate system from the water drawn off at taps). The direct system is subject to furring or corrosion of pipes, while the indirect system, although universal in large installations, is expensive for small houses.

The problem has been overcome by the development of patented indirect cylinders which effectively separate the boiler flow (primary circulation) from the stored hot water while allowing the boiler to be filled and vented through the cylinder without the need for an additional cistern and pipework.

The usual loading for immersion heaters used in this way is 3kW. This gives a very slow recovery rate. The 3kW heater will take some three hours to raise 150 litres of water 55°C. This slow rate of heating a cylinder may cause considerable annoyance and often contrasts unfavourably with the very much quicker heating-up achieved by the boiler, which will invariably have a higher rate of heat output. This is particularly the case when heating is also provided by the boiler. Except in the coldest weather the boiler will have unused capacity which can contribute to water heating and will thus speed the recovery rate of the cylinder.

Immerse heater - 3kW → 150l of 55°C ?. 60 [illegible] 3 hr [illegible]

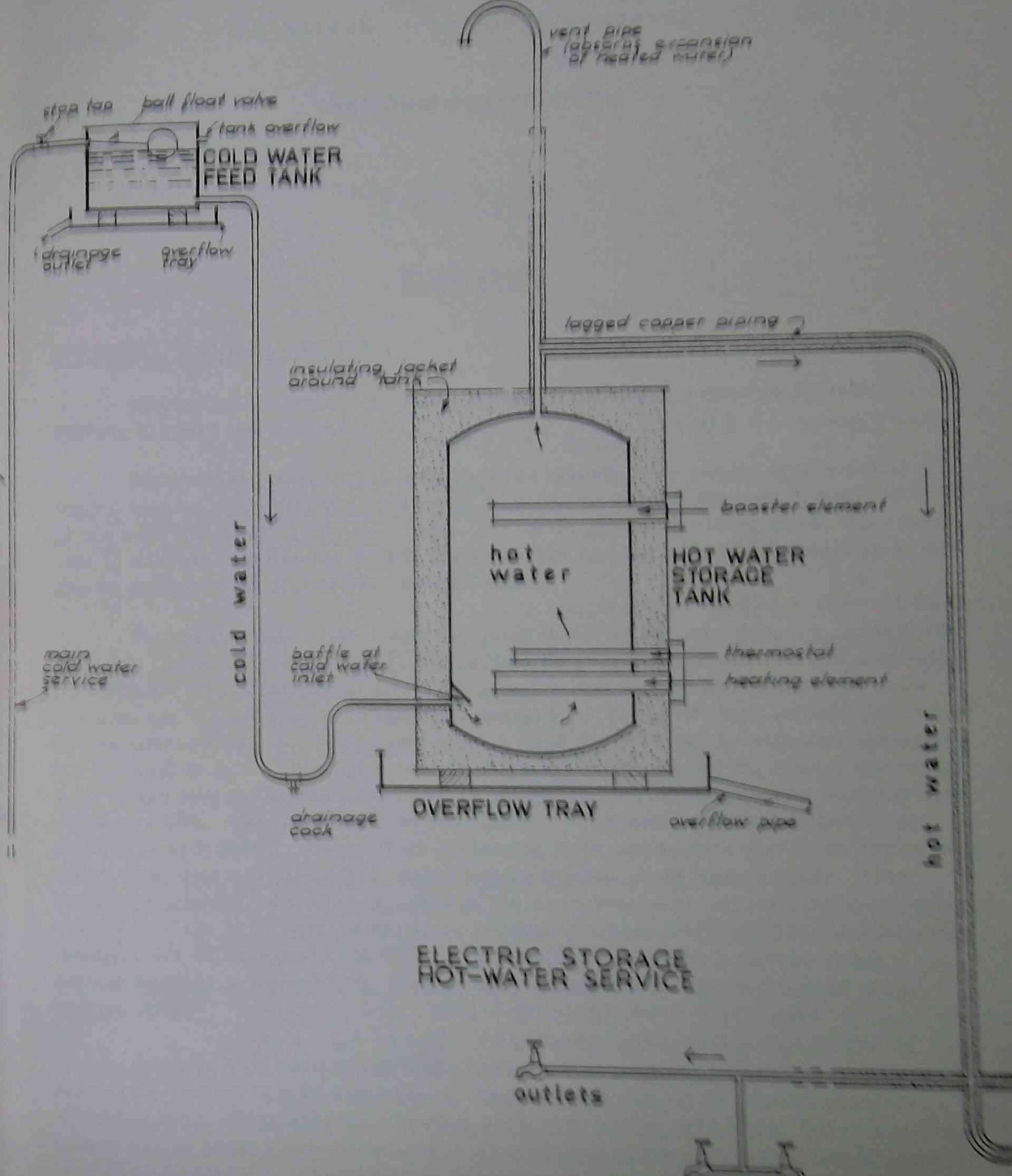
QUESTION PAPER NO. 27

1. Name two advantages of electricity over coal or briquettes as a fuel for a hotwater system.

2. Draw in simple diagrammatic form a storage hotwater system, complete with feed tank and connecting to four points (bath, sink, troughs and basin). Name each of the parts and show the direction of water flow in all pipes.

3. (a) Explain briefly in your own words, the object of a booster element in an electric hotwater service.

   (b) What is the purpose of the thermostat?



HOT WATER PLUMBING

paper 27
PLATE 1

PREPARATION OF THE CEILING

(i) Setting out the Battens Suitable battens are ex. 50 x 25 oregon or soft pine. They should be straight grained and well seasoned. Ceiling battens are usually fixed to the timber joists. In setting out battens, set out the positions to take cornices, joints, mouldings and any parts which have definite positions. Then calculate the spacing between these. The maximum distance between centres is 450 mm.

Flat headed 50mm gauge nails are used for fixing battens but if much packing is required longer nails should be used.

(ii) Straightening the Battens Joists are rarely straight throughout, and in order to have a straight ceiling it is necessary to pack the battens down to line up with the lowest batten.

In order to allow for packing down, one method is to leave the nail heads protruding about 12mm when tacking the battens up, and to drive them home when packing is done.

(iii) Packing the Battens To pack the battens, packing pieces are inserted between the batten and the joist and should go across the full width of the batten to give an even bearing. The wooden packing pieces of correct thickness should be used.

FIXING THE CEILING SHEETS

As battens and joists cannot be seen readily by workmen when they are holding a sheet, the positions of these are marked on the wall, in such a position that they will not leave a permanent mark. The cornice usually covers these marks. By sighting the marks, the positions of the battens are quickly found.

Sheets for ceilings should be pulled into position on the scaffold and carried to a point under their final position. A light smooth piece of timber, about 100 x 25 in section, is useful for stiffening sheets during the fixing operations. This is placed lengthwise in the centre of the sheet and held against it at the ends. The workmen then quickly pull the sheet up over their heads onto a horizontal position. The board is supported on the heads of the workmen whilst driving in sufficient clouts to hold the sheet up. While one workman holds the sheet firmly, the other quickly drives in more clouts.

The best fixing for ceiling sheets is obtained if the clouts are driven into battens close to the joists. Battens are generally springy between the joists.

These provisions are vital in ensuring adequate adhesion between the background and the undercoat; similarly, render and floating coats must be scratched whilst they are setting to give a good key for later coats

Excessive draughts must be prevented whilst the set is taking place, the drying out should be allowed to proceed naturally, traffic on floors having a plastered ceiling should not be allowed until the set is completed. The cracking of plaster frequently occurs where there is a change of background, as for example, between the walls of a house and the ceiling. This can be prevented by having a cornice or by making a horizontal cut with a trowel at the junction

Plastering Technique

Door and window frames, skirting plugs and similar joinery work - known as first fixing - having been completed, the surfaces to be plastered are prepared as described above and cleaned. Wall surfaces are done first and those that are very porous are dampened if necessary. Assuming that three-coat work is being used, the render coat is mixed and applied evenly by a plasterer's trowel; this is made reasonably true by a two-handed trowel about 1 to 2m long known as a float. If metal or timber angle beads are used at the angles, they are fixed before the render coat. Before the undercoat has hardened, the surface is well scratched to give a key for the next layer. Screeds or 150mm wide strips of floating coat are then formed vertically at 1.8 to 3m intervals, they are made plumb and in exact alignment; intermediate screeds are then made about 1m apart and the spaces between are filled and levelled as before. The surface is again roughened, the setting coat applied, and this is polished with the steel trowel just before it sets; over-trowelling is deprecated as it can cause crazing (fine hair cracks). The technique is similar for two-coat work

Cement and/or lime undercoats must be allowed to dry before further coats are added and unlike gypsum mixes, the surfaces must first be sprinkled with water.

Skirtings, architraves and other cover moulds should not be fastened - known as secons fixing - until the plastering has set.

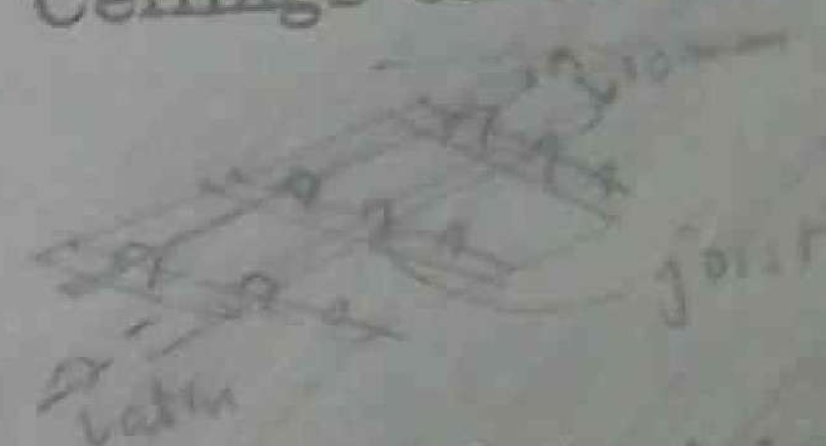
Plastering Failures

Popping, pitting and blowing caused by unsound lime and that which has not been slaked properly. The unslaked particles expand to leave small holes in the plaster.

Poor adhesion caused by a high suction of the backing, too rapid drying out or by moisture being imprisoned in the wall which subsequently emerges through the plaster in the form of blisters. Due also to inadequate key and incorrect choice of plaster.

Cracking due to shrinkage on drying out, is associated with cement or lime mixes. Movement of the background is also responsible, as for example the drying out of timber ceiling joists. Caused also by snads containing more than 5% silt and clay. Failure tc provide discontinuity where the background changes is another reason.

Ceiling Collapse Wood lath and plaster ceilings are rarely used now, they collapse (as will metal lathed ceilings) if the key is inadequate or if they are vibrated by traffic before they have set. Ceilings on concrete surfaces must be given a good mechanical key.



PLASTERED CEILINGS

Plastered ceilings are the usual type of finish to joists in domestic work.

For a joisted ceiling, the wood lath and plaster finish was the traditional method. Timber laths 38mm wide, from 3 to 13mm thick were nailed to the joists 10mm apart, the coarse stuff was well laid on to the laths so that the plaster penetrated the gaps and spread out behind them. This gave a good mechanical key and resulted in first-class work free from cracks which are sometimes common in present-day board finishes. Wood lath and plastering and lime based [illegible] now been replaced, very largely, by metallic lathing or plasterboard [illegible] gypsum plaster mixes.

Expanded metal lathing, which should be protected from corrosion [illegible] galvanizing (if condensation is expected) is nailed to the joists and [illegible] of plaster. Metal lathing is made in sheets 610 to 680mm wide [illegible] long, the thickness varies with the joist spacing, e g. 0.56mm and [illegible] joists at 350mm and 450mm centres respectively; 0.7mm metal [illegible] the usual domestic joist centres of 400mm. The short way size of [illegible] 6mm and 10mm, the former for hairless plaster, both being [illegible] added. The sheets are fixed with 32mm galvanized clout nails or [illegible] centres. The joists must be lapped at least 25mm and wired [illegible] with 1 2mm galvanized soft iron wire.

For concrete floors, the metal lathing is fixed to flat bars [illegible] the floor.

22mm by 6mm flat bars supported at 1.2mm intervals and placed at 450mm centres are commonly used; a 6mm dia. suspension rod will support $1.5m^2$ of ceiling.

Rending coat and floating coat mixes applied to the lathing can be 1 cement: 2 lime: 9 sand; as well as aiding plasticity during application, the lime also minimises corrosion; 0.5kg of hair is added to $0.093m^3$ of first coat. Such mixes must be allowed to dry out throoughly before further coats are added. The same coats using gypsum plaster can be 1 plaster: 2 to 3 lime: 8 to 9 sand. A suitable finishing coat on both these mixes is 1 plaster: 2 to 4 lime putty. Special metal lathing plaster is also used for undercoats in the proportion 1 plaster: 1 sand; this can be finished as above, or with neat plaster.

Plasterboard

This consists of a core of gypsum plaster bonded between two sheets of heavy paper: there are four types from 10 to 13mm thick: baseboard, lath, plank and insulating baseboard. They are all similar except that the latter has a covering of aluminium foil on one side (that placed next to the air space and which is not plastered), and are obtainable in several sizes; 1.2m by 1.8m wallboard being commonly used. The boards are nailed to the joists at 150mm centres with 32mm by 2 2mm galvanized plasterboard nails. They should be fastened so that the joints are staggered. The joints are strengthened by a strip of 100 to 125mm wide jute scrim cloth which is plastered over them as they are being filled. When this has set, the surface is levelled with a coat of plaster between the scrimmed joints and a final coat is applied over the whole area; this is two-coat work (13mm thick) and used for good quality work. A cheaper finish is one-coat work (5mm thick) the plaster skimming follows immediately after the joints have been scrimmed. The same setting coat is used for two-coat work on a floating coat of plaster: 1½ sand. Lime must not be used in these mixes on plasterboard.

Insulating fibreboard is used in a similar way, scrimmed and plastered (preferably in one coat) with special low setting expansion quality plaster.

Plasterboard can also be used alone without having a plaster finish. In this case the board has chamfered edges in which a strip of linen or paper reinforcement is bedded in a special fine plaster which is also used to flush-point the joints. The latter system is widely used in Australian domestic work.

SPRAYED AND LIGHT WEIGHT PLASTERS

The development of sprayed plasters of various types is fairly recent, compared with the traditional hand applied materials. Sprayed plaster is used for a number of applications such as (i) decoration; (ii) acoustic treatment, (iii) fire-proofing.

The light-weight aggregates normally used for these plasters are vermiculite and perlite. Both aggregates are formed as a result of heat treatment driving off water, the steam from which expands the material. Since accurate grading and proportions are necessary to obtain a plaster with consistent properties, such mixing is done at the factory and only the addition of clean water is necessary on the site, the plaster being applied in the normal way or by spraying. Such plasters have exceptional fire resistance, good thermal insulation and considerable resilience, and in consequence, resistance to cracking. In addition, vermiculite aggregate plasters have good adhesion to concrete backings.

Weight

Approximately 2 kg. per square metre per 12mm thickness dry weight. This compares with approximately 6kg for gypsum and 8kg for lime or cement in the same thickness.

Fire Resistance

For most elements of structure these plasters double the fire resistance normally attained when traditional plastering is used.

As has been mentioned in previous papers, plaster is accepted as a fire-proofing material by most Building Authorities. Whereas concrete was once regarded as the only material for efficient encasing of structural steelwork, plaster under proper conditions is an efficient and much lighter substitute. To give a practical example, the Victorian Uniform Building Regulations allow a four hour fire rating for the following when applied as an encasing to steel columns.

> "38mm of gypsum-perlite or gypsum-vermiculite plaster over expanded metal lath weighing not less than 1.6kg/m^2 spaced 12mm from the faces and edges of the steel by means of steel channels 1.6mm in thickness at 600mm vertical spacings and expanded metal corner beads, the space between the resultant casing and column being not necessarily filled."

Solid Partitions - of plaster may be constructed in two ways:

(i) by use of precast gypsum blocks or panels.

(ii) by applying plaster (by hand or spray) to metal framing and lathing.

Precast blocks with hollow cores are made up to about 900 by 450 by 75 or 100mm thick for laying horizontally in a similar way to brickwork, producing a wall 75 or 100mm thick.

The light-weight aggregates normally used for these plasters are vermiculite and perlite. Both aggregates are formed as a result of heat treatment driving off water, the steam from which expands the material. Since accurate grading and proportions are necessary to obtain a plaster with consistent properties, such mixing is done at the factory and only the addition of clean water is necessary on the site, the plaster being applied in the normal way or by spraying. Such plasters have exceptional fire resistance, good thermal insulation and considerable resilience, and in consequence, resistance to cracking. In addition, vermiculite aggregate plasters have good adhesion to concrete backings.

Weight

Approximately 2 kg. per square metre per 12mm thickness dry weight. This compares with approximately 6kg for gypsum and 8kg for lime or cement in the same thickness.

Fire Resistance

For most elements of structure these plasters double the fire resistance normally attained when traditional plastering is used.

As has been mentioned in previous papers, plaster is accepted as a fire-proofing material by most Building Authorities. Whereas concrete was once regarded as the only material for efficient encasing of structural steelwork, plaster under proper conditions is an efficient and much lighter substitute. To give a practical example, the Victorian Uniform Building Regulations allow a four hour fire rating for the following when applied as an encasing to steel columns.

> "38mm of gypsum-perlite or gypsum-vermiculite plaster over expanded metal lath weighing not less than 1.6kg/m^2 spaced 12mm from the faces and edges of the steel by means of steel channels 1.6mm in thickness at 600mm vertical spacings and expanded metal corner beads, the space between the resultant casing and column being not necessarily filled."

Solid Partitions - of plaster may be constructed in two ways:

(i) by use of precast gypsum blocks or panels.

(ii) by applying plaster (by hand or spray) to metal framing and lathing.

Precast blocks with hollow cores are made up to about 900 by 450 by 75 or 100mm thick for laying horizontally in a similar way to brickwork, producing a wall 75 or 100mm thick.

A setting coat of plaster may be applied, or a complete 2 coat finish (floating and setting) as necessary. Precast hollow panels are also made the full height of a typical wall for vertical fixing.

Plaster may be applied to expanded metal which is fixed to light steel framework spanning from floor to ceiling. Some patented lath and frame systems are on the market, and these provide, when plastered, either solid or hollow partitions varying in thickness from 50 to about 110mm. Pressed metal sections for skirtings, door frames, etc., are provided as part of the partition system, and metal studs may be of pressed steel or fabricated from steel rods.

EXTERNAL PLASTERING OR RENDERING

Rendered walls are an alternative finish to facing bricks, they can be made in different colours and are used in places where clay bricks would be out of harmony with the surrounding landscape or where the only local brick is a concrete one of dull appearance. Rendering is used extensively as a waterproof finish to no-fines concrete walls, such walls are made from 300mm thickness and upwards and consist of 1 part cement: 8 parts of large aggregate (13mm): sand is not included in the mix and a sound well-insulated wall results because of the air voids.

Gypsum plaster mixes are quite unsuitable for external rendering; much traditional work still exists and this is made of lime mixes protected by paint. Cement: lime: sand mixes are now adopted and the proportions of these three materials is again dependent on the nature of the background and also upon the degree of exposure. A good key must always be provided, the bricks must be well fired and durable and the joints raked out 13mm; surfaces should be dampened if they are too dry before plastering starts and strong finishing coats must not be applied over weaker undercoats.

Of the many types of rendered finishes, the following are popular: scraped finish, roughcast (wet-dash), pebble dash (dry-cash) and machine finished. Smooth well-trowelled surfaces should be avoided as they tend to "craze", if cracks develop they are very obvious. The range of cement: lime: sand mixes given below varies in strength in order to suit the degree of exposure: two types of background are considered: (a) strong, as given by dense bricks and concrete, and (b) moderately weak as with light-weight concrete, etc.

Scraped Finish

1 : 1: 6 to 1 : 2 . 9 on (a) and (b) backgrounds for both undercoats and finishing coats, the top 1.5mm of the latter is scraped off just as it begins to harden. This removes the top fatty skin which tends to develop during the application of the wood trowel which should always be used in preference to the steel trowel.

Building Construction

Paper 28

Roughcast Finish

1: 0: 3 to 1: 1: 6 for (a), with 1: 1: 6 for (b) as both undercoats and the second coat. Whilst the latter is still soft, a mix of the same proportions but including 60% of 6mm gravel in the aggregate is thrown on to the wall to give the wet-dash finish. This is more durable than the next finish described.

Pebble-dash Finish

The mix and the procedure is the same as for roughcasting except that the thrown-on coat consists of dry pebbles or crushed gravel only; the pebbles tend to drop off in time.

Machine-made Finish

(Tyrolean) The undercoat procedure is the same as for the scraped finish. The final coat is thrown on by the blades of a small hand machine, alternatively it can be sprayed on by a hose delivering the mix by air pressure.

****

Stott's Correspondence College

BUILDING CONSTRUCTION

PAPER No.13

BRICKWORK (Part 1)

The bricklayer's trade is one of the oldest in the history of Building. It is one which has retained its importance and has seen a number of developments. Nevertheless in spite of these changes the fundamentals of bricklaying remain essentially the same as they have always been, and a knowledge of these basic points is important for any builder.

This paper and the following one are to be read in conjunction with the textbooks "Bricklaying Fundamentals" and "Bricklaying Operations" which are issued with this Course. Although reference is made in these notes to certain sections of the textbooks, the student is advised to study the entire book as he proceeds.

1. TERMS

It is recommended that the student should commence by reading pages 19 to 22 of the textbook "Bricklaying Fundamentals". These give a number of the more important terms which are commonly used when referring to brickwork. These names will be repeated many times throughout the Course in various references, and these four pages can be used as a guide until the terms are familiar.

Take particular care to understand the following terms : Arris, Bat, Stretcher, Header, Bed Joint, Perpend, Course, Quoin, Closer King Closer and Queen Closer).

2. BRICKS

Study pages 2 to 8 of the textbook regarding bricks. Some special types of bricks are as follows:

(a) Sill bricks (also spelt 'Cill') are special flat bricks made for use on sloping window sills.

(b) Fire bricks are special heat resisting bricks made for use in fire-places, incinerators and large chimney flues. Firebrick is also available in large slabs for fireplace backs and in special shapes as required for circular flues and other applications.

(c) Heeler bricks are thin bricks - usually 40mm or so thick instead of the usual 75mm. They are used for cappings (i.e. tops of walls or chimneys, etc.) and also for decorative purposes, as in fireplace surrounds.

(d) Tapestry bricks are also decorative bricks. They too are often thin and may have decorative grooving or similar patterns on the edges.

3. MORTAR

As described in pages 8 and 9 of the textbook the three main types of mortar in common use are :

(a) Lime mortar
(b) Cement mortar
(c) 'Compo' mortar

Mortar can be made more waterproof, usually by the addition of patent mixtures, and can of course be coloured when it is required to match the brick-work.

Note the proportions of sand and cement, etc., used in the various mortars. These proportions can be varied somewhat but those given are a good indication of typical mixes.

Cement mortar is used for brickwork below ground, for sills, steps, chimneys and other places requiring special strength or waterproofing. Compo mortar is used in most other places. Lime mortar is not commonly used now.

4. DAMP-PROOF COURSES

In spite of their apparent hardness bricks are very porous, and dampness can soak through brickwork for long distances. To prevent, or at least to control the passage of moisture, Damp-proof Courses (often abbreviated to "D.P.Cs") are inserted in brickwork as required. The most common place is just above ground level - in order to stop damp from rising from the ground. A second D.P.C. is often placed 2 courses above this one as an additional protection.

The student should refer to Section 8 of the textbook, "Bricklaying Operations".

Damp-proof courses are also necessary in a number of other places, for example:

(a) In parapet walls, above roof level.

(b) In chimney stacks, just above roof level.

(c) See Section 8 of the textbook for illustrations.

Materials used for damp-proof courses can vary considerably, as described in the textbook. A common type mentioned in the book is an aluminium sheeting covered each side with bitumen.

Basements, and other areas below ground, are usually waterproofed either by a cavity wall or by a coating of asphalt or other damp-proofing. Both these methods are shown in the textbook.

5. REINFORCEMENT

Brickwork is usually "tied" together by setting strips of wire mesh reinforcement into some of the horizontal brick joints. This applies particularly to cavity walls and is clearly explained and shown diagrammatically in Section 11 of the textbook, "Bricklaying Operations".

6. WALL TIES

Study the section on "Cavity Walls" on pages 36 to 39 in the above textbook.

7. VENT FACES are described in detail on pages 42 and 43 of the textbook. The importance of room ventilation should not be overlooked, and ventilation of the area under the Ground Floor is also extremely important.

8. LINTOLS (also spelt 'Lintels') are required to support the brickwork over openings. They are covered in more detail on pages 57-60 of the textbook.

9. BONDING

This is one of the most important aspects of the bricklayer's trade, and simply refers to the method of arranging the bricks in a wall so that they are lapped together to give greatest strength and best appearance. Study "Bricklaying Fundamentals", Sections 13 and 14, paying particular attention to the following -

Firm fixing is obtained if clouts are driven a short distance on each side of the joists. This requires more clouts but reduces the span between then, thereby lessening any tendency for the sheets to sag. Electrical wires should be pulled through where required.

SCRIMMING

Scrimming is one of the most important operations in fixing work. Its object is to tie sheets together and this work must be done properly to be successful.

After punching has been completed, the plaster is gauged in a bucket and taken above the ceiling. Fibre of scrim is dipped into the plaster and then laid over the joints and rubbed on to the sheets or mouldings, on each side of the joint. At least a 25mm grip should be allowed on each side of the joint, and should be the full length of the joint.

Corners under the hips of a roof are most likely to be improperly scrimmed as access is sometimes difficult. Extra care is therefore necessary at these points.

Light wooden strips are often held or tacked over the face side of joints in the sheets to prevent any plaster from running through. If plaster is very dry it is advisable to splash the backs of the joints with water before scrimming.

FLUSH JOINTS

There are three methods of making flush joints which are commonly used:

(i) Scrimmed Joint It is the strongest type of joint, the hemp and plaster binding the sheets firmly together. Access to the top of the ceiling is necessary.

A batten if fixed on each side of the joint which crosses the joists, at about 25mm from the joint.

The sheets are fixed about 10mm apart and hemp fibre which has been dipped into plaster is laid on the back and edges of the sheets, and then rubbed onto the sheets on each side of the joint.

Joints running the other way are treated in a similar manner but have no battens parallel with the edges.

(a) Stretcher bond - the most common of all.

(b) English bond - usually regarded as the strongest bond for walls of 220mm or more in thickness.

(c) Flemish bond - double and single.

(d) Colonial bond.

Draw for yourself the 2 plans of a 230mm thick wall in English bond shown on page 68. Note how the "Queen Closers" (which are simply cut bricks 55mm wide by 110mm long) are placed beside the end "header" in each second course, thus "pushing over" all the adjacent bricks in the same course 55mm. This of course brings them into the correct place to lap properly over the bricks below and above. This method of obtaining the correct method of overlapping is used in many types of bond, as can be seen from the textbook illustrations. The student should make himself familiar with these typical arrangements of bricks in the various bonds and should be capable of drawing them to scale. (A brick being drawn as 230 x 110 mm on plan by 76mm high.)

10. JOINTING

Struck joint - brickwork of horizontal mortar joint

The most common method of finishing the horizontal mortar joints in brickwork is probably the "Struck" joint. There are however, a number of alternatives, and these are shown on page 2 of "Bricklaying Operations".

Refer also to pages 48 and 49 regarding "Expansion Joints". These are more important in brickwork than ever before because of the "newness" of most bricks and the resulting increased tendency for the bricks to change in size with time and changes in temperature, etc.

11. BAGGING

By smearing a thin film of mortar over the face of a brick wall as the work proceeds, a cement coloured surface is produced. This is often used in stores and similar buildings where plastering is considered too expensive. It has also been used for its decorative effect on houses, etc. The textbook refers to it on page 3.

[illegible] thin film mortar [illegible]

Bagging

[illegible]

QUESTION PAPER No. 13

1. What is meant by the following terms, as applied to Brickwork?

   Use sketches where possible.

   (a) Perpend

   (b) Closer

   (c) Heeler brick

   (d) Struck joint

   (e) Wall ties

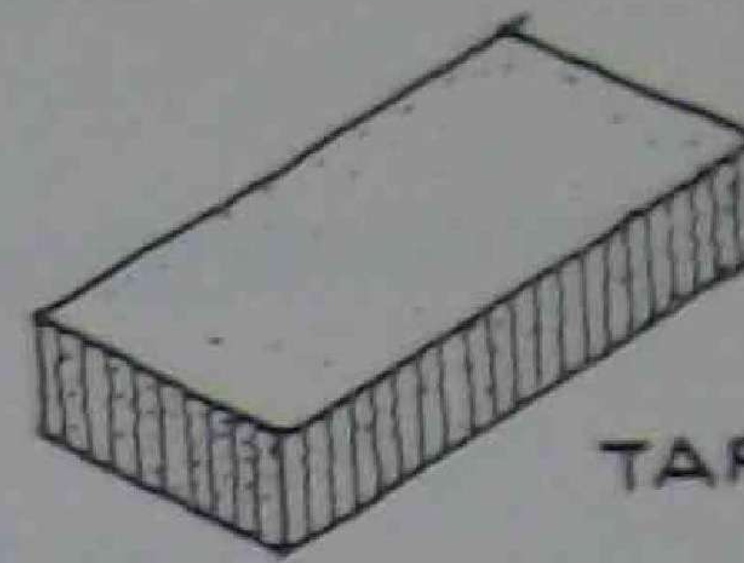
2. Draw a simple elevation of a small section of wall in :

   (a) Stretcher Bond

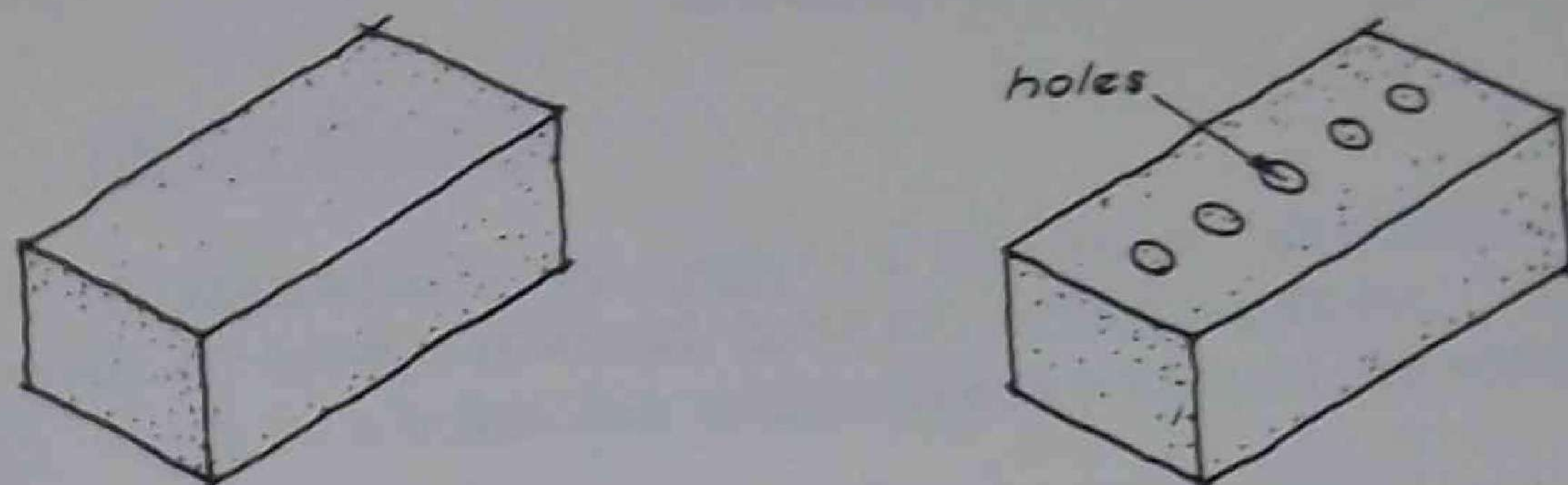
   (b) English Bond

---oOo---

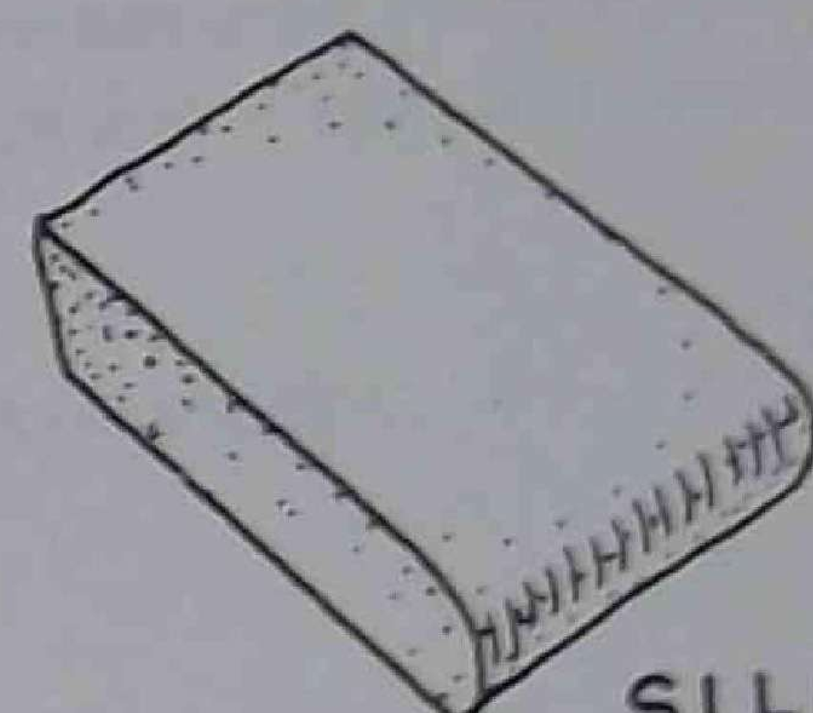
HEELER BRICK



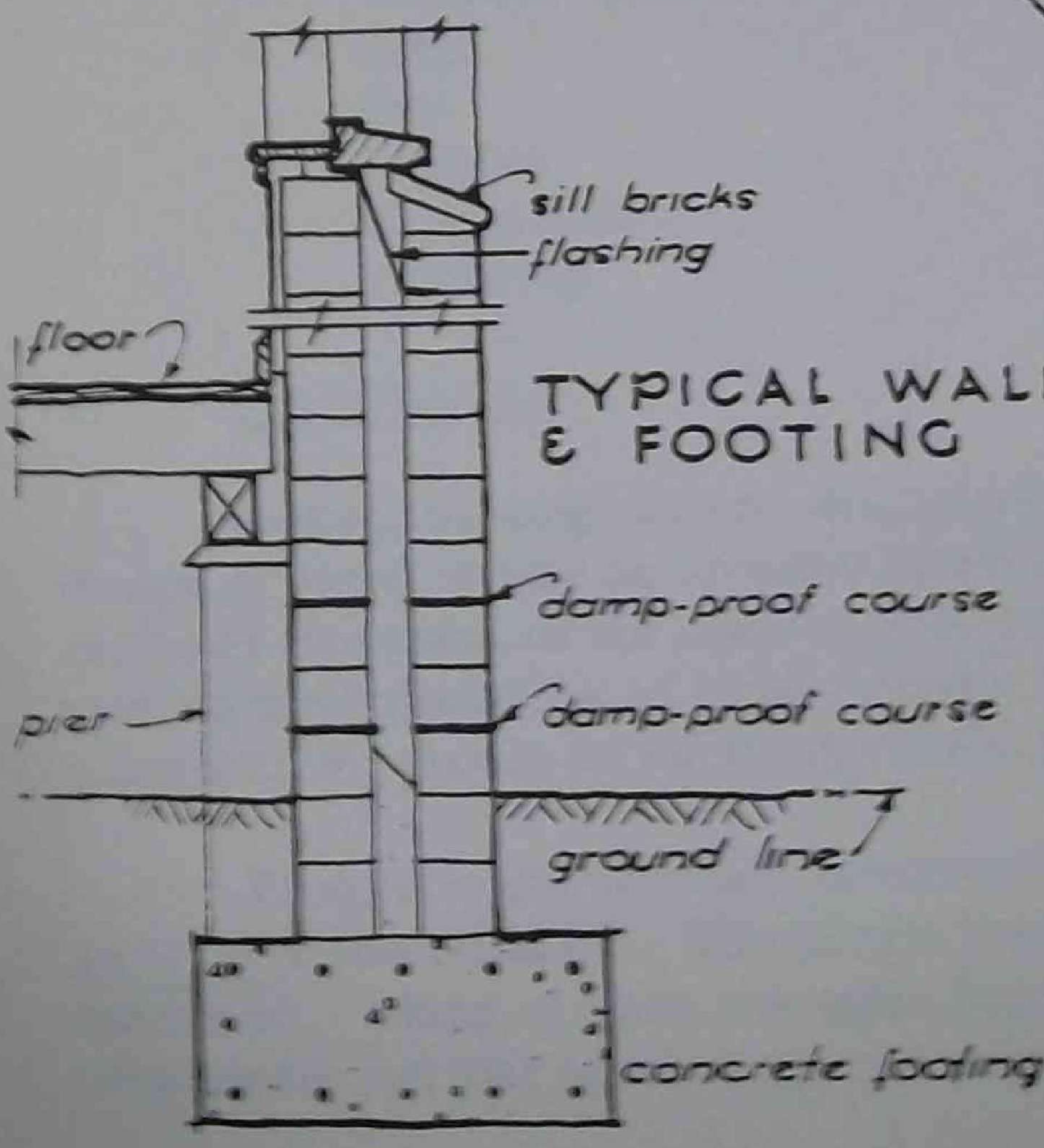
TAPESTRY BRICK



TYPICAL WIRE-CUT BRICKS



SILL BRICK



TYPICAL WALL & FOOTING

BRICKWORK

paper 13
PLATE 1

BUILDING CONSTRUCTION

PAPER No.14.

BRICKWORK (Part 2)

1. BRICK ARCHES

Fundamentally, an arch is a method of spanning over the top of an opening in a wall, by means of small units all acting together. This is in contrast to a lintol, which is a beam and spans directly across the opening.

Arches can be constructed of brick or stone units.

Study pages 51 to 55 of "Bricklaying Operations" and learn the terms used in arch construction. The following terms are very commonly used - not only in brickwork, but in masonry and other trades - and are particularly important:

Span
Voussoir (pronounced 'voo-swah')
Soffit
Key
Spandril
Gauged arch
Centering

2. FIREPLACES

Central heating has not eliminated the popularity of the open fireplace, the design of which should be familiar to every builder. There are many types of enclosed fire units on the market now, and no regular rules can be laid down regarding the installation of these, except to say that the recommendations of the manufacturer should be followed carefully in every case.

Fireplace and chimney construction is described and illustrated on pages 78 to 86 of the textbook. The terms listed on pages 78 to 80 should first be examined. Many of them are quite familiar even to those not accustomed to building terms, but several special names are also included in the list.

A simpler fireplace detail is shown on page 79 of the textbook. This illustrates clearly the basic rules of good fireplace design, namely:

(a) Sloping back, which is carried well up behind the front opening (preferably 200 or 230mm above).

(b) Adequate flue size. 230 x 230mm should be regarded as minimum for any open fireplace. A large fireplace should have a flue of 350 x 230mm or so (i.e. 1 brick x 1½ bricks in size). Note the parging of the flue.

(c) Narrow throat This is the 110mm opening between the fireplace and the flue. It could be reduced to 75mm which is a common width to use. (Take note that this top opening is almost directly over the centre of the actual fire area.)

(d) Smoke shelf. This is the horizontal area directly under the flue opening, and is provided partly to prevent any rain coming straight on to the fire and partly to stop down-draught.

(e) Well-proportioned fireplace opening. The depth of the back hearth (i.e. the place where the actual fire is put) should never be less than 450mm, and in a large fireplace should be increased to 525mm or so. The width of a fireplace opening should be greater than the height of the opening. 750 mm is a practical minimum width.

The flue should always be carried sufficiently high above the roof line to prevent down-draughts. A reasonable rule is to take the top of the chimney at least 350mm or so higher than the level of the nearest ridge line.

3. CAVITY WALLS

The hollow brick wall was referred to briefly in the previous paper. A more detailed description can be read in the textbook on pages 36 to 40.

The cavity wall is now the standard method of brick house construction in most parts of Australia. Study the drawings on page 31 of the textbook. This shows clearly how the 275mm wide wall is built up from a concrete footing, with piers on the inside to support the floor construction. The hollow wall is carried up to ceiling level, with a timber "plate" sitting on top of the inside wall thickness to act as fixing for the roof timbers. The outer 110mm wall thickness is merely carried up to the height required to reach the eaves construction.

The construction of gable walls is illustrated also on pages 97 and 98.

Footings: Refer to pages 20-23 of the textbook.

Flashing: Refer to pages 62-66.

Brick paving: Refer to pages 98-99.

4. MEASURING BRICKWORK

Calculating the number of bricks in a job is very important when preparing estimates and tenders. This is fairly simple arithmetic, but a few points of interest to the student are shown on pages 38 to 42 of "Bricklaying Fundamentals".

Bricks are normally measured and ordered by the thousand at the present time. The student should make himself familiar with the approximate method of estimating bricks as discussed in the textbook above.

QUESTION PAPER No.14.

1. Draw to a scale of 1:10 (preferably with drawing instruments) a Gauged Brick Arch having a span of 900mm. (Refer to textbook, page 53.) Show the following on the drawing:

   (a) the span P 54

   (b) Voussoirs

2. Draw to a scale of 1:20 a wall Section through a Brick Veneer Construction. Include the names of the various parts shown.

3. Describe in your own words the factors which are important in the correct design of an open brick fireplace. Illustrate your reply with freehand sketches.

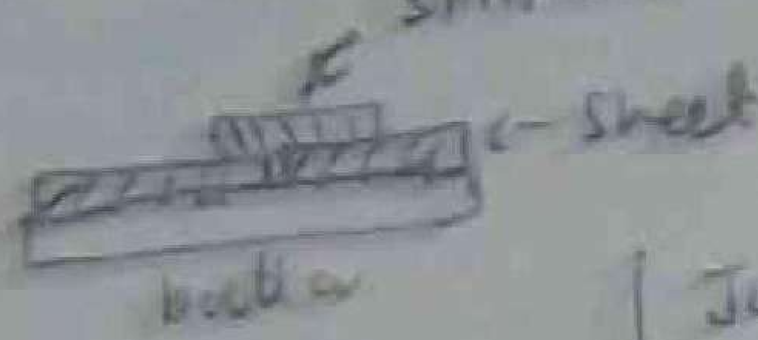
mote + P35

--oOo--

(ii) Caulked Joints   It is sometimes used when access to the top of the ceiling is not available.

The edges of the sheets are hacked well with a sharp knife, to expose a fair proportion of fibre. Fibre is chopped into short lengths and mixed with plaster. It is then forced well up into the joints, so that it overlaps the top slightly and grips the exposed fibres in the sheets. This type of joint is not as good as the scrimmed joint.

(iii) Rebated Joint   Sheets may be nailed to the one batten, provided it is wide enough and fixed to correct lines. The rebate is roughened and strips of scrim, dipped in plaster are laid in the rebate across the joint, thus tying the sheets together.



STOPPING

Joints and nail holes are stopped with neat plaster, or in some cases, with plaster and putty. A retarder is often used. Lime putty should be used sparingly, the less the better. Laying trowels, small tools, joint rules, and soft brushes are the main tools required.

The object of stopping is to fill up all the holes and to leave a clean face to match the cast work.

ACOUSTIC TILES (Plaster composition)

These are frequently fixed by fibrous plasterers, and are often finished with fibrous plaster mouldings. Usually they are made in set sizes and any variation of width of room is provided for by varying the margin. As each maker has different styles, it is advisable to work to manufacturers' instructions.

****

QUESTION PAPER No. 29

1. Describe briefly the following terms as they apply to fibrous plaster work:

   (a) battens
   (b) scrimming
   (c) stopping
   (d) caulked joint.

2. Draw a freehand sketch through a typical fibrous cornice showing its relation to wall and ceiling.

3. Describe the most important aspects of wall and ceiling preparation before the fixing of fibrous plaster sheets.

BUILDING CONSTRUCTION

PAPER NO. 30

ELECTRICAL INSTALLATION

The Electrician's trade is another which is highly skilled and specialized. Unlike some of the traditional trades, it is becoming more important and complex each year. Not only is more electric power being required each year to supply an increasing quantity of mechanical plant and to cope with improved standards of artificial lighting, but even the process of building makes greater use than ever before of electric equipment. At the present time power is required on the building site at a very early stage, and trends indicate that this need will increase even further.

1. Terms: (a) The essential commonly used terms relating to electric pressure, current and power are:-

Volt	- The Unit of electrical pressure.
Ampere	- The Unit of electrical current or intensity of flow.
Ohm	- The Unit of resistance.
Megohm	- 1,000,000 ohms.
Watt	- The Unit of power (= Volts x Amps)
Kilowatt	- 1,000 watts.
Kilowatt Hour (or Unit of Electricity)	- 1 KW for one hour.

The simplest rule in electrical calculations is also the most important. This is "Ohm's Law" which states that the relationship of Current, Voltage and Resistance in a circuit of direct current is given by:-

$$\text{Volts} = \text{Amperes} \times \text{Ohms}$$

Alternative statements of the same law would be

$$\text{Ohms} = \frac{\text{Volts}}{\text{Amperes}} \quad \text{(or)} \quad \text{Amperes} = \frac{\text{Volts}}{\text{Ohms}}$$

In the case of Alternating Currents, the Resistance in Ohms is replaced by the "Impedance" in ohms. Impedance takes into account the frequency of the alternating current, and its detailed study is beyond the scope of this Course.

(b) The accepted abbreviations used in electrical work are those listed below. The student should study the unfamiliar ones and refer back to them whenever necessary, until he is familiar with them:-

A.	Amperes
A.C.	Alternating Current
C.P.S.	Cycles per second (refers to frequency of A.C.)
D.C.	Direct Current
E.M.F.	Electro-motive force (electrical pressure, or voltage)
H.T.	High Tension (i.e. high voltage)
K.W.	Kilowatt
K.W.H.	Kilowatt-Hour
L.T.	Low Tension
P.P.	Power Point
S.B.	Switchboard (S.S.B. = Sub-switchboard)
S.E.C.	State Electricity Commission (Victoria)
T.P.S.	Thermoplastic Sheathed (refers to plastic covered wire)
T.R.S.	Tough Rubber Sheathed (rubber covered wire)
V.	Volts
V.I.R.	Vulcanised India Rubber (cables insulated with vulcanised rubber)
W.	Watts.

2. Direct and Alternating Current:

(a) Electricity may be divided into two main types - Direct and Alternating. Direct Current (or D.C.) may be considered as a continuous flow of electricity in one direction - from "positive" to "negative". Alternating current, on the other hand, is a reciprocating or alternating flow, that is, the direction of the current along the wires is first in one direction and then the other; one being a varying positive flow and the other a varying negative flow. A combination of one positive pulse and one negative pulse is known as a complete "cycle". The number of cycles in one second (C.P.S.) is a measure of the Frequency of the A.C. Local practice is to generate alternating current at a frequency of 50 C.P.S.

(b) Alternating Current has many advantages over Direct Current for power distribution. The big advamage, in simple terms, is that the voltage may readily be "stepped up" or "stepped down" by the use of transformers. A transformer is a very efficient electrical device usually consisting of an iron core on which are wound two insulated coils of wire, each having many turns. Alternating current fed into one of these coils will cause a corresponding varying magnetic field around the iron core, which in turn induces an alternating current of similar frequency in the other coil. The voltage induced across the second coil is approximately proportional to the ratio of the number of turns in that coil to the number in the first (or "primary") coil. Thus by adjusting the number of turns in the second coil (the "secondary winding") the output voltage can be adjusted within a very wide range, either greater or less than the primary voltage. Keeping in mind that Power is the product of voltage and current, it will be appreciated that an increase in voltage through a transformer will introduce a reduction in the current, while a decrease in voltage through a transformer will make available a larger current.

The practical application of this control of A.C. voltage (and current) is seen in the reticulation of electric power over long distances. The size of wire needed to conduct electricity depends on the current flowing. Thus by reticulating A.C. at many thousands of volts, high power can be transferred with a reasonably low current flow. This is done, for example, from Yallourn in Victoria to many parts of the State. At its destination, this high tension voltage (H.T.) is supplied to "step-down" transformers which supply the normal 230 to 250 volt supply.

Transformers of much smaller types are frequently used in household equipment (radios, television, etc.) to adjust the 230 V. supply as required for the equipment concerned. Step-up transformers are required for neon type lighting, which requires high operating voltages.