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# PLASTERERS' WORK

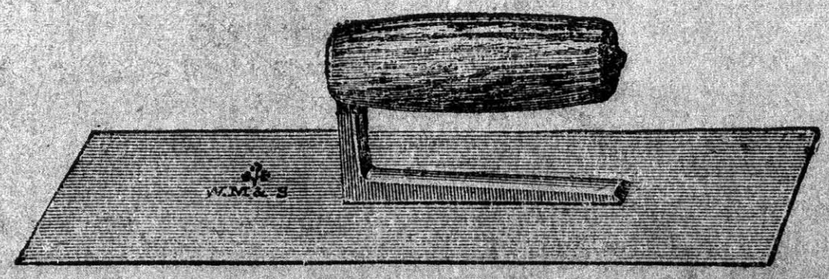
**Materials; Tools; Plastering Ceilings and Walls; Mouldings and Cornices; Plaster Casting; Estimating and Measuring; Repairing Plastered Surfaces**

**With Numerous Illustrations.**


**Edited by**

**PAUL N. HASLUCK**

***Editor of "Work," "Building World," etc.***


**CASSELL & COMPANY, Limited**

**London, Paris, New York & Melbourne**

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# PREFACE.

THIS Manual contains, in form convenient for everyday use, a comprehensive digest of the knowledge of Plasterers' Work scattered over twenty-one volumes of BUILDING WORLD—one of the weekly journals it is my fortune to edit.

In preparing for publication in book form the mass of relevant matter contained in these volumes, much had to be arranged anew and largely re-written. It is, therefore, impossible to distinguish the writings of individual contributors for acknowledgment.

Additional information on the matters dealt with in this Manual, or instructions on kindred subjects, may be obtained by addressing a question to the Editor of BUILDING WORLD, La Belle Sauvage, London, E.C., so that it may be answered in the columns of that journal.

P. N. HASLUCK.

*La Belle Sauvage, London,*
*March,* 1906.

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# LIST OF ILLUSTRATIONS.

# PLASTERERS' WORK.

## CHAPTER I.

### PLASTERERS' MATERIALS.

THE plasterer, as the term implies, works in plastic adhesive compositions, which are laid on walls and ceilings, both internally and externally, to stop crevices, reduce inequalities, and produce an even, delicate surface, capable of being decorated in colour. These compositions are as various as the modes of applying them, the rudest material being a compost of loam or marly clay and lime. This, of course, is used only for the meanest purposes, and, being laid on in one coat, is washed over with a thin mixture of lime and water (lime whiting). There are many grades between this and the highest work of the plasterer.

The book will deal chiefly with the work of the operative plasterer in the building trades; thus, attention will be drawn to the necessary materials and tools and to the methods of plastering walls and ceilings; then the running of cornices and similar moulded work will be described, and much of the remainder of the book will be devoted to the methods now in vogue for plaster casting from various kinds of moulds—work which, though included in the plasterer's craft, does not often come within the scope of the ordinary journeyman plasterer. The latter part of the subject is exhaustively treated in a "Work" handbook, "Clay Modelling and Plaster Casting," and readers are referred to that hand-

book for any further particulars of the various processes of casting they may require.

The materials commonly used by the plasterer comprise laths, lath nails, lime, sand, hair and plaster, and cements of various kinds.

Laths are narrow strips of firwood, either rent from the tree trunk or sawn from battens. The wood useful for splitting into laths is technically known as "lath-wood." It is mostly Baltic fir, which is imported from Memel and other Baltic ports in half-round logs—the young trees cut into lengths and split down the centre. The laths are cut to various lengths, to suit the distances of joists and studs or quarterings of a partition ; and in thickness they vary from $\frac{1}{8}$ in. to $\frac{3}{8}$ in. Ordinary laths are in 3 ft. or 4 ft. lengths, about 1 in. wide, and called single laths if about $\frac{3}{16}$ in. thick, lath and a half when about $\frac{1}{4}$ in. thick, and double laths when about $\frac{3}{8}$ in. thick. They should be free from all splits and other defects, and all knotty or crooked laths should be rejected.

There is some misunderstanding as to what is meant by a bundle of laths. The standard bundle consists of 100 laths, but for every 6 in. less than 4 ft. in length, an additional ten laths per bundle is allowed. For example :—Bundles of laths 3 ft. long contain 120 laths = 360 ft. run ; bundles of laths $3\frac{1}{2}$ ft. long contain 110 laths = 385 ft. ; bundles of laths 4 ft. long contain 100 laths = 400 ft. ; bundles of laths $4\frac{1}{2}$ ft. long contain 100 laths = 450 ft. ; bundles of laths 5 ft. long contain 100 laths = 500 ft. The length of a lath varies in different districts. In south-east Lancashire, joists and spars are set at 16 in. centre to centre, and the custom is to use laths 4 ft. in length, thus spanning three spaces.

It is usual to reckon that 1 bundle of 3-ft. laths (360 ft.) and 670 nails will cover from $4\frac{1}{2}$ to 5 super. yards ; as will also 1 bundle of 4-ft. laths and 625 nails.

Woven wire is sometimes used instead of laths, and of late years expanded metal has been very highly recommended.



Lath nails are either wrought, cut, or cast, the last named being the cheapest. They can be purchased in several sizes ; for single laths, $\frac{3}{4}$ in. or $\frac{7}{8}$ in. ; for lath and a half, 1 in. ; and for double laths $1\frac{1}{4}$ in. long would be suitable. $\frac{7}{8}$-in. nails cut run about 380 to the pound. Wire and other nails are sometimes used.

Expanded steel lathing is made in sheets 8 ft. long by 18 in. or 24 in. wide, but can be made wider if necessary. This lathing is entirely bedded in the plastering, so is beyond the reach of fire. For application to walls, the meshes should run horizontally, the long way of the mesh, and so that the slope of the strand is inward and downward in order to afford the plastering material a good key, and also to secure the greatest rigidity. In lathing ceilings, care should be taken to have the mesh all placed one way, and little or no pressure is necessary in working to obtain a good key ; too much pressure results only in a waste of material. Expanded metal is also adapted for use as lime, sand, or ballast screens. Expanded metal (3-in. to 6-in. mesh) is also used for embedding in concrete floors to strengthen, lighten and cheapen construction.

The limes used by the plasterer include rich limes, poor limes, and hydraulic limes. "Pure," rich or fat limes are the purest, and are obtained from calcareous or chalky stone : these limes are not found in an absolutely pure state, but contain a small percentage of impurities. Pure lime is one of the principal materials used by the plasterer, for it is easily slaked, and increases in bulk to a large extent ; it can be gauged with plaster for the finishing coat, which readily sets and hardens.

Poor limes slake but slowly, do not increase in bulk like the rich limes, and are not so easily and readily mixed and gauged with other materials ; the impurities they contain are not useful impurities such as would render them hydraulic ; they are poor, therefore, as regards both purity and hydraulicity.

Hydraulic limes contain varying quantities of useful impurities, such as alumina and silica, from 25 to 35 per

cent., which enable them to set independently of atmospheric influence, and they are largely used for foundations and underground work. Blue lias lime is one of this class, and is obtained from rocks of the blue lias formation.

Hydraulic lime is used chiefly for external work, and is more uncertain in its action than pure lime, but owing to those useful impurities which enable it to set and harden in wet situations, it is especially suited for use in places where it is deprived of atmospheric influences. Hydraulic limes are divided into three classes—(*a*) feebly hydraulic lime containing from 5 to 15 per cent. of these useful impurities ; (*b*) hydraulic lime containing from 15 to 25 per cent. ; (*c*) eminently hydraulic lime, containing from 25 to 35 per cent. A non-hydraulic lime may be converted into a hydraulic lime by adding alumina and silica.

With regard to the methods of using the above limes, rich or fat lime, when used as plasterers' putty, should be slaked, run through a fine sieve into the putty bin, and there allowed to remain to cool and stiffen for four to six weeks before it is used. For plasterers' coarse stuff it should be slaked and run through a sieve ; for mortar it is often slaked without being run through a sieve, but in both cases before it is used it should remain in the bed after mixing for at least fourteen days, to allow of cooling and to prevent expansion after the work is finished. Poor lime possesses much the same properties as rich lime, but having a larger percentage of impurities it must be used with a smaller proportion of sand, it takes longer in slaking, and does not increase so much in bulk as the rich lime ; it can be slaked in much the same way as rich lime. Hydraulic limes (including blue lias) should be used as soon as they are thoroughly slaked. When ground and slaked they should be used like cement, but should not be used immediately after being ground, although they must be used immediately they are mixed with water.

Blue lias lime is not used in the London district for



internal plastering, the only use to which it is put in plasterers' work being for external rendering. If it must be used, it should be allowed to lie for at least three days after being mixed, so that it may get thoroughly cool before use. For this reason it is unsuitable for gauging with plaster if fresh. If the lias is in lump it needs careful slaking, but if it is used ground there is less damage of the work "blowing." Its unsuitability for plastering arises from the following facts :—It is non-porous, and is not economical. Wall-plaster should be of a somewhat porous nature, so that it may readily absorb the moisture that on a change of temperature condenses on a wall ; lias lime gives plaster a very non-absorbent surface. Chalk lime, when used for plastering, can be mixed with 4 or $4\frac{1}{2}$ parts of sand ; lias lime will only bear 2 parts of sand, and is therefore considerably more expensive than chalk lime. Lias lime slakes very sluggishly, and, as has been said, is apt to blow when used for plastering.

The different kinds of sand used by plasterers should be placed, as regards usefulness, in the following order : (1) Pit sand ; (2) river sand ; (3) sea sand. Pit sand is the best on account of the sharper angles and the rougher surface of the grains, but it must be freed by washing from earthy, loamy, or clayey matters. The grains of river sand usually have smooth and round surfaces ; this sand, therefore, does not form so good a key as pit sand ; it is largely used for rough-cast work, and should always be washed. Sea sand should not be used for general plastering work, the grain being round and smooth, and containing various salts which cannot be altogether removed by washing. A wall plastered with sea sand would be permanently damp ; indeed, all sea sand and some pit sand will cause "saltpetreing" in the plaster, this being caused by the atmospheric action on the salts. The best way to prevent saltpetreing is to wash all pit and river sand, to reject sea sand, and never to use sea water. The sand grains should not be too small, especially with non-hydraulic limes, where the

porousness of the mortar affects its hardening. In all cases a very fine sand, by exposing more surface for the lime or cement to cover, requires more cementing material for the same strength.

Sand may be washed by being stirred in a pan or tub of water, the overflow from which will carry off the impurities. Clayey sands may be heated sufficiently to bake the clay and destroy its affinity for water. Loamy sand is not so objectionable where frost cannot affect the mortar.

Burnt clay, old bricks, clinker from brickfields, stone refuse, broken pottery, ashes and slag from furnaces, when ground, have been used as substitutes for sand, and often (stone refuse excepted) add considerably to the setting properties of the lime.

The simplest and best test for sand that is to be used for plastering is to examine the sand with a hand lens. The best sand is that which is colourless, fairly even in grain, and the particles of which are angular. Water-worn sand, or that in which the particles are rounded, sand which is coloured, or that which is very irregular in size, is not so suitable. Chemically, there is very little difference in various kinds of sand; the colourless ones are nearly pure silica, while the coloured varieties contain more or less oxide or hydrated oxide of iron.

Hair is used in plastering to give keying quality, and to bind the material. Hair should not be matted together, but should be clean and long, and should be well beaten before it is added to the coarse stuff. The hair is obtained from the tanyard, and is usually specified as "long piled clean cow-hair." The hair should be long, sound, and free from grease and dirt, and, if wet, should be dried. Before mixing with the mortar, the hair should be batted, beaten up, or switched with a lath until the matted portions are thoroughly separated. The usual plan is to put the hair on the plasterer's board, and the labourer, with a 2½-ft. lath in each hand, beats the hair until it is in a condition for use. The



ordinary proportion is 1 lb. of hair to 2 cub. ft. of stuff for best work, and 1 lb. of hair to 3 cub. ft. of stuff for ordinary work. If the coarse stuff is hand-mixed, the hair may be added with the other ingredients at the first; if machine-mixed, the hair should not be added until just before the stuff leaves the machine. This precaution is necessary in order to prevent the hair being broken into short pieces and thus wasted.

There is no substitute of equal value to ox-hair for plasterers' work. Wool might be used, but would not be so efficient, and would also be too expensive. Shoddy, the material used by upholsterers, well carded and separated, might also be used as a substitute for hair, but its value would be small. Of late years, however, Manilla fibre has been highly recommended.

Plaster-of-Paris, which is produced by the calcination of gypsum, is obtained in abundance near Paris, hence its name; it is also obtained from Derbyshire and the surrounding districts. It is largely used by plasterers to mix with putty to form gauged stuff for the finishing coat of plastering on walls and ceilings, where it is used in about the proportion of three parts of putty to one part of plaster; when gauged for cornices a larger proportion of plaster is often used, the object being to aid the setting, increase the hardness, and form truer arrises to the members of the moulding forming the cornice. The best way of gauging plaster-of-Paris is not to pour the water on to the plaster, but to sprinkle the plaster into the water.

Coarse plaster-of-Paris is a very light brown colour, rather than white, it containing dark specks of iron and other impurities. The figure-caster's plaster is the fine material made by calcining the picked raw gypsum. Superfine plaster is dazzlingly white, and is used for facing small casts.

The mortar used by the plasterer is made from the best stone lime; chalk lime is not suitable, although it is sometimes used for putty. The lime should be freshly burnt, and should be laid under cover if possible. A pit

of a suitable size, about 18 in. deep, and lined with boards or bricks, is prepared, and also there should be a tub about 3 ft. in diameter and 2 ft. deep. A quantity of the lime is thrown into the tub and covered with water; it will begin to boil in a short time, and is stirred with the drag or larry till it has all fallen, when it is ladled into a riddle or sieve fixed above the pit; it should be of a thick, creamy consistency, but not too thick. When the riddle is full of "craps," as they are called, it is emptied, and again refilled, till the pit is full; if hair is to be added, it is mixed in the pit with the drag, and the whole is allowed to stand till stiff. If water rises to the top of the mortar in the pit, it should be run off. Sometimes the lime is slaked, and used in powder instead of being boiled, but it works better when boiled. If the lime is wanted for putty, hair is not added.

Fine stuff is used for the setting or finishing coat in ordinary work. It consists of pure fat lime slaked with a small quantity of water, more being afterwards added so as to bring it to the consistency of cream. The mixture is then left to settle in a tub, any surface water is drawn off, and the remainder is allowed to evaporate until fit for use. For top coat in ceilings a small quantity of white hair is mixed with the fine stuff.

The fine stuff thus brought to the proper consistency for use is strained through a hair sieve and known as plasterers' rough mortar putty.

Coarse stuff is rough mortar composed of lime and sand and cow-hair; and is used in ordinary plastering for the first coat in two-coat work or the first and second coats in three-coat work. It is usually mixed in the proportion of 1 part (by measure) lime to 1 or $1\frac{1}{2}$ part sand in order to ensure stiffness; the sand should always be clean sharp fresh-water, not sea, sand, the mixing water fresh, and about 1 lb. of cow-hair being mixed with each 3 cub. ft. of mortar. The hair should be well beaten, long, sound, and strong, free from grease and dirt and well separated. When there is sufficient hair in mortar, it



should, when taken up on a spade or trowel, hang down from the edges without falling off. Coarse stuff used for walls does not require so much hair in it as top stuff used for ceilings. After mixing it should be left for a week or so to cool before using.

Gauged stuff, also called "putty" and "plaster," is composed of three-fourths to four-fifths fine stuff, or putty, and the remainder plaster-of-Paris, more of the latter being used according to the rapidity of setting required. It must be mixed in small quantities for immediate use, and is the material for running cornices, etc. When time is limited each successive coat of plaster can be gauged in order to quicken its setting, but fast setting gauged work is very apt to crack.

Although exact proportions are stated in the previous paragraph, it should be said that the amount of plaster-of-Paris that should be added to lime in order to make the gauged plaster set hard and quickly, depends upon the kind of lime, and can only be determined experimentally. One part of plaster-of-Paris to 3, 4, or 5 parts of lime may be required. The greater the proportion of plaster-of-Paris the quicker will be the setting, but the liability to crack afterwards will also be increased.

Common stucco is made up of 1 part of lime to 3 or 4 parts of clean washed sand thoroughly incorporated. For finishing surfaces in imitation of stone, the sand should be coarse.

Bastard stucco is used for finishing surfaces intended to be painted, and consists of a mixture of two-thirds fine stuff without hair and one-third very fine washed clean sand.

Skimming is the trade name for the setting or finishing coat for walls or ceilings. Very little sand is needed in this, not more than 1 part sand in 7 or 8 parts lime; indeed, sand is sometimes dispensed with altogether.

Selenitic plaster, mortar, or cement, was invented by Major-General H. Y. D. Scott, and it combines cheapness with rapid setting and ultimate hardness. Selenitic

lime is ordinary lime to which sulphate of lime has been added. In making selenitic plaster, the energetic slaking of a feebly hydraulic lime is stopped by adding a certain proportion of plaster-of-Paris to the water which is to be used for mixing with the lime, the result being that the lime appears to have the properties of a cement imparted to it. The mixture is effected as follows :— throw into the 5-ft. pan of an edge-runner two or three 3-gallon pails of water, to the first of which one pint of plaster-of-Paris has been added, and gradually introduce a bushel of prepared lime ; continue the grinding until the whole is reduced to a creamy paste. The sand, burnt clay, or other ingredients may then be added, and ground for ten minutes more. Selenitic cement has the advantage, when used for plastering, of allowing the setting coat to be applied in forty-eight hours after the first set has been put in. It is an excellent substitute for Portland cement. It takes double the usual quantity of sand, and is stronger, even then, than the ordinary mortar, and plastering is finished in much less time than by the common mode.

In using selenitic plaster, the proportions for the first coat are 1 part lime to 3 parts clean, sharp sand ; for the second or floating coat, 1 lime to 4 sand ; for the third or setting coat, 2 lime to 3 sand, with a hod of ordinary lime putty to each bushel of selenitic lime. The only special precautions to take are to mix in small quantities, and apply speedily.

Many special plastering materials have been introduced within the last few years, and well known among these is Sirapite, a fire-resisting and hygienic plaster. A sack (2 cwt.) of Sirapite will be sufficient to cover 10 sq. yd. or 12 sq. yd., finished $\frac{3}{8}$ in. thick. For lath-work take 2 parts of Sirapite to 1 part of good pit sand, and for brickwork use 1 part of Sirapite to 2 or 3 parts of sand. When finishing plaster-work, two coats of this preparation are advised, one following the other within a few hours, thus saving a lot of time. A thin coat only is necessary, thus making the drying



process much easier. Plastering with Sirapite on cottage walls, ceilings and partitions is said to be as economical and as good as three coats of common lime-and-hair plastering. A cheaper method of plastering is to use Sirapite and common lime plaster ; it can be finished in two coats, put on thin for economy. The proportions are : For walls, 1 part of Sirapite to 1 part of common lime plaster ; for ceilings, 1 part of Sirapite to 1 part of common lime-and-hair plaster. Finishing may be in neat Sirapite, or it may be mixed with more or less lime putty.

Granite plaster is a trade speciality—an artificial stone composition, manufactured in the form of a finely powdered material. For use it is mixed with sand, no more material being mixed than can be applied in an hour. This material may be applied to lath-work, brick, stone, or other building material in the usual way ; it is exceedingly easy and plastic to use, it dries quickly and it produces a hard and lasting result. Within twenty-four hours after its application it becomes dry, hard, dense, and metallic, yet has great elasticity. It will bear rough treatment without denting, chipping, cracking, or loosening.

Asbestic plaster is another special material ; it is obtainable in two varieties : the "rough," employed for the render and float coats, and the "finish" for the setting coat. It is fireproof, and is an excellent non-conductor of heat or cold. Another great advantage is that nails can be driven into the plaster as readily as into wood. It is used in the same way as ordinary plaster. For a porous surface such as brickwork, coke-breeze concrete, etc., the "rough" should be mixed in the proportions of 5 of asbestic to 1 of lime to form the render and float coats. This is larried well together, the lime being run through a very fine sieve into the asbestic and the mixing being done, if possible, while the lime is hot. The plaster can be used after it has been allowed to stand for a few hours. No more water should be added than is necessary to make the plaster

work easily. For non-porous surfaces, such as wood, or expanded metal lathing, stone, iron, etc., mix the "rough" in the proportions given above, but gauge into the mixture when ready for use one-third plaster-of-Paris. The asbestic plaster is sold in bags of 100 lb.; twenty bags, or a ton of 2,000 lb., when mixed with lime in the manner indicated, will cover about 80 sq. yd. $\frac{3}{8}$ in. thick, on a well-laid brick wall. If the plaster is laid on lathing spaced far apart, or on an expanded metal, there will be less covering capacity by 10 yd. or 15 yd. to the 2,000 lb. Where outside work is to be done the gauging should be with Portland cement in equal proportions. For inside work, where neither paint nor paper is to be applied for some time, Portland cement can also be used instead of plaster-of-Paris. The "finish" when used for a setting coat is mixed with an equal quantity of lime putty, gauging with it when ready for use from one-third to one-half of plaster-of-Paris.

Petrifite, still another speciality, in colour and texture is somewhat akin to coarse plaster, and possesses the power of binding together waste materials. Coarse ballast, destructor refuse, sand, ashes, garden mould, slate, stone, and coal dust, granite chippings, sawdust, wood pulp, asbestos, canvas, straw, road sweepings, and even old newspapers can be combined with petrifite in varying proportions, to produce by simple moulding without pressure, blocks of concrete, bricks, tiles, slabs for paving and building, imitation marble, granite and slate, pipes, statuettes, etc. Used with sand as mortar petrifite has the property of binding ordinary stock bricks together almost as a solid block of stone; used as plastering material, it can be painted upon soon after the trowel has left it, simply by mixing any dry mineral colouring matter with petrifite in water, and using it as a wash, by which means the various marbles can be imitated. Cast upon plate glass (previously greased) upon which a marbled or other pattern has been traced in liquid petrifite, slabs of imitation marble and granite are produced for decorative purposes with a very smooth



face which can be polished equal to natural marble. However, for work which has to set under water, petrifite will probably be no competitor with Portland cement, for, according to statements made, blocks placed under water to set do not prove so satisfactory as those allowed to dry in air. Common garden earth (which no other cement will bind) and petrifite make a hard, solid stone four times as strong as the best Portland cement and washed sand of the same proportions; petrifite mixed with three times its weight of sea sand is, at ten days, 25 to 78 per cent. stronger than natural sandstone, and will stand more than ten times the crushing strain of similar blocks made with the best Portland cement and pit sand; moulded petrifite and Carrara marble dust are 18 per cent. stronger than the natural marble from which the dust was made, and nearly 50 per cent. stronger than Purbeck marble; and slate dust and petrifite are stronger even than marble.

The manufacture of fibrous plaster is a comparatively new industry. In the making, say, of a moulded cornice of this material, the mould is first placed in position, and over it is fixed a wooden frame. Between the sides of this frame plaster-of-Paris is puddled. When half the required thickness has been spread, a coarse kind of sacking—jute fibre—is laid over it, and this in turn is buried beneath another layer of puddle. The plastic mixture sets very quickly, and by the time the cornice is finished it is getting pasty. In an hour it becomes quite hard. Fibrous plaster is light, durable, and pliable, and a sheet of it can be dropped on the floor without breaking it. It is now being manufactured in sheets of various sizes, the usual thickness being about $\frac{5}{8}$ in. One side is prepared with a smooth face; the other side is left rough from the trowel. Fig. 1 (p. 22) shows a section through the sheet or slab. On the two outer vertical edges is a 1-in. by $\frac{1}{4}$-in. deal lath, to which is attached a network of unmade string or jute strands roughly woven to about a $\frac{3}{8}$-in. mesh; see plan, Fig. 2. A layer of plaster about $\frac{3}{16}$ in. thick is placed in the casting mould.

The laths containing the netting are then laid on and covered with more plaster to the thickness required; this surface is left rough to form a key for the floating coat when fixed. Fibrous plaster can be obtained in sheets about 32 in. by 20 in. If the slabs are carefully nailed or screwed, they are as substantial as ordinary plaster, and present the advantage that they may be painted almost immediately after fixing.

The following is a slightly different method of making fibrous plaster slabs to any given size. The rules are first fixed to the required size, and laths and some

Fig. 1.

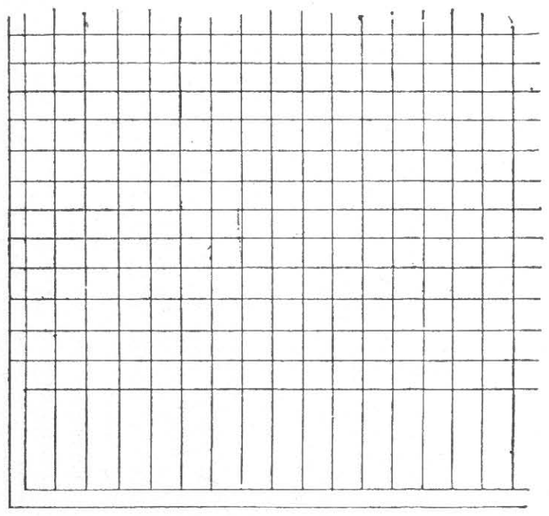

Fig. 2.

Figs. 1 and 2.—Sheet or Slab of Fibrous Plaster.

canvas are cut. The plaster is next gauged, and should be gauged stiff. For the first layer, a gauging should at the same time be made up with size-water. The stiff plaster should be spread with a laying trowel, and the canvas should be well pressed into it, and allowed to lap about 2 in. or 3 in. over the rules. A coating of the sized plaster is next put on with a brush, and the laths are bedded in the soft plaster, the canvas is turned over, and the edges are well brushed in. The face should be scratched and the mould filled up to the laths with a composition of plaster and sawdust, or some other light aggregate. This is gauged fairly stiff, and is ruled off



from the laths; the face is scratched with a brush to give a key for the setting stuff. The slabs are taken out of the mould and placed in the drying-room until dry and ready for fixing. The slabs are fixed to joists with large-headed galvanised nails, and fixed about 6 in. apart, the joints being filled in with plaster gauged with size-water. The joints should be left with a rough face to serve as a key. The suction of the slabs may be stopped with size-water or a substitute, and may be set with patent cements, or with ordinary lime and sand setting stuff.

The chief cements used by the plasterer are—Roman, Portland, Keene's and Parian, but in addition there is a number of lesser known cements.

Roman cement, when of good quality, with fine clean, sharp sand in the proportion of 3 of sand to 1 of cement, and well executed, forms a very good external coating for walls, and is then commonly called "compo." It is a natural cement, made by burning at a low temperature nodules from the London clay, dredged up off Harwich, etc., and from shale beds of the lias formation. The ground cement should not weigh more than 75 lb. per bushel. It should be kept in air-tight casks; if exposed to air, it becomes inert and weighs more. Good Roman cement is generally a rich brown colour, and sets in about fifteen minutes, but its strength is never more than one-third that of good Portland. It should be mixed with 1 or $1\frac{1}{2}$ parts of sand to 1 part of cement, in small quantities, and should be used at once.

Portland cement—so called because the mortar formed by it when mixed with sand is supposed to present the appearance of Portland stone—is much esteemed for outside work, as the colour to which it dries is sufficiently agreeable to the eye, without the necessity for applying any colouring wash; whereas Roman cement is too often of a dark, dirty tint, requiring the application of paint or colour to render it tolerable. Portland cement is also much valued for its waterproof properties. It consists generally of 3 parts of white or 4 parts of grey chalk and water, mixed in a mill with 1 part of

alluvial clay, then run off to settle. The material is dried and burnt in a kiln, and ground for use ; or it may consist of crushed limestone and clay or shale, roughly burnt, ground together and mixed as powder in a pug mill, then slightly moistened and pressed into a brick form, dried, burnt, and ground for use. The quicker-setting varieties, weighing from 90 lb. to not much over 100 lb. per struck imperial bushel, should be used. Portland cement is used for wall-plastering, for skirtings, for concrete floors, and tile-fixing, and for coring or floating under the more expensive cements; it is generally mixed with 3 parts of fine, sharp sand.

Keene's cement is a mixture of plaster-of-Paris and alum, and is thus not suited to outside work. The fine quality is white and takes a good polish. When applied to brickwork, the first, or rendering, coat should be of Portland cement. The coarse quality does not take such a good polish, but forms a hard surface, which can be painted or papered within a few days of its application.

Parian cement is plaster-of-Paris with the addition of borax and alum. It can be painted within a few hours of application, provided it is on lath and plaster, as the moisture dries out at the back. Parian is used for inside work only, and is applied the same way as plaster-of-Paris. Its chief merit is that it sets rapidly, when applied to newly-built or damp walls, and can be painted at once. Four bushels of Parian cement, with an equal quantity of clean washed sand, will cover 10 yd. super., $\frac{1}{2}$ in. thick. It can be treated in different colours, in imitation of marbles, etc.

With regard to distinguishing the difference between plaster, and Keene's and Parian cements, an experienced man would be able to tell the difference between them in bulk by running his fingers through some samples ; but if there is any doubt in the matter it can soon be dispelled by gauging a small quantity. Plaster will set almost immediately ; the cements will take longer to harden, and will ultimately attain a greater hardness than plaster. Between Keene's and Parian cements,



however, the difference is very slight (the former being merely plaster mixed with alum, and the latter the same substance to which borax is added), and it would require a large experience to be able to distinguish between them either in bulk or in finished work. Keene's cement is usually of a pinkish colour ; plaster and Parian cement are white. Quality is reckoned by degrees of fineness, and this is easily determined by rubbing a small portion between finger and thumb.

Medina, Harwich, Sheppey, and Calderwood cements are varieties of Roman cements, differing but slightly in appearance and characteristics. Medina cement is manufactured from septaria obtained from the Isle of Sheppey ; it is of a lighter brown than Roman cement, sets very rapidly, and is used in tide work for pointing and rendering walls exposed to a pressure of 15 ft. of water.

Martin's cement is a white cement for internal purposes, and has great covering power, 1 cwt. of it with the same quantity of sand being found to cover 6 yd. super. or 7 yd. super., $\frac{1}{2}$ in. thick. For walls or floors, a $\frac{1}{2}$-in. coat of 1 part coarse cement to $1\frac{1}{2}$ parts clean washed sand, with $\frac{1}{8}$-in. finishing coat of pure cement, is all that is required. It is manufactured in three grades of fineness.

Atkinson's cement is specially applicable to outside work which is to be painted at once. It is warmer in colour than Portland, and, setting quickly, it is very useful for castings.

Mastic is specially applicable to outside work which is to be painted at once, but on account of its cost it has been superseded by Portland cement.

Metallic cement, so called because it has a metallic lustre, is suitable for outside work, and is intended to dispense with colouring or painting.

Marble dust is sometimes used in hard-finishing plastered surfaces, and should be about as coarse as sand.

Robinson's cement is hard-setting, and is suitable for castings and mouldings. It is also used for plastering where work requires finishing very quickly. The

makers state that it can be papered or painted in a few days after finishing; the cost is rather more than ordinary plastering. It is made in three grades.

Whiting is pure chalk ground to a fine powder. It is used chiefly with water and size for white-washing plastered ceilings and walls of common rooms; it is not durable for external work. 12 lb. of whiting, ½ lb. blue-black, and 1¾ gallon of size are required for 100 yd. super., once done; 21 lb., ¾ lb., and 2¾ gallons if twice done.

Zinc white is used in kalsomining, when an extra clear white and fine finish are desired.

Brickdust serves as a colouring material in finishing; it should be passed through a very fine sieve.

Sawdust is used in mortar for outside walls, to guard against the action of water and frost. It is the best material known to prevent plaster from scaling off, and should be free from chips and shavings.

Glue or size is used in kalsomine and washes. White glue is always preferable, especially where colouring is not used.

Colouring materials commonly used in plaster are included in the following list:—Lamp-black, drop-black, ivory-black, powdered charcoal, red aniline, Venetian red, Indian red, vermilion, ultramarine blue, indigo blue, blue vitriol, Spanish brown, umber (raw and burnt), chrome-yellow, pulverised clay, etc.



# CHAPTER II.

## Tools used by Plasterers.

An attempt is made in this chapter to describe in their logical order the chief tools used by the plasterer.

The lathing hammer (Fig. 3) is used for driving in the lath nails, the notch being useful for withdrawing nails, and the hatchet edge for roughing surfaces to obtain a key for the plaster, and for hacking off old plaster. The pene of the hammer is indented to prevent it slipping

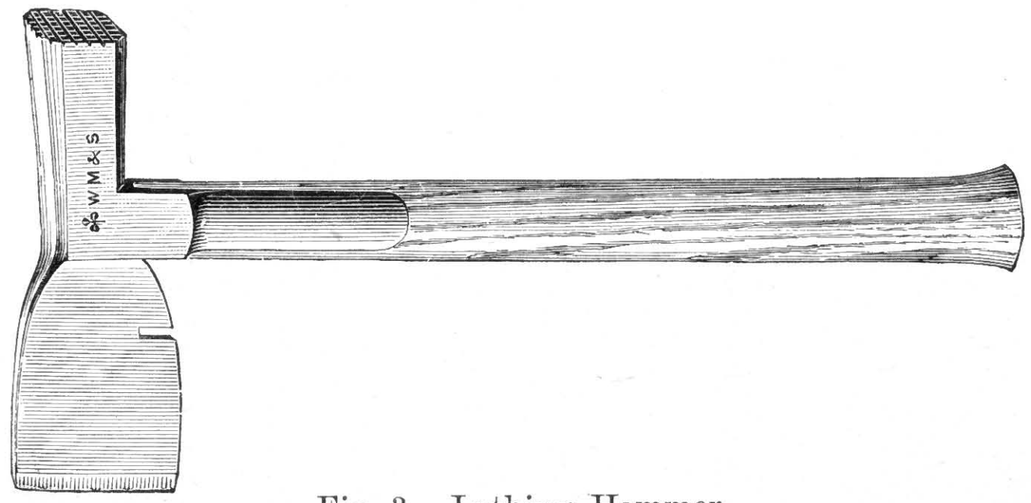


Fig. 3.—Lathing Hammer.

off the nail heads. The American pattern lathing hammer head is shown by Fig. 4.

Pails, usually of galvanised iron, are used for carrying water, plaster, mortar, etc.

Sand screens are of two chief kinds—the large upright screen (Fig. 5), and a small sieve. Lime and sand can be properly mixed by screening them together.

The slack box (slaking box) is about 8 ft. by 3 ft. by 1 ft. deep, and is made of good sound timber, 1 in. thick. It has at one end a slide-gate on which are

nailed slabs to prevent the lumps and sediment from passing through when the gate is raised to run off the lime.

The spade used by the plasterer for mixing mortar,

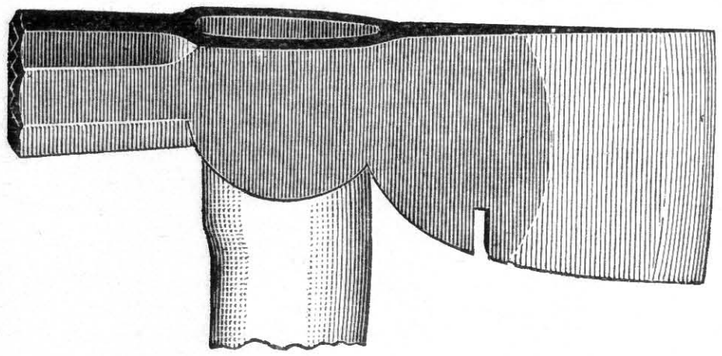

Fig. 4.—American Pattern Lathing Hammer Head.

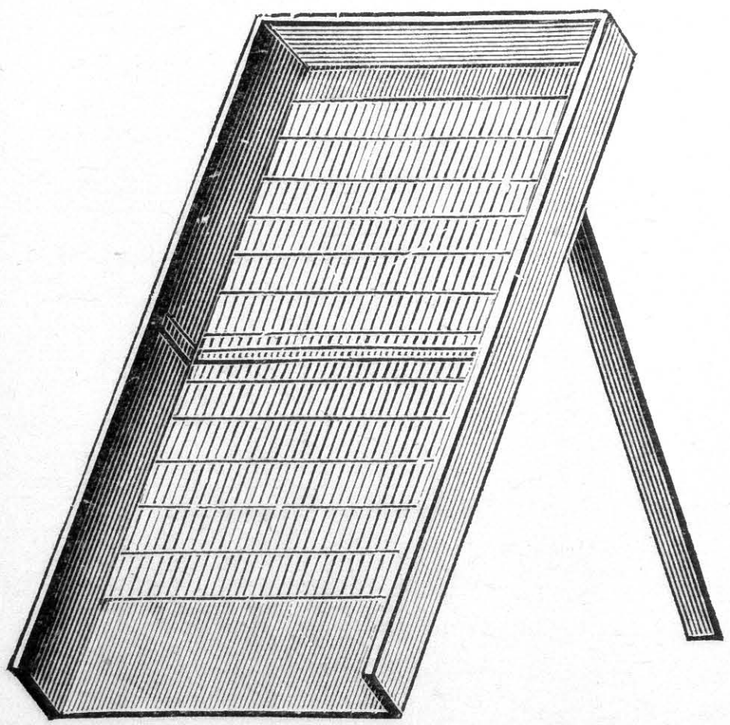

Fig. 5.—Upright Sand Screen.

cement, etc., is of the same shape as that used by the bricklayer's labourer.

The drag or larry (Fig. 6) is a three-pronged rake for mixing the hair in making hair mortar. It is liable to



be confounded in name—but not in purpose—with the plaster-caster's drag, a piece of flat steel with one edge serrated (see Fig. 47, p. 73).

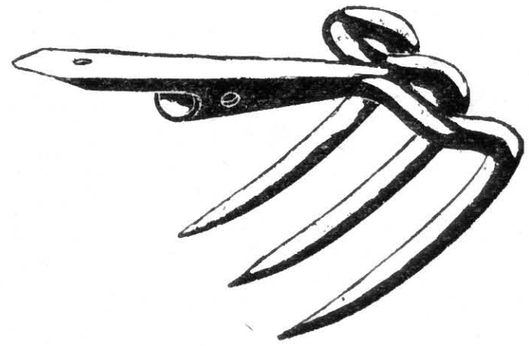

Fig. 6.—Drag, Larry, or Hook.

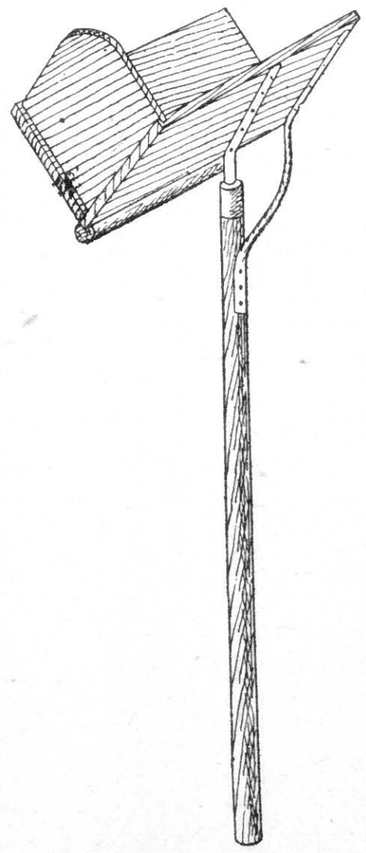

Fig. 7.—Mortar Hod.

Mortar beds are generally made of boards, and of different shapes and sizes, but not usually more than 1 ft. or 2 ft. deep. The sides and ends should be

strongly fastened, as they have to sustain a great pressure.

The mortar hod (Fig. 7) is made by nailing together two boards, about 1 ft. wide by $2\frac{1}{2}$ ft. long, at right angles, forming a trough-shaped box; an end piece is then nailed on one end, and the boards are bevelled towards the angle at the other end. Then a handle is attached a little forward of the middle, and a flat block, or pad, is placed just behind the handle, to rest on the carrier's shoulder.

Mortar boards are generally made about $3\frac{1}{2}$ ft. square, of boards 1 in. thick, with close joints. The boards are nailed to two cleats, which should be placed a good distance apart so as to admit the head of a barrel

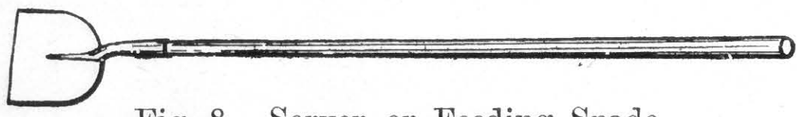

Fig. 8.—Server, or Feeding Spade.

between, as the boards are often placed upon a barrel when being used.

The server, or feeding spade (Fig. 8), is a small spade with a long handle, with which the hawk-boy or labourer beats up the mortar to keep it from setting, and feeds the plasterer's hawk with small portions at a time. The handle being long, the plaster can be conveyed to the hawk even when the plasterer is at work on a ladder.

The hawk (Fig. 9) is a board, about 10 in. square, with a short handle in the centre of the back, used by the plasterer himself for holding the stuff when applying it with the trowel.

The putty sieve (Fig. 10) is used for straining the putty or fine stuff; an ordinary flour sieve answers the purpose admirably.

The scratcher (Fig. 11) is made of short slats nailed to cross-pieces, and is about 1 ft. wide. The slats have one end sharpened, and should be about 1 in. apart. The middle slat should be longer than the others, so that



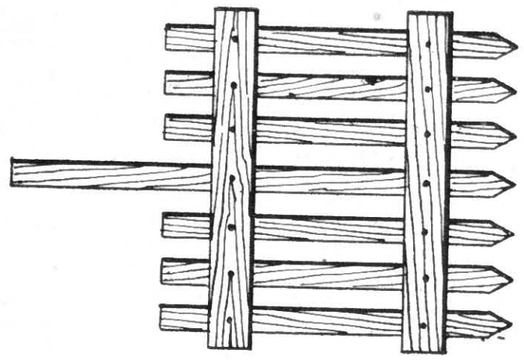

Fig. 11.—Scratcher.

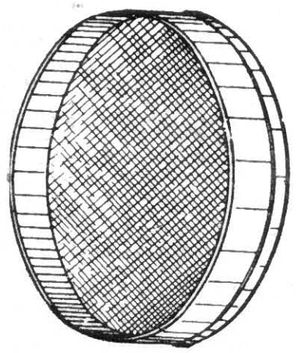

Fig. 10.—Putty Sieve.

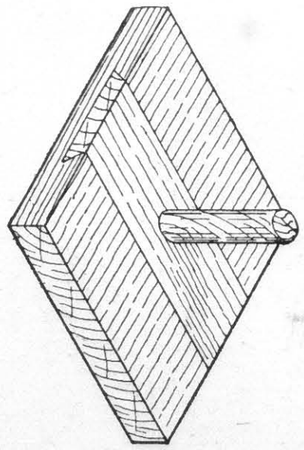

Fig. 9.—Hawk.

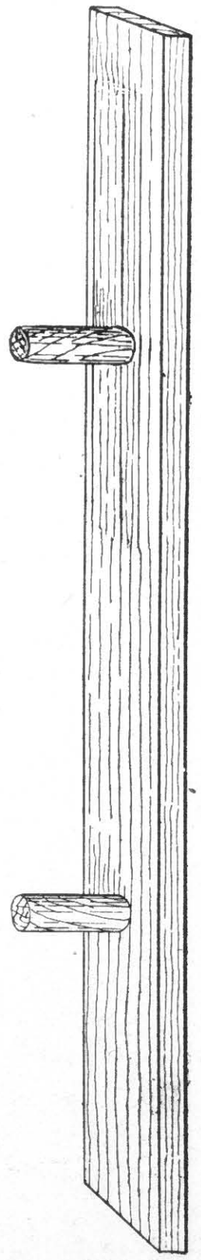

Fig. 12.—Derby Float or Darby.

the end opposite the sharpened end can be used as a handle.

Floats are of many kinds. First there is the derby float (called the "darby")—a long wooden board, with a

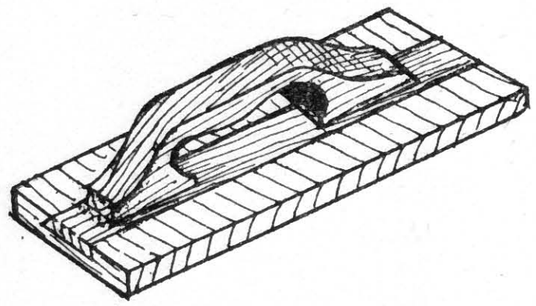

Fig. 13.—Hand Float.

flat face and two round handles (for one man to work), used in three-coat working for floating the second coat to the required surface. A modification of this tool is made of hard pine, 4 ft. 4 in. long by 4 in. wide, with one handle fastened on about one-fourth of the length from one end, and the other, which is a narrow strip, fastened with one edge flat on the darby and running lengthwise of it (see Fig. 12). The length of this strip varies from 18 in. to sometimes the whole length, for the purpose of stiffening the darby; but the length may be varied to suit the workman, and also the nature of the work to be done.

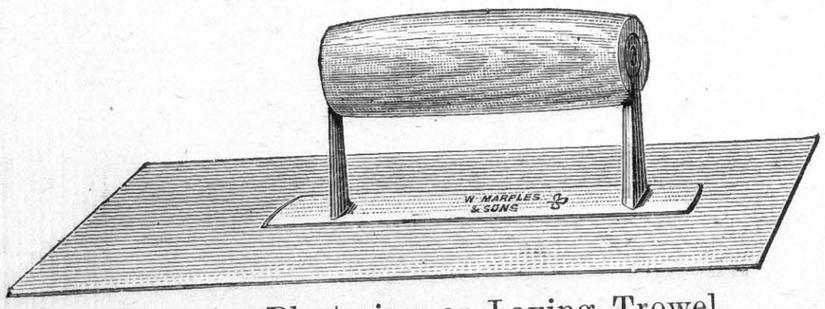


Fig. 14.—Plastering or Laying Trowel.

The hand float is a small piece of board with a handle at the back, for floating and smoothing off the finishing coats (see Fig. 13). The quirk float, or mitre of wood, is splayed off to an angle at one corner, and is used for floating in angles and mitres to mouldings.



Trowels are of two chief kinds: plastering, or laying tool, and gauging, or ordinary trowel. The plastering, or laying tool (Figs. 14 and 15) is used for laying on the plaster, being a thin polished steel plate, about 10 in.

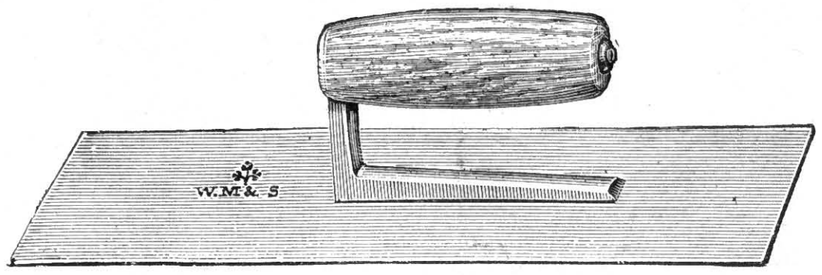


Fig. 15.—Plastering or Laying Trowel.

by $2\frac{1}{2}$ in., slightly convex on face, with a wooden handle of either of the shapes illustrated fastened to the back parallel with the blade. Gauging, or ordinary trowels (Fig. 16) from 3 in. to 7 in. long, are for gauging the stuff, which means mixing plaster-of-Paris with it, with the object of getting it to set sooner and firmer, or with greater hardness. There is also the pointer, a small pointed trowel, the same shape as a brick trowel, with a blade of good steel about 4 in. long. Principally it is used to clean tools and where a larger tool could not be used.

Jointing tools are thin triangular steel plates of different sizes, with a handle at the back, and brought to an acute angle at the point; they are used for finishing off angles and mitres to mouldings.

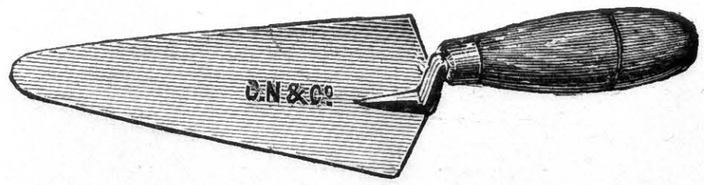


Fig. 16.—Gauging Trowel.

The joint rule (Fig. 17) is a mitring tool now made in steel, but formerly made in wood.

Mitring tools are used to make mitres by hand where they cannot be easily made with the mould, and also to

finish breaks or balks in the moulding. They consist of a number of steel and wooden tools of a variety of shapes and sizes: among these is the mitring-rod, a flat tool $\frac{1}{8}$ in. thick, 3 in. wide, and 1 ft. long, with one edge sharp and one end bevelled to an angle of about 30°

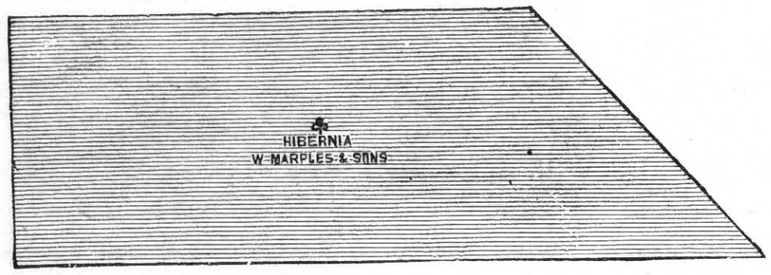


Fig. 17.—Joint Rule.

with the acute angle at the sharp edge. Stopping and picking-out tools are used for modelling ornaments, finishing off mitres, etc.

The angle-block is used by many plasterers; it consists of a block from 10 in. to 14 in. long and 3 in. square, having its angles true right angles; there is a handle on the opposite angle from the one which is to work in the angle of the wall. The handle and the block are generally made in one piece.

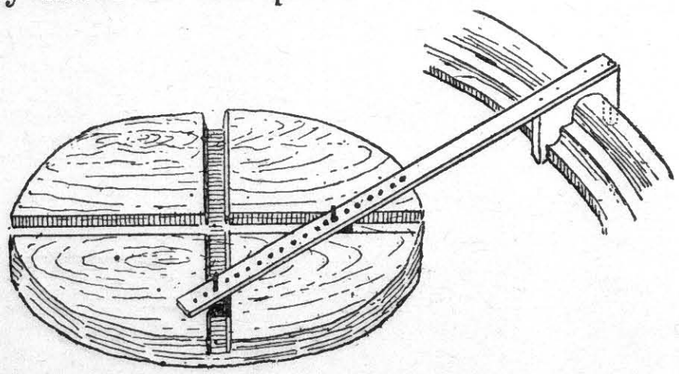

Fig. 18.—Trammel in Use.

The paddle is a small flat wooden tool, 4 in. to 5 in. long, and from 2 in. to $2\frac{1}{2}$ in. wide; one end is shaved to an edge, and the other serves for a handle. It is used by some workmen to fill the angles when finishing.

The straight-edge is a long board shot true on one



edge, for testing walls or ceilings in order to get them perfectly level.

The long rod is a planed board, 6 in. wide and 1 in. thick, with a length nearly equal to the height of the rooms in which it is to be used. These rods often have spirit-tubes inserted, like the tubes in spirit-levels.

Trammels (Fig. 18) are used for running mouldings in the forms of ellipses, arches, and various other curves.

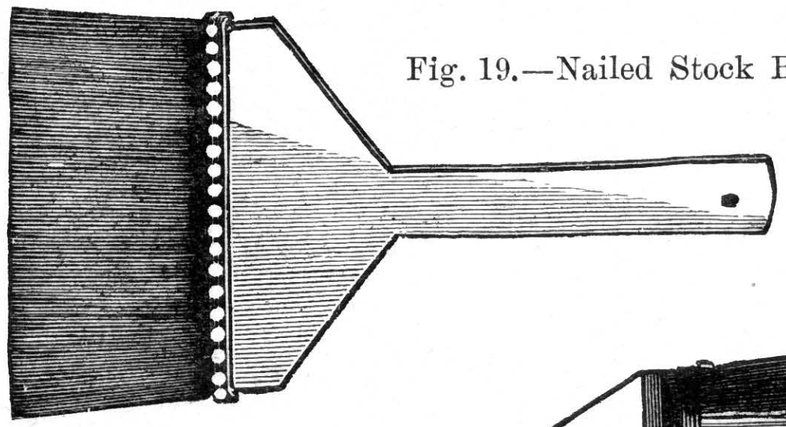

Fig. 19.—Nailed Stock Brush.

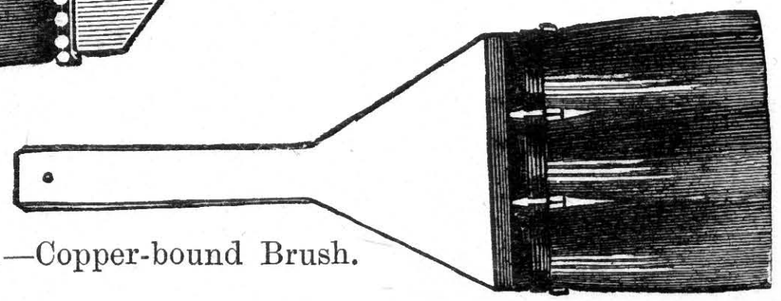

Fig. 20.—Copper-bound Brush.

They are made according to the particular use for which they are required.

Kalsomine brushes (Figs. 19 and 20) vary in size, and are made of coarse and fine hair for rough and fine work, bound with copper or other metal. The wood between the halves of the bristles should be shaved to an edge, so that water will not collect in it, and run out when the brush is inverted. The handle is short, and permanently fixed to the brush. These brushes are used for dusting, wetting, and colouring. Fig. 19 shows a nailed stock brush, and Fig. 20 a superior copper-bound brush. With the splayed edge of the former, the plasterer cleans the glut from his trowel when polishing the setting coat.

# CHAPTER III.

## PLASTERING CEILINGS.

THE various coats of plastering are distinguished according to the following description: On laths, plastering in one coat simply is said to be laid, and in two coats laid and set. In three-coat plastering on laths, however, the first coat is called pricking up, while the second is said to be floated, and the third set. On brick walls, plastering in one coat is termed rendering; in two coats, rendered and set; and in three coats, rendered, floated, and set.

Before beginning to lath a ceiling, the plasterer proves the under face of the joists to which he has to work by applying a long straight-edge, and makes up for any slight inequalities in them. When the work is not to be of a very superior kind, this may be done by nailing on laths. When the inequalities are great, or if the work is to be of fine quality, the joist must be straightened by the carpenter, who takes off excessive projections, and nails on proper slips to bring the work even. This process is called firring.

If a ceiling is to be divided into panels, the projecting portions must be cradled down to receive the laths. It is important to remember that in plastering on laths, and in ceilings particularly, the laths should be attached to as small a surface of timber as possible, because the plastering is not supported by its adhesion to the wood, but by the keying of the mortar itself, the mortar passing between the laths and bending round over them. For this reason narrow fillets of wood may be nailed all along the centre of timbers or joists over 3 in. broad, and the laths nailed to the fillets.

The laths for ceilings should be of the stronger sort.



Weak laths, if used in a ceiling, are sure to produce inequalities by sagging with or yielding to the weight attached to them. One or two weak ones in a ceiling of otherwise strong laths may be the ruin of the best piece of work. They should therefore be previously sorted, the weak, crooked, and knotty ones being rejected, and the best and straightest selected for the work.

Taking a lath that will reach across three or four openings, the plasterer strikes a nail into it on one of the intermediate joists at about ⅜ in. from the one before it, and then secures the ends of that and the one that it meets of the last row, with one nail, leaving the other end of the lath he has just set to be secured in the same manner with that which shall meet it of the next bay. This is the ordinary lap nailing mentioned on p. 90, butt-jointing being considered superior.

It is of importance that the bonding in ceiling work receive special attention. In lathing on quarter partitions, the bonding is of less importance, because the toothing which the thickness of the lath itself affords to the plastering is enough to support it vertically; but the more complete the keying, the better the result. The thinner or weaker laths are generally used for partitions.

Each lath is not made to break joint with those on either side of it; they are laid matching, or breaking joint in bays from 3 ft. to 4 ft. in width, in order to diminish the risk of cracks, which would extend along and mark the lines of junction of adjoining long rows. This is not of so much importance on walls as it is on ceilings. The hollow spaces behind lath and plaster or battens are objectionable, from their forming runs for vermin as well as channels through which offensive gases can travel to any part of the building.

When the lathing is completed, the work is either laid or pricked up, according as it is to be finished with one, two, or three coats. "Laying" is a fairly thick coat of coarse stuff, or lime and hair brought to an even surface with the trowel only. For this the mortar must

be well mixed, and of moderate consistency—thin enough to pass readily between the laths and to bend with its own weight over them, and at the same time stiff enough to leave no danger that it will fall away—a contingency, however, that in practice frequently occurs as a consequence of badly composed or badly mixed mortar, of too close lathing, or of failure to exert sufficient force to thrust the mortar through the laths and form the keys. The plaster should not be thicker than is necessary to form a good covering for the laths—from $\frac{1}{4}$ in. to $\frac{3}{8}$ in. thick—as any unnecessary weight of plaster only renders it more liable to break away from the keying.

If the work is to consist of two coats—that is, laid and set—the laying, when sufficiently dry, is roughly swept with a birch broom to roughen its surface, or it is scratched with a special tool—the scratcher—previously described; and then the "set," a thin coat of fine stuff, is put on. This is done with the common trowel only, or with the aid of a wetted hog's-bristle brush, which the workman uses to strike over the surface of the set, while he smooths it with the trowel in his right hand. If the laid work is allowed to become very dry, it must be slightly wetted before the set is put on, or the latter, in shrinking, will crack and fall away. It is usual to sprinkle or throw the water over the surface from the brush.

Lath and plaster, or lath-lay, float, and set, constitutes three-coat work. In this case the pricking-up coat, while still soft, is scratched or scored all over with the scratcher (Fig. 11, p. 31), which should be held at an inclination to the face of the work, in order, by undercutting the scoring, to form a better key for the floating coat. The scoring should be carefully done in parallel lines about 3 in. apart, and then crossed over by a second set of parallel lines. Sometimes several laths are used to scratch the surface over at random; but this should not be allowed. As soon as the pricking-up coat is quite firm, when good work is required, the second or floating coat is applied as follows:



The surface to be floated is surrounded with narrow strips of plastering, called screeds, made perfectly horizontal or vertical as the case may be, with the level or plumb-rule. Thus, in preparing a ceiling for floating, nails are put, about 10 ft. apart, at the corners and along the sides, and carefully driven in to a horizontal plane, which is tested by means of the level. Other nails are then placed exactly opposite to the first, at a distance of 7 in. or 8 in. from them. The space between each pair of nails is filled up with coarse stuff, and levelled with a hand float; this operation forms what are called dots When the dots are sufficiently dry, the spaces between the dots are filled up flush with coarse stuff, and floated perfectly true with a floating-rule or with a derby float. This operation forms a screed, and is continued until the ceiling is surrounded by one continuous, perfectly level screed. Other screeds are then formed to divide the work into bays about 8 ft. wide, which are successively filled up flush and floated level with the screeds.

For floating walls screeds are formed in exactly the same manner, except that they are adjusted with the plumb-rule instead of the level. The grounds for joiners' work—such as for skirtings, etc.—form screeds by which the plasterer can work, and he starts the dots of his wall-screeds from these.

After the floating coat has been brought to an even surface with the floating-rule, it is gone over with the hand float and a little soft stuff to make good any deficiencies that may appear. The floating coat takes only half the material, though nearly double the labour, required for the first coat.

The operation of forming screeds for floating work which is neither vertical nor horizontal, is similar to that of taking the face of a stone out of winding with chisel-drafts and straight-edges in stone cutting; the principle being, in both cases, to find three points in the same plane from which to extend the levelling operations over the whole surface.

Before the pricking up coat is too far set, it is scratched

over with the scratcher ; the floating coat is scoured down with a straight-grained float having two small nails projecting about $\frac{1}{16}$ in., which roughen the surface. Then, when quite dry, the third or setting coat is applied. This should be of fine stuff for colouring, whitening, or papering ; or it may be bastard stucco trowelled for painting. Trowelled stucco is set with the laying trowel, and brought to a smooth face over a surface of 2 yds. or 3 yds., and then worked over with the hand float, at the same time wetting the surface with a brush, floating and sprinkling alternately until it presents a hard, polished appearance, after which it is rubbed over with a dry stock brush.

The following is a good method of levelling a ceiling as a preliminary to plastering. Put a level line round the room and put the dots in with the square, making a pencil mark on the part of the square that is held upright, and keeping the mark on the line and squaring in the dots on the ceiling, allowing a fair thickness all over. The walls must be perfectly upright, or the ceiling dots will be thrown out of level with each other.

Cracking is caused by the shrinking of the timbers used in construction, by the unequal settlement of a building, and by the setting coat being gauged with too large a proportion of plaster-of-Paris. Blowing is caused by the presence in the plaster of portions of unslaked or only partly slaked lime. Scaling off is the result of plastering upon a surface with insufficient key, of plastering upon a dry surface, of allowing one coat of work to get too dry before the next coat is applied, or of using coarse stuff that does not contain a sufficient quantity of hair. Cracking can be largely avoided by using well-seasoned timber, and by properly counter-lathing the faces of large timber surfaces. Blowing can be prevented by thoroughly slaking the lime, and allowing the putty proper time to cool before it is used. Scaling off can be avoided by obtaining a sufficient key for all the coats of plasterers' work, by dampıng all surfaces before plastering, and by mixing a sufficient quantity of hair with the coarse stuff.



# CHAPTER IV

## PLASTERING WALLS.

THE process of plastering walls is similar to that described for ceilings and partitions on lath. The single coat is called rendering, and it need differ from laying a ceiling only in the quality of hair, which may be less than is necessary for laying on lath, and in the consistency of the mortar, which may be made more plastic to work easier, and to attach itself more readily to the wall, which must be well wetted before the rendering is applied. The set is the same, and is put on in the same manner as in two-coat work on lath. For three-coat work, the first or rough rendering is given a rough surface, and should be made to fill up completely whatever crevices there may be in the work behind. For floating, screeds must be formed as described in the previous chapter. The remainder of the work is carried out exactly the same as for lath, both for the floated and for the set coat. The narrow deal grounds to which the skirting is fixed, and which have been previously fixed by the carpenter, act as a screed for the low part of the wall. From these the plasterer plumbs upwards, making his work perfectly flush with them.

In three-coat work on walls, the following is the general practice :—The joints in the walls should be raked out, and the brickwork brushed and wetted before beginning to plaster. The walls are coated, and then scored over with the scratcher to form a key for the second coat ; this is allowed to get white dry, and then the second coat is laid on with the float, and when this is about half dry, the third coat is laid on and smoothed with the trowel and brush. The screeds are laid on at intervals

of about 6 ft. The bands or widths of plastering about 6 in. wide are straightened with the floating rule.

The plumbing of walls is generally done either by having the dots for screeds plumbed with a long plumb rule, or with a bob on a line, and having two gauges. If there are grounds, the dots should be plumbed from them. One man gets upon the top scaffold, and if there are no grounds, each man puts in a dot, plumbing it by suspending the plumb-bob and gauging in from the line, allowing a fair thickness of mortar to be put on the walls. The dots may be made from small pieces of lath, or they may be nails with large heads. The whole room is plumbed in this way. The screeds are next put on by ruling the cement or mortar, as the case may be, down in line with the dots.

In plastering a wall with common stucco (used mostly for outside work) the first thing to be done is to remove the dust by brushing, and then to wet the wall very completely. If the wall to be stuccoed be old, or one in which the joints have been drawn, the mortar of the joints must be chipped, or even raked out, and the bricks picked to expose a new and porous surface to the plastering before brushing and wetting. The wall is then covered with stucco, applied in a fluid state like common whitewash, with a strong hog-bristle brush. When this first application is nearly dry, the stucco must be laid on as in common rendering, unless the work is to be floated, when the process is nearly similar to that in floated plastering. Screeds must be formed at the highest and lowest extremities of the wall, or of that part of the wall which is in the same vertical line and is not intercepted by string-courses, and must be returned at the angles, putting the whole into a sort of frame. These screeds must be made perfectly straight and plumb, so as to be quite out of winding, by the careful application of the plumb rule and straight edge. Inner vertical screeds must then follow at 3 ft. or 4 ft. apart across the whole surface, and be made to range exactly with the outer ones. Then the interspace must be filled in as



before. As the work is make good, it must be well rubbed with the hand-float, as in the execution of trowelled stucco internally, to compress the material and produce a hard, an even, and a glossy surface. Preparation for cornices, and other projections from the straight surface of the work, must have previously been made in or on the brickwork or other work by corbelling out with bricks, tiles, etc., to form the core and the mouldings. It may be said here in advance that neckings or cornices are run with moulds in the same manner as for internal work (see Chapter V.), only that in this work the only plastic material used is the stucco itself. A mixture of plaster-of-Paris must not be allowed in running cornices, as this will not weather like the stucco, and if mixed with it will produce premature decay. When the stucco is perfectly dry, it may be painted in oil colours, or coloured in distemper ; and in either case it is generally ruled over the surface to give it the appearance of stonework in plain ashlar.

Generally, for painted work, the set must be of bastard stucco, trowelled. This coat must be worked of exactly the same thickness throughout, to preserve to the external surface the advantage that has been gained by floating. For all but the set on floated work the trowel and brush are considered sufficient to produce fine and even work ; but trowelled stucco must, moreover, be hand-floated. In this operation the stucco is set with a trowel in the ordinary manner and brought to an even surface with that tool to the extent of two or three yards. The workman then takes the hand float in his right hand and rubs it smartly over the surface, pressing gently to condense the material as much as possible. As he works the float, he sprinkles the surface with water from the brush, and eventually produces a texture almost as fine and as smooth as that of polished marble.

The best method of plastering walls to resist damp is to render with Portland cement gauged with clean sharp sand. As before, all mortar joints should be raked

out, and the work brushed and wetted. The chief factor in obtaining the best results lies in the quality and texture of the sand used as an aggregate ; pit sand is preferable for the floating coat, provided it is free from loam and earthy matter, which is removed by thorough washing. The Portland cement should be obtained from a reliable manufacturer, and delivered on the works at least a fortnight before using, in order that it may be air slaked by being spread on a boarded floor, and turned over occasionally to allow particles of lime to absorb the moisture, and in order to obtain uniformity of colour, which is desirable in finished cement work. The floating coat should be gauged in the proportion of 3 of sand to 1 of cement, the sand being of a coarse texture. Fix the necessary rules and vertical screeds, formed with materials of not less than $\frac{3}{4}$ in. in thickness, allowing the screeds to harden before using. After the floating coat has been brought to a uniform surface, and whilst it is in a green or moist condition, it should be scored horizontally, preferably with a drag composed of $1\frac{1}{2}$-in. nails, 1 in. apart, embedded in plaster. The furred edges caused by this drag are allowed to remain until the surface is quite hard, in order to preserve the undercut which is essential to a proper key. The fining coat may be composed of 2 parts river sand and 1 cement, but for an excellent finish Leighton Buzzard or silver sand may be used. The finishing coat is to be from $\frac{1}{8}$ in. to $\frac{3}{16}$ in. thick, neither more nor less.

The materials best suited for the plastering of an ordinary house are—Portland cement and Birmingham waterproof cement, which will stand the inclemency of the weather for a considerable length of time. For the inside of a house, where the question of cost is not the chief consideration, Keene's and other patent cements may be used, the floating coat having sand mixed with the cement. These cements dry much quicker and get much harder than ordinary mortar.

For the interior plastering of concrete houses either Roman or Portland cement may be used. Roman



cement, used in the proportion of 1 of cement to 1 of sharp, clean sand, is generally laid on in one thickness of from $\frac{1}{2}$ in. to $\frac{3}{4}$ in., the surface being afterwards finished with a thin coating of neat cement. The wall should first be thoroughly dry, roughened to form a key, well brushed to remove all dirt and dust, and well wetted just before applying the cement. Portland cement is used, and is applied in a similar manner, but in the proportion of 1 cement to 9 sand. For ceilings, ordinary lath and hair plaster is suitable.

For the exterior plastering of concrete houses the best material is undoubtedly Portland cement, used in the proportion of 1 part cement to 3 parts sharp, clean sand. The wall should be dry—that is, the concrete must be set—and the surface should be well brushed to remove all dust, and afterwards wetted. The surface may be marked with lines, horizontally and vertically, so as to give it the appearance of a stone wall. Cement weighing from 95 lb. to 100 lb. is quite satisfactory, and has the twofold advantage over the heavier makes of being cheaper to buy and more economical in application, as it sets more rapidly. The surface of the wall should be rough, to form a key ; this may be done in the casing in which the concrete walls are built, or by hacking afterwards. It is not satisfactory to paint or distemper on Portland cement. If the appearance is unsatisfactory afterwards, a coat of Portland cement wash, tinted as required, has the best effect, and gives the best result.

Recipes for preparing Portland cement washes are given below :—To make a wash of a grey stone colour (not the London stone colour) spread the cement dry on the floor for five or six hours, and then well mix it with water in a large tub. The consistency must be judged by the condition of the wall to which the wash is to be applied. To every 5 gal. add 1 qt. of soluble glass ; keep well stirred when using. For a cement wash for exterior walls mix 50 parts of Portland cement into a wash with water. Also mix 5 parts each of plaster-of-Paris and lime into a wash, and add this to the cement, and well

stir. Now dissolve 5 parts of powdered glue size in boiling water and pour into the wash, well stirring the whole, after which a little alum should be melted and stirred into the mass. This makes a wash that resists the damp and does not crack and chip off. The following, also, has been found very effective. Add to ½ cwt. of the wash ¼ lb. alum dissolved in ¼ gal. water and 2 lb. glue melted in 1 gal. of water ; the whole should be thoroughly mixed. The wall should be well damped before the wash is applied, otherwise the dry wall will absorb the water in the wash, which will then crack and fall off.

When Parian cement plaster is to be painted or papered immediately, the first coat or backing is usually

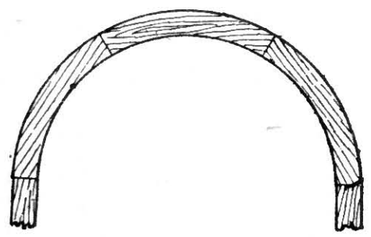

Fig. 21.—Screeds for Arch.

composed of sand and lime with plenty of hair, and is put on a full ½ in. in thickness ; the second coat or floating is of finer quality, does not contain so much hair, is used in a softer state, and is applied as soon as the first coat has set sufficiently. Two or three weeks, or even a longer time may elapse before these two coats are sufficiently dry to take the Parian cement. If time is of importance, Portland cement may be used instead of lime ; Parian cement is very often mixed with the lime in order to ensure quick-setting, and in either of these cases the second coat is omitted. The final coat is of Parian cement used neat, and the surface should be painted as soon as possible after it is dry and hard.

For plastering the walls of a conservatory, which are required to present a hard surface and, without



the use of a colour wash, look like bath stone, it is advisable to use Sirapite, which possesses great strength and adhesiveness. Two coats only are required, and the second coat can be applied a few hours after the first, so that the plastering may be begun and finished in one day. Sirapite costs no more than ordinary plastering with lime and hair, and when finished presents a beautifully polished surface.

The plastering of arches is work of more or less special character. Arches turned in brick should be sufficiently true in shape for plastering to be done without screeds—that is, providing they were executed

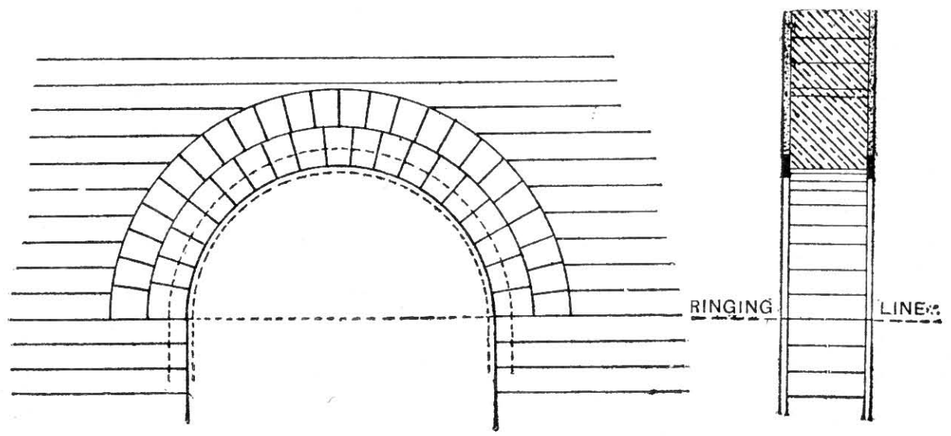


Fig. 22. Fig. 23.

Figs. 22 and 23.—Elevation and Section of Arch, showing Method of Fixing Screeds.

in a proper manner on centres. If they were roughly turned, it will be necessary, in order to ensure the soffit being perfect in shape, to fix screeds on both the faces. The screeds are prepared from ¾-in. pine boards, struck out and cut to a proper radius. For a semicircular arch the screeds will be in several pieces, as shown in Fig. 21.

Each side runs down below the springing (see dotted lines in Fig. 22), the springing line being squared across and plainly marked with a pencil. This is very necessary, as the two lines are levelled across when being fixed (see Fig. 23). Care must be taken that this is accurately done, or the arch when finished will be flewed.

Where the arches are formed with timber, the same process is adopted, but the lathing must be done previous to the screeds being fixed. Fig. 21 shows the method of forming the screed; Fig. 22, the rough arch in elevation; and Fig. 23, the rough arch in section, with the screeds fixed.

Instructions will now be given on plastering the column shown in elevation and plan by Figs. 24 and 25. The cap of the column down to the lower edge of A is square, that below that line being circular in section. On the square part of the cap, four pieces of wood about $1\frac{1}{2}$ in. to 2 in. thick, can be fixed as shown at A in Fig. 24 and also shown in the plan (Fig. 25). Another method is to make this wooden ring in two layers, so that the top pieces cover the joints in the lower ones. This ring being screwed together, it is held in position by means of wedges driven in the space between its inner edge and the brickwork of the cap. On the base of columns a plaster ring can be fixed which will form the fillit as shown at B. Next a running rule C is made to the shape of the finished column, this resting in guides which fit round the circular rings, so that when the rule is worked round it leaves the plaster in the shape required. Two rules have to be used, one of which is used to run the Portland cement, and the other to run the finishing coat of Keene's cement; or one rule can be made to do if all the columns are roughed in with Portland cement and then the metal face is fixed on to the rule after having the wood cut away to allow for the finishing coat. The moulding for the square cap can be run in lengths and mitred round the brick backing after the circular part of the column has been worked. For clearness of illustration, the guides to the running rule have been omitted, these merely being two half rings, one on the top and one on the bottom, made to fit rings A and B, so as to help in keeping the rule square while working the columns.

Rough stucco is the term applied to a surface finished to imitate stone, a large proportion of coarse sand being used—such as 3 parts to 1 part in common stucco—and the



grit is raised by working it over with a hand float faced with felt. It is used for outside work, passage walls, and for halls, staircases, etc.

Rough cast is a cheap covering, used for outside walls, and is of service as a protection from the weather. It consists of dashing on to the second coat while it is

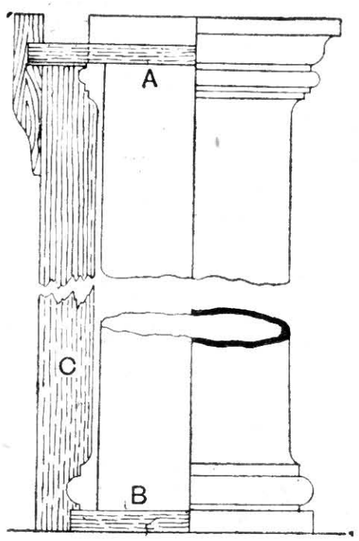


Fig. 24.

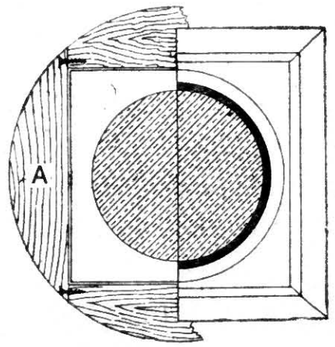


Fig. 25.

Figs. 24 and 25.—Part Elevation, Plan, and Sections of Column.

quite soft, a layer of well-washed sand, gravel, or coarse grit of any kind mixed with pure hot lime in a semi-fluid state, after which it should be at once washed over with a coat of some colouring material. The second coat is laid as evenly as possible without floating. In some districts, the rough cast is backed only with a rendering

(that is, one coat) of hair and lime mortar, and, while soft, the rough-cast, which is formed of gravel about the size of peas mixed with liquid lime, is thrown against it by a flat board with a handle at one end. As just remarked, rough-cast is washed over with colour, but there are but few pigments that will resist the action of the chemical substances contained in Portland cement used on the wall or in the wash. The two pigments that appear to withstand the chemical action of cement are red oxide and yellow chrome. These colours, if mixed with cement, make excellent red Mansfield and Bath stone imitations. Lime does not appear to destroy colours to such an extent as cement does.

Depeter work is similar to rough casting, except that small stones are pressed dry into the soft plaster by means of a board, leaving the surface comparatively rough, the colour being that of the stones used.

Depreter is a term used to describe plaster finished in imitation of tooled stone.

Pugging consists of a pricking-up coat of coarse stuff between the joists of floors to prevent the passage of sound. If on pieces of board, or tiles fixed between the joists, it can be done with a coarse stuff mixed with chopped hay, and if on laths, with hair mortar; in either case it should be not less than $1\frac{1}{2}$ in. thick.

Wall blackboards are prepared in the following way:—If on laths, plaster with three coats, the first being of good hair mortar gauged with plaster-of-Paris. When dry, brown with a coat of mortar, described as "stucco-plastering," but use a larger portion of cement. When that is dry, apply a good coat of hard-finish, coloured black with drop-black or lamp-black dissolved in alcohol; and when the finish is dry, apply two coats of liquid slating, made up of 1 lb. of white shellac; $\frac{1}{2}$ lb. powdered pumice-stone; $\frac{1}{4}$ lb. lamp-black dissolved in 1 gal. of pure alcohol. If the blackboard is to be put on a stone or brick wall, the scratch (first) coat may be omitted.

Marble finish is a hard-finish with dissolved lamp-black spattered on it in streaks with a pencil-brush just



before trowelling. The trowelling will blend the streaks of black and make them resemble the seams or grain of marble.

Scagliola is a plastering in imitation of marbles, formed of plaster-of-Paris mixed with size, and different colouring matters stirred through the mass, according to the effect to be produced. White cements, such as Keene's cement, etc., are used for the same purpose when harder and finer surfaces are required.

'Sgraffito is the art of decorating wall surfaces by means of incisions in plastic materials whilst they are in a moist state, using colouring matter in the various coats to obtain the desired effect. For two-coat work, the surface to be treated is floated to a uniform face $\frac{1}{4}$ in. less than the finished face. The design having been placed in position, mark the outline on the face of floating, as a guide for keying the finishing coat, which should be applied as soon as the colour coat is sufficiently hard. Placing the design in its original position, pounce through the outline as a guide for cutting through to the colour coat, using a worn knife to cut away the superfluous material, which is removed with a spatula; the edges of the work being sloped or inclined according to the light or shade required. For three-coat work the colour coat may be left rough, providing it is uniform, a dark colour being used as a background. This coat is ruled to within $\frac{3}{8}$ in. of the finished face, the class of work determining the thickness of the various coats. Apply the succeeding coat, and finish as soon as convenient, so that the coats may adhere in one compact mass. Expedition is specially necessary when treating exterior work, as water settling on the incisions of work improperly keyed would cause it to laminate or scale off. For colouring matter, to obtain good black use bone-black—or, for ordinary work, smiths' ashes—as an aggregate; for red, Venetian or Indian red; for brown, umber; for yellow, yellow ochre. When a neutral tint is required, a combination of two or more colours may be employed. The depth of the colour should be ascer-

tained by adding a sample of it to a small quantity of the stuff with which it is to be used, the material being allowed full time for setting. For external work, Portland cement or Aberthaw lime may be used, with sharp clean sand of a fine texture as an aggregate, in the proportion of 2 parts sand to 1 part cement. Aberthaw lime may also be used for internal work, and so also may Parian cement; but for ordinary purposes selenitic may be used with satisfactory results. The most important feature in 'sgraffito work is the selection of the colours; the surroundings, position, and class of work influence the selection and determine the distribution.



# CHAPTER V.

## MOULDINGS AND CORNICES.

THIS chapter will describe how plaster mouldings are made or "run," as it is termed. Chiefly, these mouldings are the cornices around large rooms, suggestions for which are given by Figs. 26 to 29. The cornice shown by Fig. 27 contains a moulded dentil course at A. Enrichments also may be added in panel B; these may be flutes and reeds and square floral pateræ. The cornice shown by Fig. 28 is suitable for a large room where the ceiling is rather low; the picture rail would be of deal. Fig. 29 is suitable for a drawing-room.

A cornice is run with a metal mould, which is made by cutting a plate of iron or zinc to the profile of the intended cornice, the members of the mould being filed with a fine file. The plate is next horsed; the upright piece of wood to which the plate is fixed should be perfectly square to the horizontal piece—the portion of mould which runs against the wall screed, and termed the slipper. Small straps of thin zinc should be fixed to the slipper and nibs to bear on the screeds. The mould is then placed in the intended position, and the nib and slipper are marked off on the ceiling and wall respectively. Lines are then struck for the screeds; the screeds are then traversed with a straight floating rule, the long screeds being traversed first and tried with a line, and the short screeds ruled in from off the long ones. This being completed, the mould is again placed in the angle bearing on the ceiling and wall, and should be perfectly upright and square. The line is marked for rules, the long pieces being marked and struck first, and the short ones lined from the long ones. The rules are next fixed with strongly gauged stuff to hold them in position. The mould is next run.

When a cornice has a large projection, in order to save materials, wood brackets are fixed at intervals, these being lathed and coated with mortar when the ceiling is pricked up. The depth and projection of the cornice are then marked on the walls and ceiling in each angle of the room, and between these marks level screeds of gauged stuff are run on and made perfectly straight; lines of red chalk are then struck on the screeds upon the walls the exact depth of the cornice, and laths about

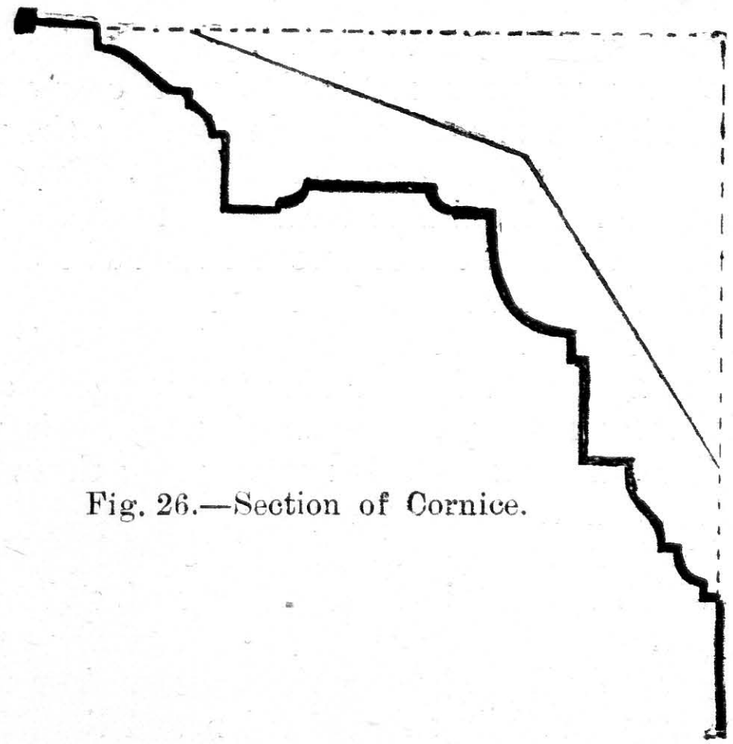

Fig. 26.—Section of Cornice.

2 in. wide, with one edge shot straight, are nailed to these marks, forming a level surface on which the mould is to run.

If the cornice is a small one, projecting but an inch or two, a backing of lime and hair will be sufficient. When a member projects several inches, and is undercut by a cove, it requires some support. This is obtained by driving in the wall a row of nails or spikes 12 in. apart, and protruding only sufficiently to allow them to be well covered by the plaster.

Two workmen are generally engaged in running a cornice. A pie of putty is formed on the board or



banker; into this water is poured, and the plaster is then sprinkled into the water by hand, and the whole is mixed up by the gauging trowel. One workman then takes a quantity of the gauged stuff upon his handboard, and applies it on the line of the proposed cornice; the other workman then applies the mould at one end, and runs it along upon the lath. The surplus stuff cut off by the mould falls off upon the board at the right-hand

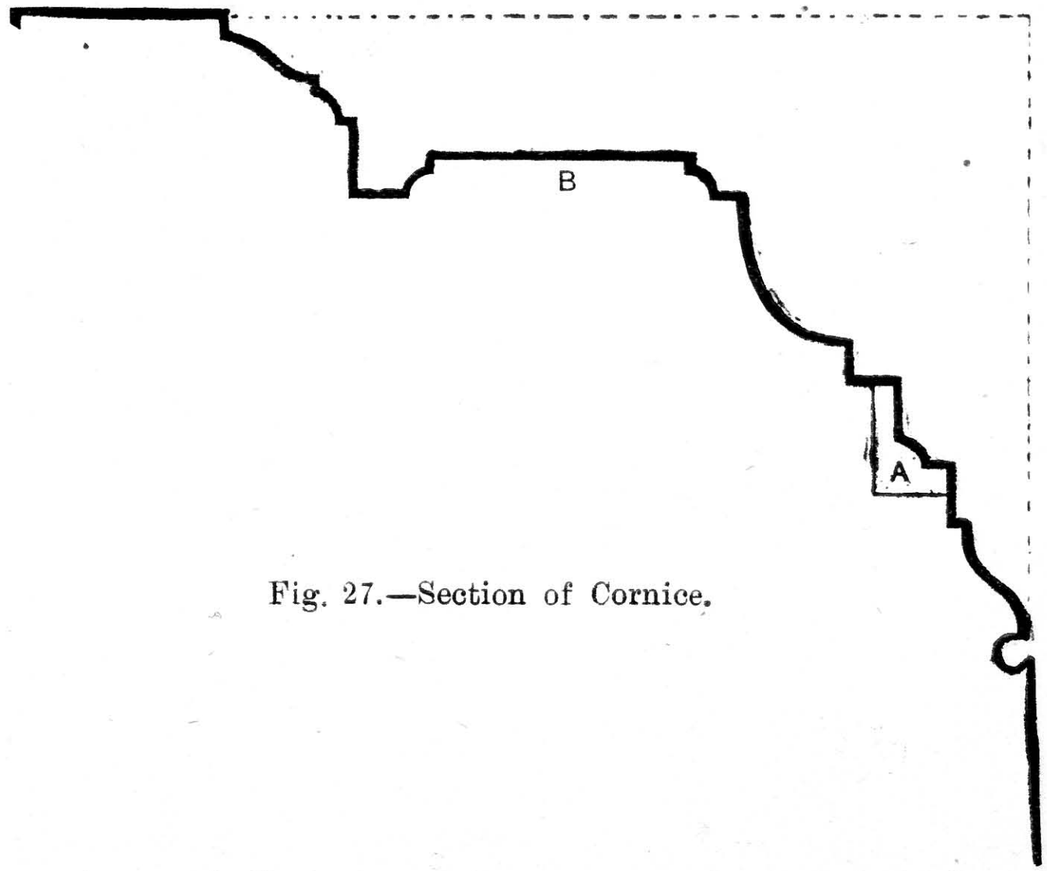


Fig. 27.—Section of Cornice.

side of the mould, and is, with another portion of the gauged stuff, applied to any portions of the cornice which have not been brought up full. When the cornice is nearly full up, the gauged stuff is made very thin, and dashed on with a brush, till it is run full up to the mould.

The mould cannot be removed from the work at right angles to the line of it, but is drawn off at the end so that no part is injured. As the cornice cannot be completed up to the angles, a length is run on the bench,

and, when quite set, is cut up into the lengths required, the mitres being cut to the proper angle and fixed in position with screws ; the butt-joints and angles are made good afterwards, and finished with the jointing tools.

Should any of the gauged stuff set, it must not be

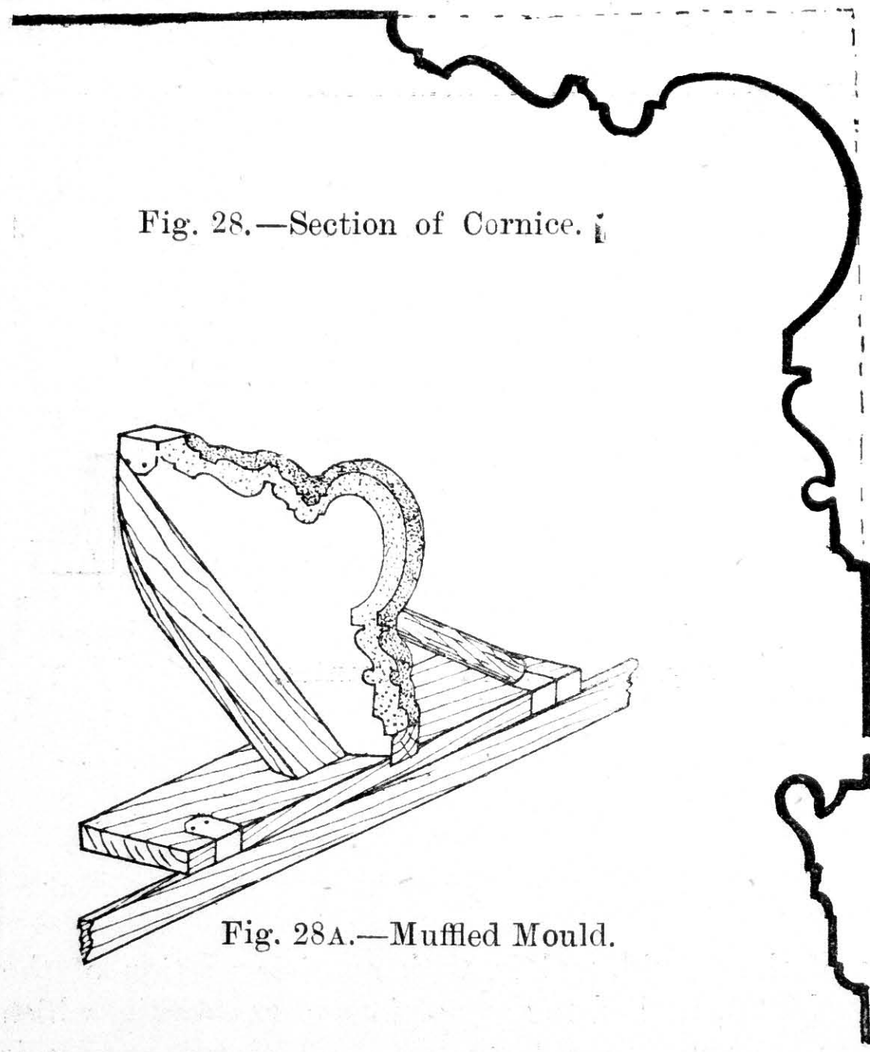

Fig. 28.—Section of Cornice.



Fig. 28A.—Muffled Mould.

remixed with water, as it is what is called "killed," and will not then set. Sometimes the mould (in beginning to run the cornice) is "muffled"—that is, the horsed edge of the mould is covered with plaster to about $\frac{1}{4}$ in. above the zinc profile, and when half-set is carefully trimmed with a knife. The muffled mould for the cornice shown in section by Fig. 28 appears as Fig. 28A.



Where a projection, such as a chimney breast, occurs, the cornice is run past at each end as far as the cornice projects, a piece of lath being nailed on the back of the cornice lath to guide the mould. Two stays are also fixed against the projecting end of the lath to keep it firm while running the cornice. When the whole of the cornice has been run, the laths are taken down and the

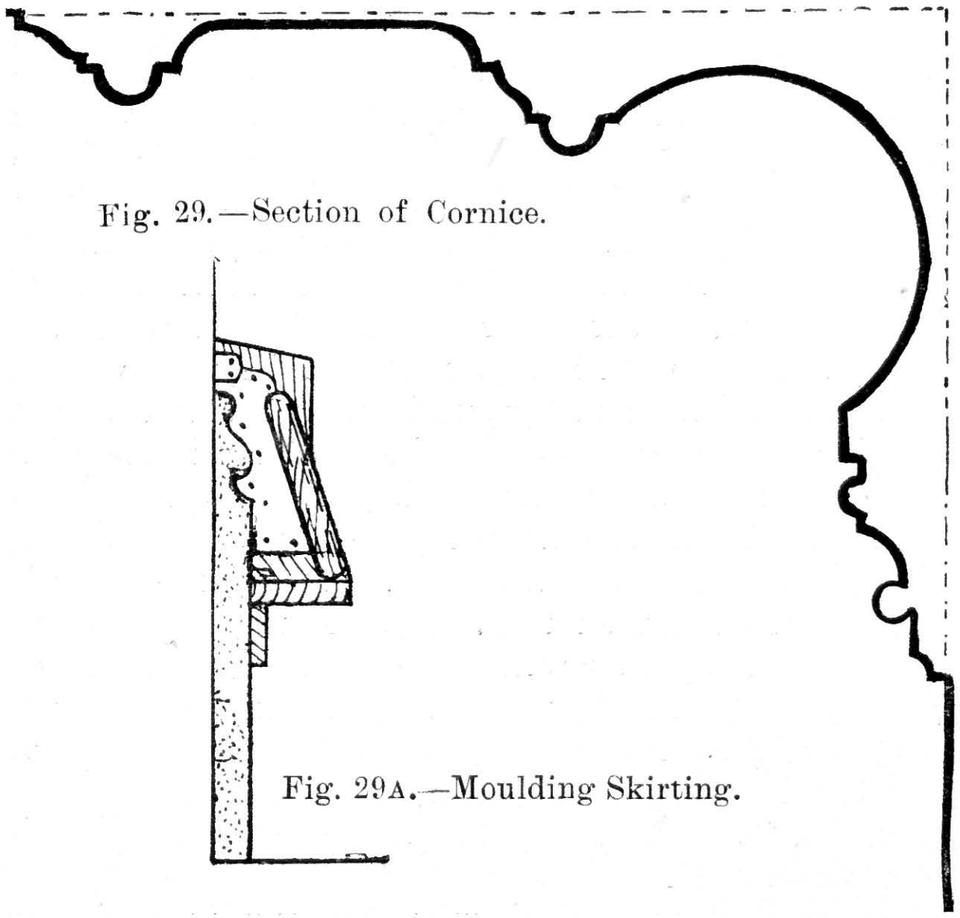

Fig. 29.—Section of Cornice.



Fig. 29A.—Moulding Skirting.

mitres or angles are put in by hand, by means of the mitring tools and rules.

In running the better class cornices, from 15 in. to 30 in. in girth, on wood brackets, lathed, the cornice is stopped, say 2 ft. from the angles. The plasterer runs a long length of the same section cornice on a scaffold, and when it is set cuts the cornice up into the required lengths, and cuts the mitres with a saw, as a carpenter would cut a wood cornice. The pieces are then offered

in position, and when properly fitted, are fixed with a plaster bed and screwed to the wood cradling; the butt joints are filled up level and tooled off. Enrichments are cast and fixed after the cornice is finished.

The following is a description of the trade methods of "putting in" a returned mitre of a plaster cornice and a returned mitre of a Portland cement cornice. In the first case, the plaster moulding having been run, and the position of the returned mitre having been ascertained, measure the projection of the moulding, and mark on the bed of the cornice the line for the bottom member. This is done by hanging a plumb-bob from the outside of the moulding and squaring out to the plumb line. Mark from the bed to the crown, and cut out to the mark and clear for the return. Try the return before fixing for intersection of the members. Next gauge up enough stuff to fix the return. If the work is dry, it should be well wetted, and return fixed and squared in from the line of the cornice. The members should be tried for intersection with joint rules, and then mitred. In putting in a return mitre in Portland cement, the projection is marked off, and marked from crown to bed, and the moulding is cleared for fixing the return. The return may be fixed the same as in plaster cornice, but fixed in cement; or it may be worked in position by hand by putting a section of the cornice, marked upon the wall in the exact position it is intended to go, and by squaring out from the wall, the stuff being put on and finished with small floats and small tools.

Beads, splays, and chamfers are run in a similar manner to mouldings. Skirtings are also run with a mould, the lath being nailed to the floor upon screeds formed to correct the irregular surface of the floor, or nailed to the face of the skirting (Fig. 29A). When the skirtings are of Parian cement, they are cored or floated up with Portland cement, to save the more expensive Parian cement.

When the mouldings are not continuous, but enriched, they can generally be run as continuous mouldings,



leaving the enrichments to be added afterwards. These are generally made of plaster-of-Paris, cast as described in the next chapter, or preferably of some lighter material such as papier-mâché, and are secured with plaster-of-Paris if resting on any projection; if not, with white lead or iron cement, or they may be screwed to woodwork, according to circumstances.

Very large projecting mouldings and cornices inside buildings are even made of coarse canvas, strained over a light framework, and washed over with gauged stuff. They are easily carried up and fixed in position. Huge cornices of this kind make a great display in the interior of the Albert Hall, South Kensington.

For cement skirtings and other parts liable to injury, either entirely Portland cement, or Portland faced with white cements—such as Parian, Keene's, Martin's, etc.—is used.

The method about to be described in detail applies to the plastering (in the solid) and setting out of a panelled ceiling, the design being geometrical and repeated and with rib mouldings about 5 in. girth; the panels have modelled ornamentation applied *in situ*.

The first consideration is the lathing, metal or wood being used, the former being fireproof, but in some cases inferior to wood as regards key for material, providing the wood laths are properly fixed, that weak or sappy ones are discarded and that they are of double thickness, butted and broken at joints, and placed $\frac{1}{4}$ in. apart. Previous to lathing, the under side of the joists should be tested with a straight-edge. If they are found to be of unequal depths, brandering should be resorted to—that is, laths should be nailed longitudinally where necessary, in order to ensure a uniform coat of material over the whole ceiling. The material is composed of well-slaked lime, sharp clean sand being used as an aggregate, in the proportion of 3 parts sand to 1 part lime, with sufficient cowhair to promote cohesion.

The first or scratch coat should be scored diagonally

in opposite directions, to form a key for the succeeding coat, and should be allowed to dry thoroughly before the succeeding coat is applied. In order to obtain the best results in solid work, the greatest care should be exercised in the selection of materials and in the methods of using them. Before proceeding to float the ceiling, it is necessary to fix the screeds as fully described in Chapter IV. If the ceiling is of an elaborate character, with the bulk of the mouldings run in position,

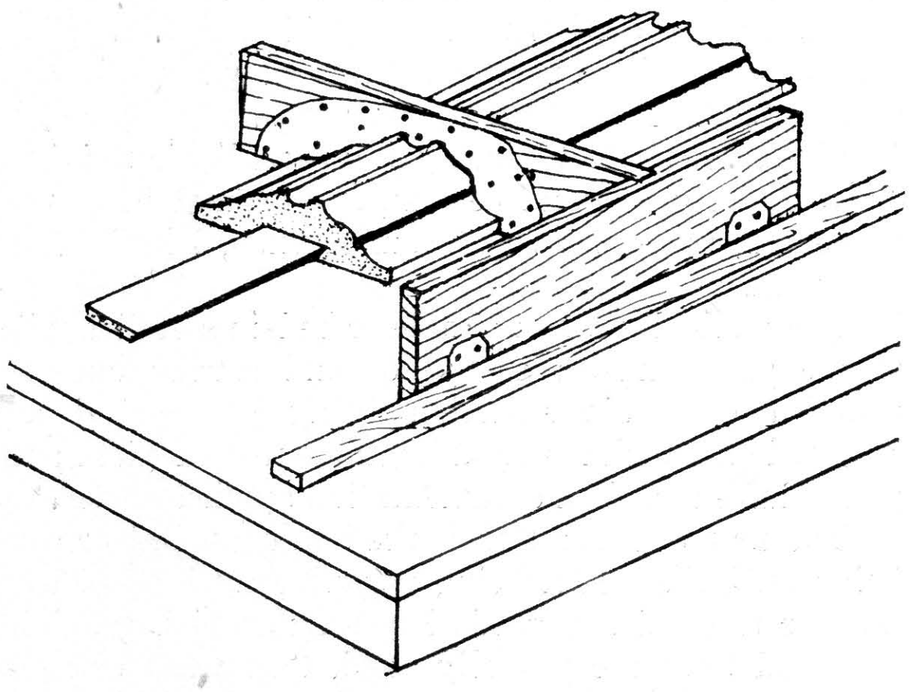

Fig. 30.—Running a Moulding on the Bench.

it is necessary, after forming the main screeds with fine stuff for the cornice, to screed the whole of the ceiling, ruling it flush with the screeds after the cornice has been run.

In obtaining the centre lines of the main ribs, take care to allow half the width on each side of the cornice line, so as to get the panels of equal size. After marking the centre lines of the intermediate ribs, mark the width and rule lines, using a separate colour to each in order to avoid confusion. Fix the rules for running by



holding them in position with gauged stuff. Before running the ribs in position, the floating should be cut through, exposing the laths with the width lines as a guide. The mould should be muffled, and the moulding cored with well-tempered coarse stuff gauged with plaster, with sufficient cowhair (for which manilla fibre is an excellent substitute for the present purpose) incorporated. The short or intermediate lengths of

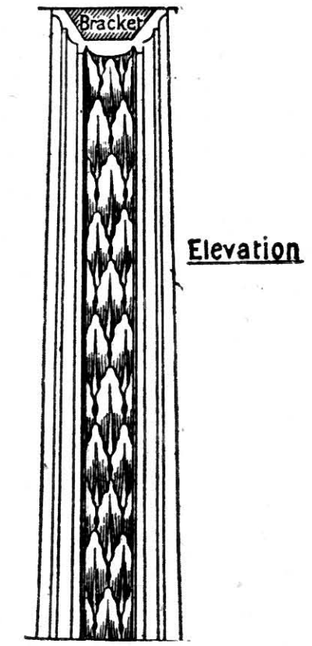


Fig. 31.

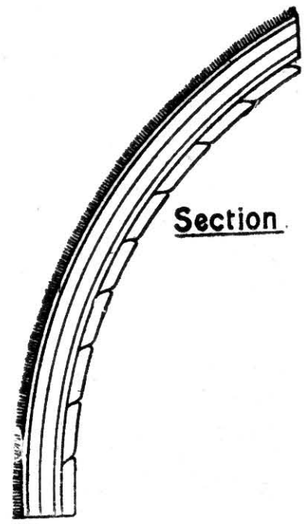


Fig. 33.


Fig. 32.

Figs. 31 to 33.—Views of Diminished Moulding for Dome.

moulding require to be run on a bench, and planted in position afterwards. When running mouldings on the bench (see Fig. 30) it is necessary to muffle the mould with gauged plaster $\frac{1}{2}$ in. thick (not illustrated), taking care to form an undercut on each side for fixing. After the core is run, it should be coated with shellac, afterwards oiling it to prevent adhesion of the rib, which, after being run, is cut to the desired lengths. It is extracted from the core with a sliding motion, and, to further increase its fixing properties, the back surface

is scored with a sharp-pointed knife held in a slanting position.

Panelled ceilings demand special treatment, according

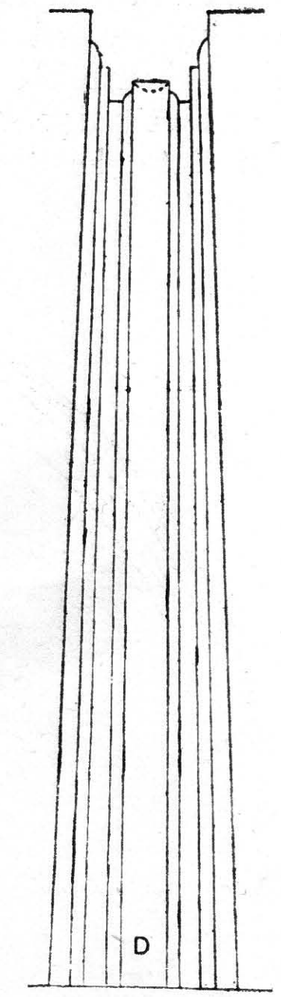


Fig. 34.

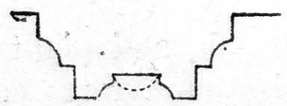

Fig. 35.

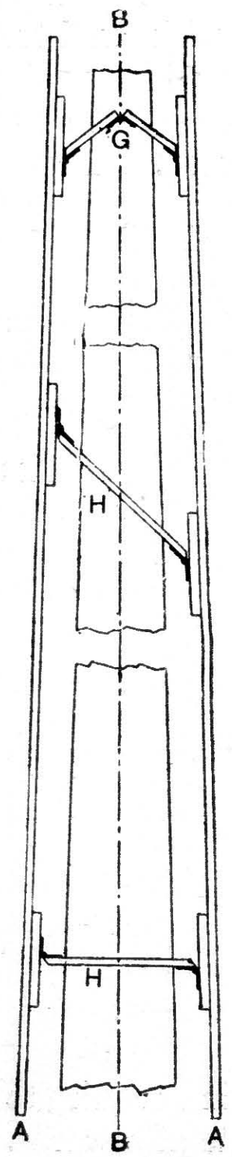


Fig. 36.

Figs. 34 to 36.—Running Diminished Moulding on Dome with Trammel.

to the size, character, and design. If the bulk of the mouldings have to be planted, it is necessary to set the ceiling with gauged putty and plaster, marking the centre lines, the width, and the radial lines. The



materials are cut to expose the laths, and the ribs are fixed with gauged putty and plaster, with cowhair or fibre to aid cohesion. For ornamentation modelled in place, it is necessary to have a full-size drawing of the panel to be executed; the drawing is placed in position, and the outline pounced through, the surface being marked as a guide when modelling, the ultimate result depending on the skill and artistic ability of the operator. The height and character of the ceiling influence the restraint or boldness of the outline. Plaster gauged with a slight proportion of lime putty, with an addition of size water to retard setting, is an excellent material for *in situ* work internally, the size of work in hand determining the quantity to be used. While the work is in progress, and before the finishing touches are applied, it should be subjected to a critical view from the position and distance it will be chiefly observable. It will then be possible to emphasise or to restrain where necessary the features of the design, so as to make the whole harmonious.

There are various methods suitable for running diminished mouldings, and before adopting any particular method it is necessary to take into consideration the position, size, and character of the work to be executed. There are two methods which may be applied with equal success to the running of a diminished moulding on a dome, as indicated in Figs. 31 to 33. One method is to run the mouldings as indicated in Figs. 34 to 36 by means of a trammel fixed in the centre of the stock (Figs. 37 and 38), diminishing the width of the moulding by running rules A A (Figs. 36, 39 and 40) fixed on the face of the floating equidistant from centre line, as B B (Fig. 36).

If the work is too large to admit of the use of a trammel, it is necessary to form pressed screeds by means of a rib cut to the required curve, setting out the centre line of each rib, and fixing the running ribs as before, with the centre line as a guide, and working the mould, beginning at the top or crown, and working downwards,

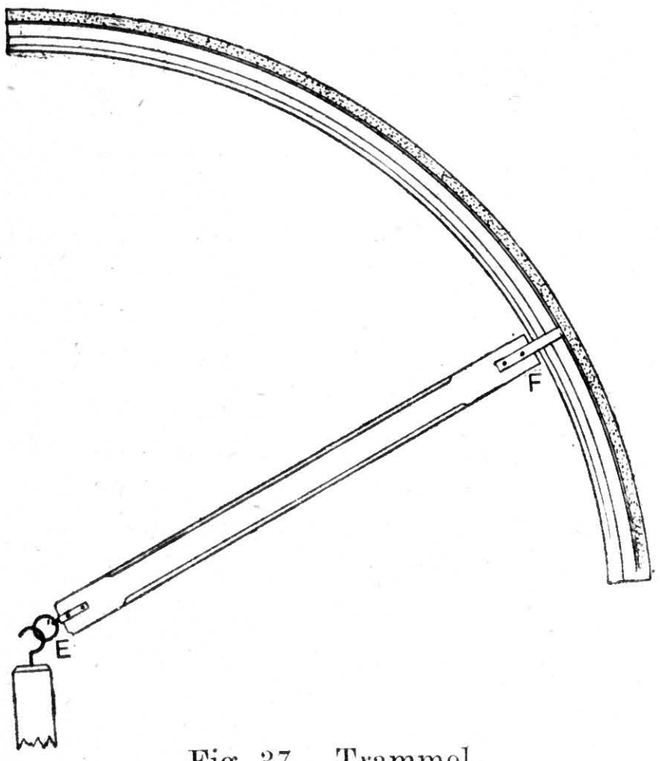


Fig. 37.—Trammel.

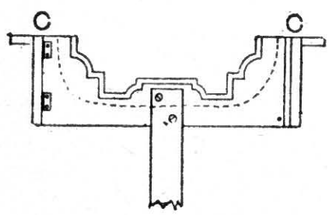


Fig. 38.—Section of Trammel at F (Fig. 37).

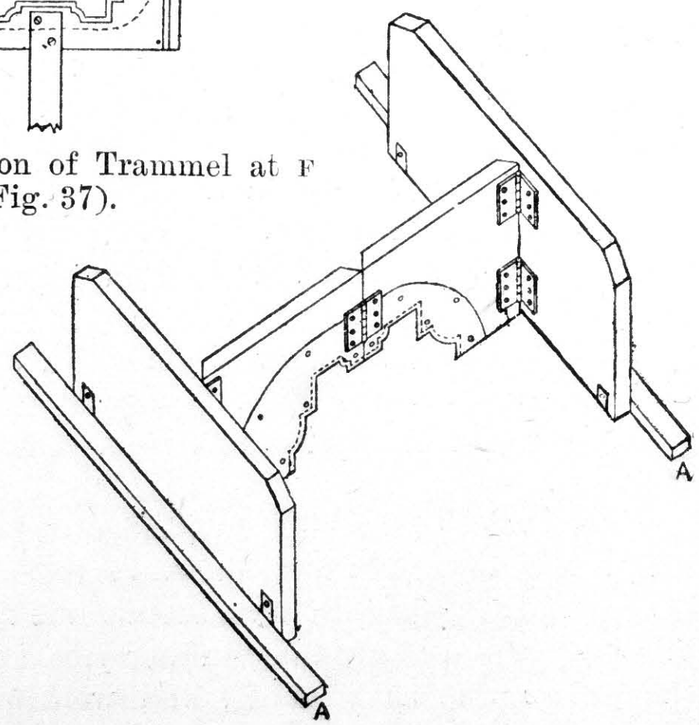


Fig. 39.—Triple Hinged Mould.



cutting the slipper at C C (Fig. 38) to the required curve, oiling it, and also the hinges, to ensure the mould working smoothly.

Another method is to fix a diminished running rule

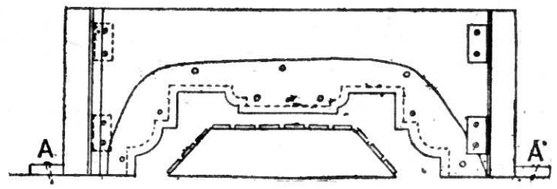


Fig. 40.—Section showing Wood Bracket for Lathing.

in the space D (Fig. 34), running each side of the rib separately, obtaining the required diminution in the enrichment only, which, of course, does not fulfil the requirements so correctly as the former method, because a properly diminished moulding should be proportionately diminished as a whole. There are, however, certain mouldings unsuitable for such treatment. Therefore,

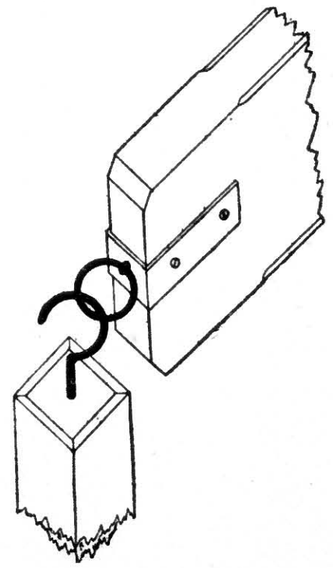

Fig. 41.—"Centre," and End of Trammel.

when dealing with diminished work, the contour of the mouldings should be considered.

Fig, 41 is a detail view of the end of a trammel E (Fig. 37) and shows a simple method which can be adopted when the section, a dome, is semicircular, the hook

being screwed into the centre of a wood block fixed securely in the centre of the span, altering the position of the mould by giving the hook a slight turn to bring it parallel with the trammel.

Still another method is illustrated at G (Fig 36), which shows a triple-hinged mould that may be used when the space does not allow of the use of a double-hinged one, as at H H, the latter being the more satisfactory, as the tendency to vibrate is not so great as with a triple-hinged mould.

The whole of the enrichment of one rib should be modelled to suit the corresponding diminish, instead of shrinking the jelly moulds (see Chapter VI.), but in order to obtain the highest results in work of this class the enrichments should be modelled when the rib is fixed.



# CHAPTER VI.

## PLASTER CASTING.

CEILING and other decorations are cast with plaster-of-Paris mixed with water to a semi-fluid state, and poured into the mould. Ordinary plaster, as used for walls, is unsuitable for the purpose. A special quality, known as

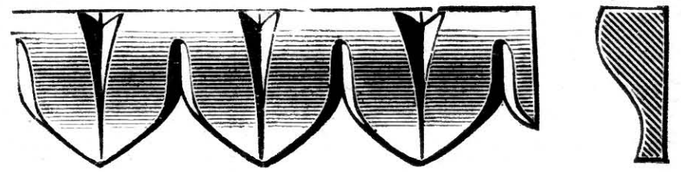

Fig. 42.—Typical Enrichment.

fine or modelling plaster, is used (see p. 15), and it is prepared by sprinkling the dry, fresh plaster into a vessel of water.

Enrichments are plaster ornaments fixed between the members of a cornice, or at the top and bottom, and sometimes in both positions. They are cast in various lengths, and typical designs are shown by Figs. 42 and 43.

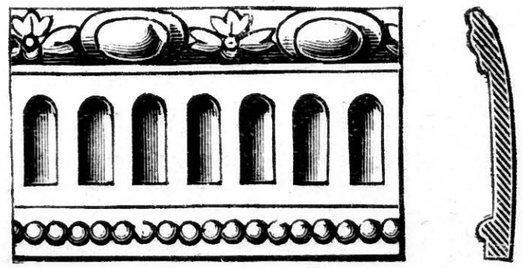

Fig. 43.—Typical Enrichment.

In running the cornice, grooves or rebates are formed, into which the enrichments are fixed with liquid plaster.

Enrichments are also made of carver's compo, a mixture of glue, resin, and whiting; in papier mâché, with a priming of whiting and glue over it; and in carton-

pierre, with layers of whiting and glue. These enrichments are lighter and more flexible than those made of plaster, and can be bent and fixed with screws.

Trusses (Figs. 44 to 46) are cast in plaster-of-Paris, and are of various forms and sizes. They often have a moulded cap fixed on the top. They are fixed at the springing of arches and in similar positions.

Ceiling flowers are cast in plaster, and are in several pieces. They are fixed in the centres of ceilings, and in panels formed in ceilings. When a gas pendant or chandelier is fixed in the ceiling, the centre of the ceiling flower is cut out to fit the wood pateris of the gas-fitting. When the various pieces of the ceiling flower do not touch each other, centre lines for each separate portion of the flower are marked on the ceiling, to which the different pieces are fixed. They are also made in papier-mâché, etc.

The moulds employed in plaster casting may be of plaster, wax, sulphur, gelatine, etc., each material having its own particular application. Gelatine is superior to them all, on account of its flexibility, and by its use the tedious process of piece-moulding is dispensed with, and the cost of production therefore materially lessened. Each of the above-named materials has its own peculiar advantages, which should be considered with reference to the class of work to be executed. Plaster is best adapted for reverse and piece-moulding; wax, for moulding small work, when sharpness of outline is required; sulphur, for flat work of a delicate character, such as plaques, metal medallions, etc. In some cases wax is superior to gelatine for moulding flat enrichments, giving cleaner and sharper casts and a more durable mould. Gelatine is decidedly best for moulding large work, whether flat or undercut, its flexibility minimising the risk of damage to the mould.

The wax and plaster waste-moulding process is adopted when only one cast is required, the mould being destroyed to get at the cast. It is more economical and quicker, and gives better results than plaster piece



moulding, especially in work of a delicate nature, or where sharpness of detail is a consideration. The mould is made from a clay model, which sometimes is coated with shellac and afterwards with oil to prevent the

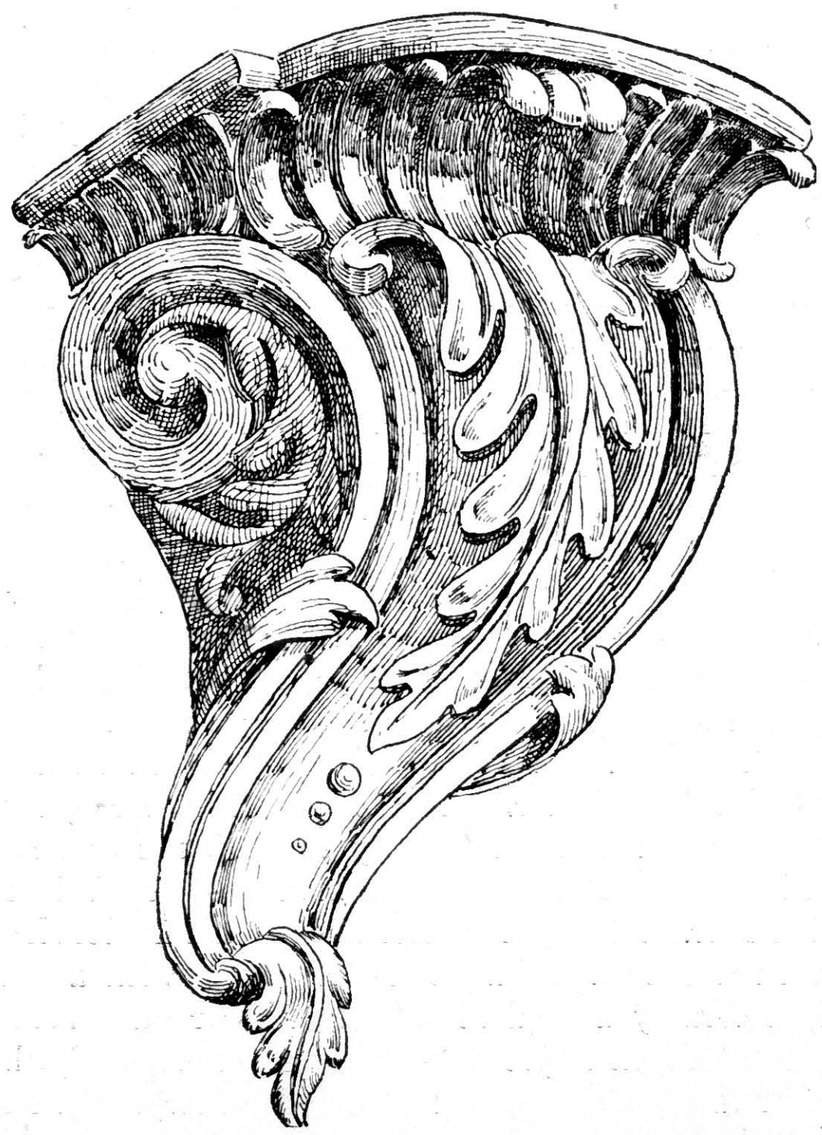

Fig. 44.—Truss.

mould adhering to it; but this method is to be deprecated, as it has a tendency to destroy the life of the model and the individuality of the modeller. If the model is partly dry, it should be sprinkled with water, using a camel-hair brush, blowing off any excess water by means of a blower; or, if the model is not too large

tilting it to allow the water to run off. Proceed to use clay which has previously been beaten on a clay board to a thickness of ¾ in., cutting it into strips wide enough to form a fence round the model to prevent wax from escaping and allowing wax to cover the salient parts of the model, the fence being, if necessary, held in position with gauged plaster. The wax, before being poured, should be tested by dipping the finger (previously oiled) in it to ascertain its degree of heat. In pouring the wax, begin at one side, or at the lowest part of the model, following it up as the wax proceeds, in order to obviate air-bubbles and cooling of wax, which causes seams in the mould. After the wax has got slightly cool, form a channel with the fence by which superfluous wax may return to the pot or utensil used, tilting the model to allow the wax to escape, and leaving a uniform coat of ¼ in. thick over the entire model. After the skin, as it is called, has become hard, the undercut parts should be stopped with clay to prevent plaster from biting or adhering, the whole of the wax being afterwards washed with clay water ; then, sufficient plaster is gauged in a liquid condition and poured over the wax, strips or laps of canvas being laid to strengthen and economise the plaster. If the model is large, insert strips of wood where necessary to keep the case rigid, levelling the dots to allow the mould to be solid when turned over. After the plaster has set, the model should be turned over, the clay being removed with a blunt tool, preferably a modelling tool of the required shape, care being taken to preserve the face of the mould, which is afterwards washed with soap and water, again oiled, and again washed with soap and water, removing excess water by means of a sponge when the mould is ready for use. The liquid plaster is poured into the mould, this being inclined so that the plaster flows into all the markings, and the surplus is poured out again, thus producing a hollow cast, which is stronger and lighter than a solid one. The cast may be released by plunging the mould into warm water or covering it with hot cloths.



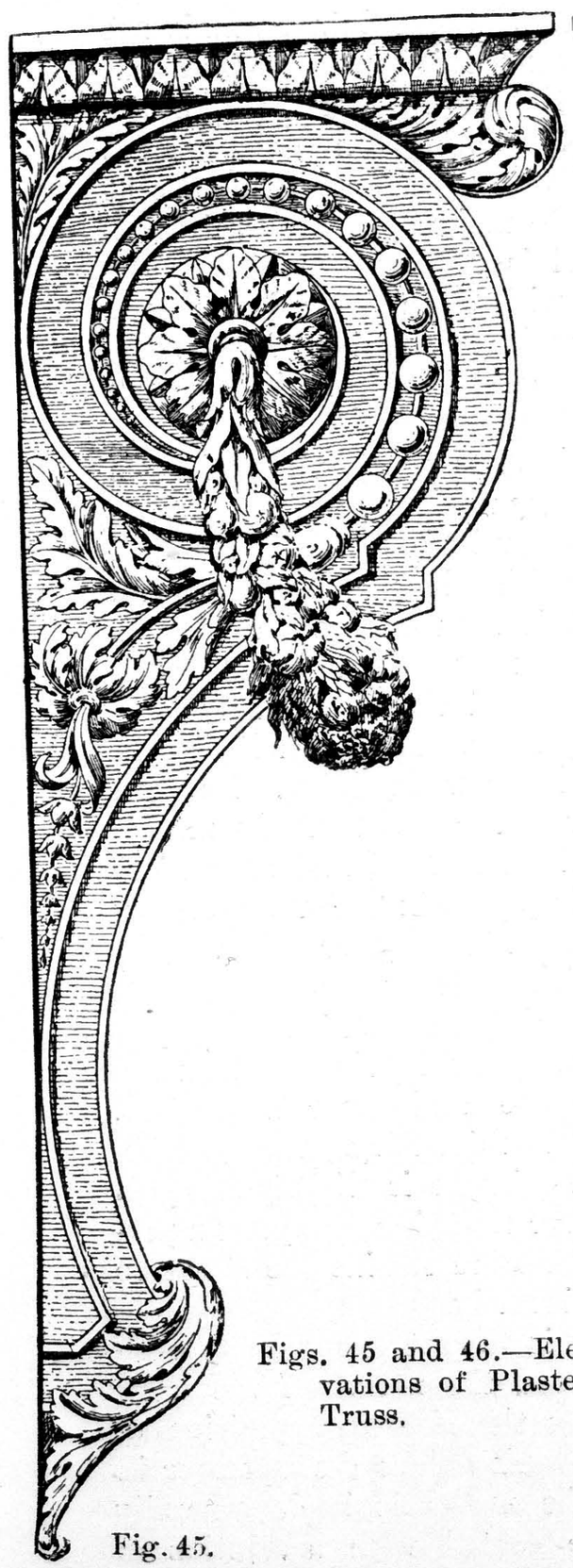

Fig. 45.

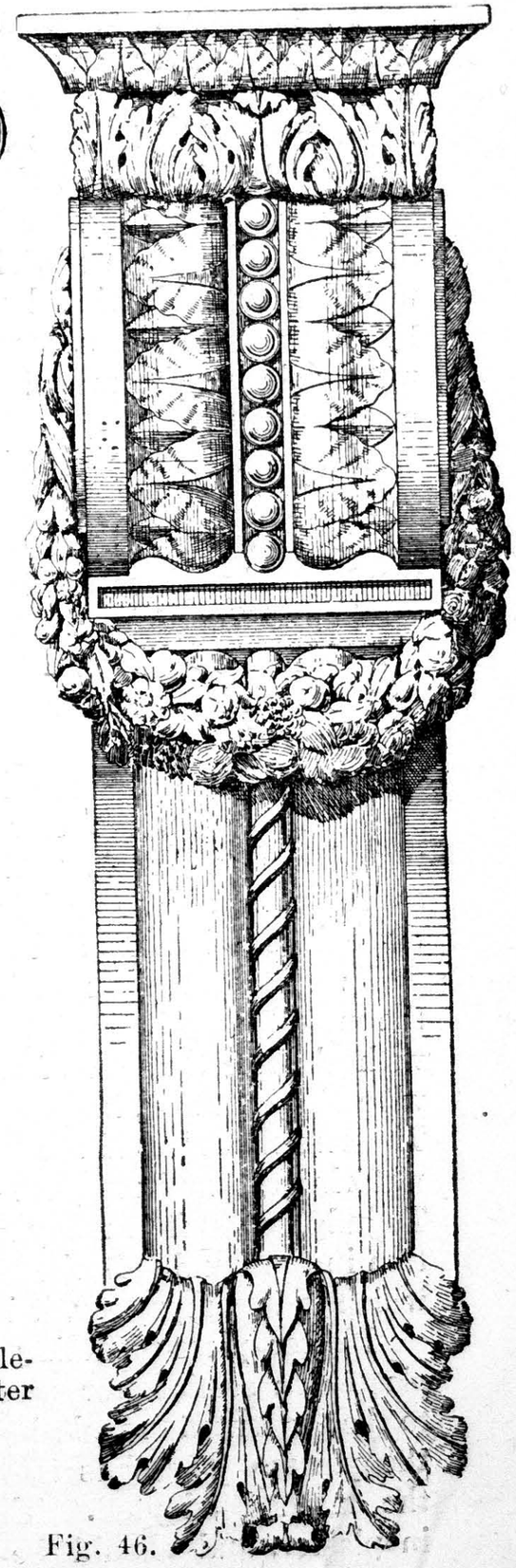

Fig. 46.

Figs. 45 and 46.—Elevations of Plaster Truss.

In a common process of waste-moulding, wax is not used at all. Over the clay model is poured a thin coat of fine plaster preferably tinted with ink so that in the subsequent chipping out the worker can guard against driving the chisel into the cast. Over the tinted coat is poured coarser plaster to make up the full thickness of the mould. The model is removed as before, the mould thoroughly rinsed with clean water, is seasoned by saturating the surface with a solution of soft soap, merely rinsing the mould to rid it of froth, before commencing to fill.

Portland cement enrichments are produced in two ways—by the wet and the dry methods.

In the wet process, the mould is generally made of plaster, and well seasoned with oil or water to stop all suction of the plaster. It is then oiled with paraffin. To obtain the best work, the neat cement should be put on the mould with a brush, and then backed up with cement and sand, or substitutes, allowing a hollow in the back of the cast for a key when fixing. As soon as hard enough, the cast is taken out of the mould, placed on the bench, well cleaned off, and allowed to set for a day. The cast is placed in water for two or three days to harden, and then is ready for fixing.

In casting cement enrichments by the dry process, the mould is made of plaster, and all suction is stopped with shellac, the face of the mould being well dusted with French chalk, keeping the mould as dry as possible. The cement and sand are well mixed dry. Then, with a watering-can and rose, the mixture is slightly damped. To judge when it is ready for ramming, compress a portion in the hand. If the mixture retains the shape to which it is compressed, it is ready.

Plaster piece-moulding is the art of moulding with plaster in sections or pieces, the nature of the work to be executed regulating the size and position of the pieces. The class of work guides the operator in the method adopted. The model is itself generally in plaster, and should be coated with a solution of



soap, to stop absorption and to prevent the adhesion of pieces. Shellac is an inferior substitute for soap. For undercut work or models on the round, with a base moulding, it is necessary first to do the base, which may be moulded and cast separately if the work is big.

The base, if circular, may be moulded in three pieces ; if hexagonal, octagonal, or rectangular, there may be as many pieces as there are sides, the joints being made at the mitres or intersection of mouldings.

Before proceeding to mould the model, it is advisable to mark faintly with a pencil the intended position and size of each piece, deciding the relative positions of the whole previous to moulding ; place strips of clay on the model to follow the outline of the first piece taken in

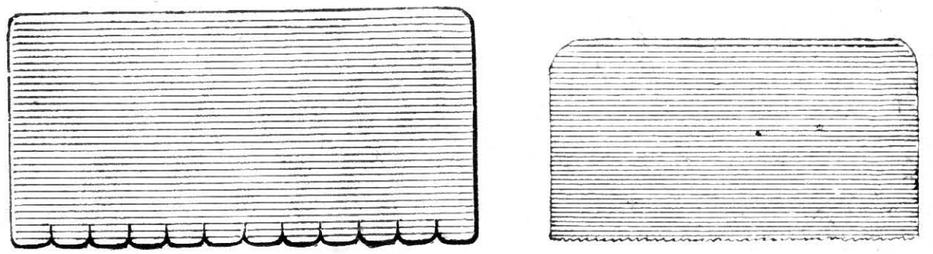

Fig. 47.—Steel Drags.

hand (beginning at the base, and working upwards), as a guide for applying the gauged plaster, and also to form a fence to protect the liquid from escaping. When the work is set these guides are removed, the ragged edges being cut away, and the piece formed to the required outline, slightly sloping the sides in order that the piece may draw freely, care being taken to avoid any sharp angles, which are liable to get damaged when extracting them from the model. It is necessary to form an occasional closing piece to hold adjoining parts in position, a length of wire being fixed in the closing piece whilst the latter is in a moist condition, cutting a hole in the case, opposite the inserting wire, and securing it to the back of the case by means of a cord or wire held tight by the insertion of wedges. If the work is big, and consequently requires a great many parts, it is necessary

to number the back of each piece in order to avoid confusion when placing them in position previous to casting. Each piece, after being trimmed, is replaced on the model, and tapped evenly with a flat-headed hammer (called a moulding-hammer), in order that it may fit closely. Straighten the back by means of a steel drag (Fig. 47), remove all dust from the face of the model, and soap the sides and edges of the piece to prevent the adhesion of the adjoining piece. If the pieces are large, joggles are formed to increase further the holding qualities of each after the whole of the pieces are made ;

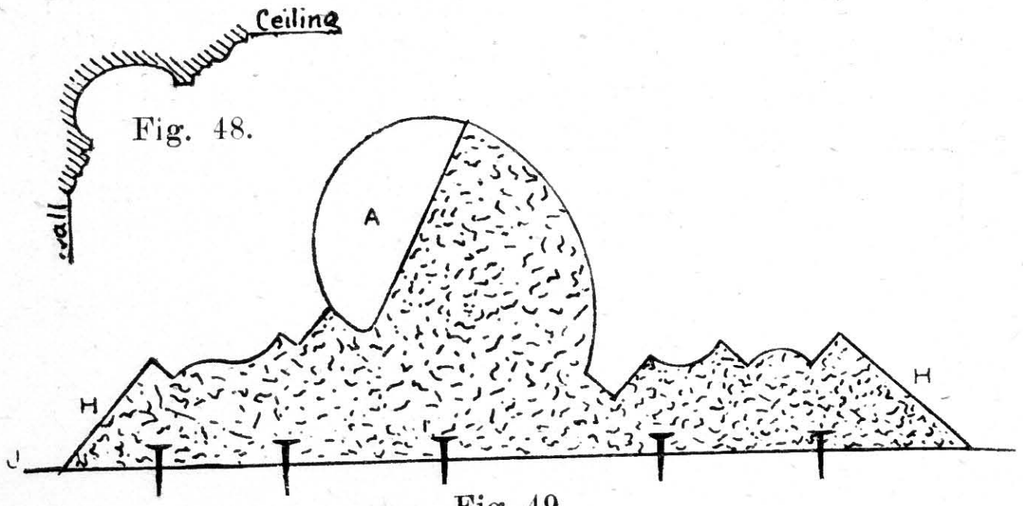


Fig. 48. Fig. 49.

Fig. 48.—Section of Cornice in Fibrous Plaster. Fig. 49.—Reverse Mould.

the back is coated with a solution of soap. The case may be made in sections, which are held in position by cords wound round them. Fibrous plaster cases are preferable, being more economical, stronger, and easier to handle than solid cases. The pieces are extracted in the reverse order to that in which they were inserted, and are treated with a solution of soap to indurate them before they are replaced in the case prior to casting. In order to obtain the highest results, only superior plaster must be used. After the cast is made, the fineness of the seams on the cast affords an indication of the quality of the workmanship. The seams are removed by means of a scratch tool of the required shape. Work from which



the seams have not been removed provides an opportunity for beginners to study the position of the various pieces.

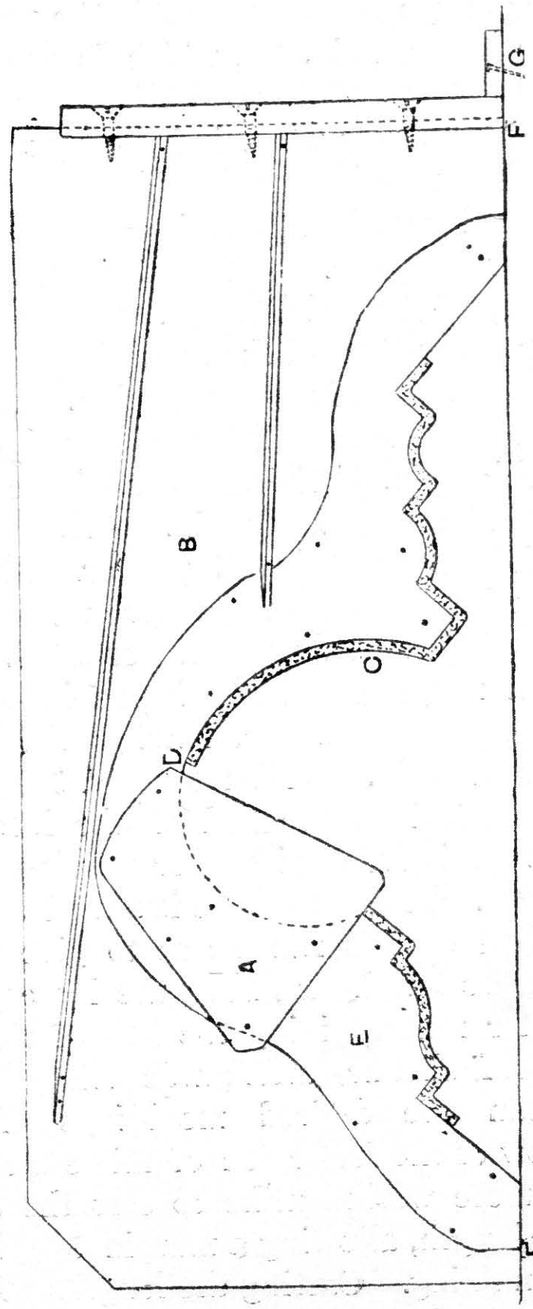


Fig. 50.—Running Mould in Position.

The example of work about to be described partakes of the nature of cornice running as well as that of plaster casting by the piece-moulding process. It is the making of a running mould for running a reverse plaster piece-

mould for casting a fibrous plaster cornice, the section being as in Fig. 48.

The first consideration in setting out a running mould for forming a reverse mould is the position of the loose piece plate A (Fig. 49), which is necessary when running undercut mouldings, the loose piece allowing the cast to draw freely when it is being removed from the mould. The running mould (Figs. 50 and 51) having been made, the loose piece plate is fixed temporarily on the stock B or template. The plaster muffle C, $\frac{3}{16}$ in. in thickness, is applied to within $\frac{3}{4}$ in. of the piece plate at D (Fig. 50), in order that all the mouldings, including the loose piece, may be run in one operation. If the cornice is large, wood brackets should be fixed on the bench, 1 ft. apart, to within 1 in. of the contour of the mouldings. Laths are fixed longitudinally $\frac{1}{2}$ in. apart, and the whole is covered with canvas soaked in plaster. The core may be formed with pieces of plaster that have been previously used for moulds, models, or cases. After the core has been run, it should be keyed in order to promote adhesion of the whole, leaving the bed of the loose piece and $\frac{3}{4}$ in. marked D (Fig. 50) untouched. Joggles are formed on the bed of the loose piece in order to prevent it from sliding or moving during the running process. The rough core is allowed to get cool before the final coat is run, so as to give the plaster sufficient time to swell. Remove the loose piece plate and the plaster muffle, giving the bed of the former a coat or two of shellac, afterwards oiling to prevent adhesion. Run the desired mouldings of sufficient length to allow of the formation of mitre stops at each end, as it is more workmanlike to cast the cornices to the required length, allowing a margin of $\frac{1}{2}$ in. to $\frac{3}{4}$ in. for freedom in fixing. Casting the lengths to the exact measurement often involves cutting when fixing. The mould, after running, is coated with shellac, and afterwards oiled with an admixture of pure Russian tallow and sweet oil dissolved over a slow fire. When oiling the mould, care must be taken to prevent the oil from



flooding the undercut or other mouldings, as that accident would cause bad results in casting. The following is a list of letter references to Figs. 49 to 53 not previously mentioned : E, iron template ; F, bench screeds ; G, running rule ; H, striking off edges ; J, bench line ; K, slipper ; L, braces ; M, wood inserted in cast ; N, grounds for fixing purposes ; O, ceiling joist ; P, lath and plaster ceiling. Figs. 52 and 53 show, respectively,

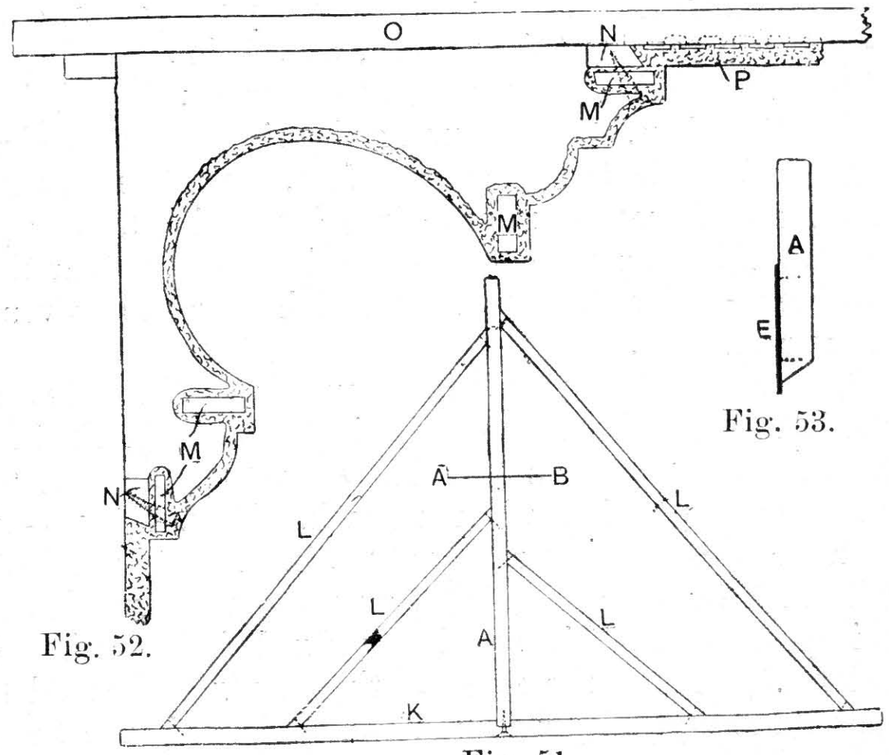


Fig. 53.

Fig. 52.

Fig. 51.

Fig. 51.—Plan of Running Mould. Fig. 52.—Section of Fibrous Plaster Cornice in Position. Fig. 53.—Section of Part of Running Mould.

a section of fibrous plaster cornice in position, and a section on line A B (Fig. 51).

The method of moulding with gelatine depends entirely on the character of work to be executed. In the treatment of flat surfaces, such as friezes, enrichments in low relief, etc., a solid mould is sufficient ; but where the work is more massive, is undercut, or is of a complicated nature, it is imperative to resort to case-making in order to economise gelatine, and for greater ease in handling.

After the model has been prepared for moulding, strips of wood, 1 in. by ¼ in., should be tacked on top and bottom as "striking off" edges ½ in. from the members, in order to prevent irregular shrinkage of the gelatine in the case, and also to provide a means of fixing so as to keep the gelatine in position. The model should then be covered with thick paper to prevent the clay from adhering.

Clay that has been previously beaten on a clay board to a regular thickness of, say, ⅝ in., should be laid on the model, strips of clay to form a rebate being laid at the edges. The ground or bearing, after the clay has been brought to a smooth surface, should be greased to prevent the case from adhering, care being taken not to allow the wood to be oiled, as it is necessary that the gelatine should adhere to the wood in order to prevent undue shrinkage.

The case should be made of fibrous plaster. Before the case is removed from the model, it should be marked in two or more places on the sides next to the bench, to indicate its position when replacing it on the model after the clay has been removed, as, in order to obtain a uniform thickness of gelatine over the whole model, it is imperative that it should be fixed in its original position. Remove the case and the clay from the model, cutting the necessary vent and funnel holes in the case, giving it two or three coats of shellac, and afterwards oiling to prevent the jelly from adhering. The model should be oiled, taking care to prevent excess oil from flooding the undercut and delicate parts.

Replace the case on the model, keeping it in position by means of struts fixed to the ceiling, and also securing it by strips of canvas soaked in plaster. Place gauged plaster round the sides of the case next to the bench, to prevent the jelly from forcing its way out. Place one or more funnels, according to the size of work in hand, at the lowest part of the model, and of sufficient length to allow the jelly to cover the highest part of the model, securing them by means of gauged plaster. Pour the



jelly at the funnel best suited, continuing the process until the jelly appears in an adjoining funnel, and following it up as it appears in each funnel. Keep pats of clay in readiness to stop the vent holes as soon as the gelatine appears, and in case of mishap, when jelly escapes from an unexpected quarter. After the jelly has sufficiently cooled (it may take from eight to twelve hours, according to the size of the model in hand), when the case is ready for removal, release the struts, plaster fences, and funnels, taking care to keep clean and preserve superfluous jelly in vent holes or funnel holes and protuberances on the back of the mould. The mould afterwards is dusted with French chalk and placed in the case, which has previously been fixed in a position suitable for casting. Dust the face of the mould with chalk to remove the excess oil, and give it a solution of alum water to harden the face. If the gelatine is of a superior quality, further treatment is unnecessary, but with an inferior kind the mould may be further indurated by coating it with terebene in order to form a glaze.

The oil for gelatine moulds may be composed of paraffin wax, kerosene, and a small addition of sweet oil, the whole being melted over a slow fire.

It is necessary, when gauging the plaster for casting, to add powdered alum in the proportion of, say, 1 tablespoonful of alum to 1 pail of gauged plaster. This treatment tends to harden the face of the gelatine mould, and absorbs excess water.

The gelatine must be of good quality, costing about 1s. 6d. per pound, and when bought should be cut up into small pieces and soaked in water till soft. The can in which the gelatine is melted is made so as to fit into another sufficiently large to allow plenty of water to surround it—that is, the gelatine is melted by means of the heat from the surrounding boiling water, and must not be allowed to come into direct contact with the fire. The gelatine should be made just thick enough to pour easily, and at the same time sufficiently thin to enter all the crannies of the ornaments.

# CHAPTER VII.

## ESTIMATING AND MEASURING PLASTERERS' WORK.

PLASTERING of all kinds, as well as lathing, is paid for by the yard super. (square yard), the prices varying with the materials employed, the nature of the finished face required, and whether the work is straight or curved. Small pieces, narrow widths, and mouldings are charged by the foot super. (square foot), or by the foot run in the case of very narrow widths. Ornamental parts are paid for separately by the foot super., foot run, or by the number, according to their nature.

In measuring ceilings, take from wall to wall, less one projection of cornice, and then make all deductions. Take mean length of the cornices, etc., by measuring from out to in, and by the girth, wherever the mould has been run. In the case of enrichments, measure them separately, in addition to feet super. of plain cornice. Plastering on walls is measured from the top of the grounds or cement skirtings to the foot of cornice ; and on laths add one-third the height of the cornice for stucco and two-thirds for laid and floated work.

Ordinary sized openings in plastered walls are generally measured in to allow for the labour of plastering the jambs or reveals. When the openings are deducted, the jambs and reveals are measured separately. The quirking of beads is measured by the lineal foot.

Rough casting and concrete floors are measured by the super. yard.

Cornices, beads, splays, chamfers, skirtings, and architraves are measured by the lineal foot or by the superficial foot, the girth of the moulding being taken.

Mitres, breaks, and returns are counted at so much each.



Trusses, keys, bosses, and ceiling flowers are counted at so much each.

Panellings, pilasters, fascias, etc., are measured per foot super.

Copings, kerbs, and similar works are measured per foot super.

The price includes all scaffolding, tools, etc., except in special cases.

The chief points that should be observed in measuring plasterers' work are :—Keep external work separate from internal work ; measure generally by the yard super., including narrow widths ; in cement and stucco work narrow widths should be separate ; keep circular work separate from straight ; keep plastering in small quantities separate from the rest, and measure by the foot super. instead of by the yard ; deduct openings, but not chimney pieces.

Assume that it is required to know how many yards super. of plastering, feet super. of cornice, and feet run of Keene's arris (at angles of chimney breast) there would be in a a room 30 ft. by 18 ft., and 15 ft. high, the cornice being 12 in. on ceiling and 10 in. on walls (girth 30 in.), with two breaks of 10 in. to chimney breast, which is 6 ft. 6 in. wide, the skirting (wood) being 10 in. high ; the allowances for deductions are :—Door, 7 ft. by 3 ft. 6 in. ; window, 7 ft. by 5 ft. ; and fireplace, 4 ft. by 3 ft.

In the first place, the ceiling 30 ft. × 18 ft., deducting one projection of cornice = 12 in. = 29 × 17 = 493 ft. super. Walls 30 ft., 18 ft., 15 ft. high, deducting $\frac{1}{3}$ depth of cornice ; also $9\frac{1}{2}$ in. for skirting = 13 in. ÷ 15 = 13 ft. 11 in.

30 ft. + 18 ft. × 2 = 96 ft. add 1 ft. 8 in. for 2 breaks.

| | ft. | in. | | |
|---|---|---|---|---|
| = | 97 | 8 | × | 13 ft. 11 in. |
| | 13 | 11 | | |

| | | | |
|---|---|---|---|
| 89 | 6 | 4 | |
| 8 | 8 | 0 | |
| 1261 | 0 | 0 | |
| 1359 | 2 | 4 | wall super. |
| 493 | 0 | 0 | ceiling super. |
| 1852 | 2 | 4 | total. |

| | ft. | in. | pts. |
|---|---|---|---|
| | 1852 | 2 | 4 |
| Deduct | 76 | 11 | 0 |

9)1775 3 4(197 yd.
9

87
81

65
63

2 ft.

| | yd. | ft. | in. | pt. |
|---|---|---|---|---|
| | 197 | 2 | 3 | 4 |

*Deductions.*

| | | ft. | in. |
|---|---|---|---|
| Door, 7 ft. × 3 ft. 6 in. | = | 24 | 6 |
| Window, 7 ft. × 5 ft. | = | 35 | 0 |
| Fireplace, 4 ft. × 3 ft. | = | 12 | 0 |
| Chimney breast, 6 ft. 6 in. × 10 in. | = | 5 | 5 |
| Total ... ... | | 76 | 11 |

*Cornice.*

| ft. | in. | |
|---|---|---|
| 97 | 8 | 2× ft. 6 in. girth. |
| 2 | 6 | |
| 48 | 10 | |
| 195 | 4 | |
| 244 | 2 | super. |



| | ft. | in. | |
|---|---|---|---|
| Ft. run of arris = | 13 | 4½ | |
| | | 2 | |
| | 26 | 9 | Keene's arris. |

197 yd. 2 ft. 3 in. 4 pt. plastering.
244 ft. 2 in. super. cornice.
26 ft. 9 in. run Keene's arris.

Generally a plasterer is attended by a labourer, who mixes and keeps his board supplied with materials ; also there may be a boy, called a hawk-boy, who feeds his hawk from the board. A plasterer, labourer, and a boy can lath, lay, and set about 20 yds. a day, or render and set about 30 yds. a day. In London and the suburbs it is usual for the plasterer to run his own putty, although it is not unusual for one of the builder's labourers to perform the operation ; for which the actual amount of cash paid is deducted from the plasterer's contract. When a master plasterer undertakes to plaster a house throughout at a certain price per yard, he is expected to run his own putty ; while if a journeyman takes the job on his own account from his master—that is, works by the piece instead of by the day—it is a question if he should run his own putty, that being really a labourer's job. It is a matter which should be mentioned when the job is undertaken.

Scaffolding is not generally charged extra in new work, but must be taken into account in estimating repairs which cannot be done from the ordinary trestles and boards used by the plasterer.

The estimator's work will be facilitated if the following facts are committed to memory :—One hundred yards of lathing require 20 bundles of laths and 7,600 nails ; 100 yds. of rendering or laying, 20 bushels of chalk lime, 40 bushels of sand, and 3 bushels of hair ; 100 yds. of floating require about twice as much as rendering ; and setting requires 10 bushels of lime, 2 bushels of white hair, and a little sand, if used ;

"render set" requires per 100 yds. 30 bushels of lime, 42 bushels of sand, and 5 bushels of hair. "Render, float, and set" 40 bushels of lime, 62 bushels of sand, and 7 bushels of hair to 100 yds. One and a half bushels of Portland cement will plaster 2 yds. super. $\frac{3}{4}$ in. thick.

Cement mortars—such as 2 Portland cement, 1 sand—have, after a short time, a tensile and an adhesive strength nearly equal to that of good brick—that is, 280 lbs. per sq. in. Strong hydraulic mortar—such as 1 blue lias and 2 sand—has a much greater tensile strength than power of adhesion. The former may be taken at 140 lbs. per sq. in. The best grey hydraulic mortar, after a period of six months, will not adhere with a greater force than 36 lbs. per sq. in. to hardest grey stock bricks; 18 lbs. to soft place bricks. The tensile or adhesive force of the weaker hydraulic mortar—such as 1 Halling or Dorking grey chalk lime—or pure lime mortar—such as 1 white chalk or Portland stone lime with 3 sands—should not be counted on at all. A factor of safety of 3 should be taken. Adhesion, however, cannot be depended upon unless the bricks are free from mould-sand, and this applies also to cements unless they are well wetted.

### WEIGHT OF LIMES AND CEMENTS.

| Description. | In Lump, per | | Fresh Ground, per | |
|---|---|---|---|---|
| | Bushel | Cub. ft. | Bushel | Cub. ft. |
| | lbs. | lbs. | lbs. | lbs. |
| Plymouth stone lime .. | 70 | 54½ | — | — |
| Grey chalk lime .. .. | 56 | 44 | — | — |
| Keynsham blue lias .. | 80 | 62¼ | 63 | 49 |
| Lyme Regis ,, ,, .. | 75 | 58½ | 70 | 54½ |
| Roman cement .. .. | — | — | 77 | 60 |
| Portland cement .. .. | — | — | 110 | 78 |
| Scott's or selenitic cement | — | — | 60 | — |
| Plaster-of-Paris .. .. | — | — | 74 | 57·7 |



### MEASURES OF LIMES AND CEMENTS.

| | |
|---|---|
| A chaldron of lime | = 36 imperial bushels, heaped. |
| ,, ,, | = 2 measures, 3 ft. long, 3 ft. broad, 3 ft. 3 in. high. |
| ,, ,, | = 52 striked bushels. |
| ,, ,, | = Two hundreds of lime. |
| An imperial bushel of lime | = 1·29 cubic feet, |
| A bag of lime | = 2150·4 cubic inches. |
| A single load of sand | = 27 cubic feet. |
| A double | = 54 ,, ,, |
| A load of mortar | = 27 ,, ,, |
| A bag of Portland cement | = 2 bushels = 2 cwt. |
| A barrel | = 4 ,, = 4 ,, |

### PROPORTION OF BULK OF MORTAR TO THAT OF CEMENT AND SAND USED. (*By Experiments.*)

| Bushels. | | Gallons, Water. | Bulk of Mortar, Cub. inches. | Proportion.* |
|---|---|---|---|---|
| Cement. | Sand. | | | |
| 1 Roman .. | 0 | 3⅜ | 1,872 | ·844 |
| 1 ,, .. | 1 | 4⅝ | 3,384 | ·762 |
| 1 Portland .. | 0 | 3 | 1,872 | ·844 |
| 1 ,, .. | 1 | 3 | 3,415 | ·770 |
| 1 ,, .. | 2 | 4½ | 4,965 | ·746 |
| 1 ,, .. | 3 | 5¼ | 6,549 | ·738 |
| 1 ,, .. | 4 | 6 | 8,277 | ·746 |
| 1 ,, .. | 1 | 1⅞ | 1,728 | ·779 |

* The proportion is that of bulk of resulting mortar to that of cement and sand used.

The decrease of bulk caused by mixing and wetting the materials must always be considered in estimating the materials required, and is best ascertained by actual trial with samples. The following data may, however, be taken as a guide :—

A cubic yard, or 27 cubic feet, of ordinary concrete requires 34 cubic feet of gravel, sand, and lime; therefore, in the proportion of six to one, a cubic yard of concrete will require 1·1 yds. of gravel and sand to 3

## BULK OF MORTAR.

TABLE SHOWING THE QUANTITY OF MORTAR PRODUCED FROM ONE IMPERIAL BUSHEL OF VARIOUS LIMES AND CEMENTS. (*By Experiment.*)

| | Description. | Lime or Cement. No. of Bushels. | Sand. No. of Bushels. | Water. No. of Gallons. | Quantity of Mortar in Cubic feet. | |
|---|---|---|---|---|---|---|
| In stone. | Stone Lime (Plymouth) .. .. | 1 | 3 | 12 | $3\frac{1}{4}$ | 6 gallons of water are required to slake, and 6 gals. to mix each bushel. |
| | ,, ,, .. | 1 | 3 | 12 | 4 | |
| | ,, ,, .. | 1 | 3 | 12 | 5 | |
| | Lias Keynsham .. | 1 | 3 | $9\frac{1}{2}$ | $3\frac{1}{12}$ | 3 gallons of water are required to slake each bushel. |
| | ,, ,, .. | 1 | 3 | 10 | $3\frac{2}{3}$ | |
| | ,, ,, .. | 1 | 4 | 12 | $4\frac{1}{3}$ | |
| | ,, (Lyme Regis) | 1 | 2 | $8\frac{1}{2}$ | $2\frac{3}{4}$ | 2 gallons of water are required to slake each bushel. |
| | ,, ,, | 1 | 3 | $8\frac{1}{2}$ | $3\frac{1}{4}$ | |
| Ground. | ,, (Keynsham) | 1 | 2 | $4\frac{3}{4}$ | $2\frac{1}{2}$ | |
| | ,, ,, | 1 | 3 | $5\frac{1}{2}$ | $2\frac{5}{6}$ | |
| | ,, ,, | 1 | 3 | $6\frac{1}{2}$ | $3\frac{1}{8}$ | |
| | ,, (Lyme Regis) | 1 | 2 | 6 | $2\frac{3}{4}$ | |
| | Cement (Roman) .. | 1 | None | $6\frac{1}{2}$ | $1\frac{1}{8}$ | |
| | ,, ,, | 1 | 1 | $6\frac{1}{2}$ | $1\frac{3}{4}$ | |
| | ,, (Portland) .. | 1 | 1 | $3\frac{3}{4}$ | $1\frac{3}{4}$ | |
| | ,, ,, | 1 | 1 | $3\frac{1}{2}$ | $1\frac{3}{4}$ | |
| | ,, ,, | 1 | 1 | $3\frac{1}{2}$ | $1\frac{3}{4}$ | |
| | ,, ,, | 1 | $1\frac{1}{2}$ | $4\frac{1}{8}$ | $2\frac{1}{12}$ | |
| | ,, ,, | 1 | 2 | $5\frac{1}{4}$ | $2\frac{7}{12}$ | |
| | ,, ,, | 1 | 3 | $6\frac{3}{4}$ | $3\frac{1}{2}$ | |



## MATERIALS FOR RENDERING, PER YARD SUPER.

| Kind of Work. | Lime unslaked. | Sand. | Hair. | Water. | Plaster-of-Paris. |
|---|---|---|---|---|---|
| | cub. ft. | cub. ft. | lbs. | gals. | — |
| Rendering only, $\frac{3}{8}$ in. thick .. .. | ·15 | ·23 | ·1 | 1·20 | — |
| Render 1 coat and set, $\frac{1}{2}$ in. thick .. | ·22 | ·23 | ·12 | 1·80 | — |
| Render 2 coats and set, $\frac{3}{4}$ in. thick .. | ·60 | ·68 | ·19 | 2·68 | — |
| Render and float, $\frac{5}{8}$ in. thick .. | ·25 | ·38 | ·17 | 2·00 | — |
| Render, float, and set, $\frac{3}{4}$ in. thick .. | ·32 | ·38 | ·18 | 2·60 | — |
| Setting with putty and plaster, $\frac{1}{8}$ in. thick .. .. | ·10 | — | — | 1·00 | ·03 |

For rubble or very rough brickwork the above quantities must be increased.

bushels of lime, without taking into account any decrease of bulk from ramming.

Concrete, if less than 1 ft. thick, is usually paid for by the yard super., according to the nature of the materials, and if over 1 ft. thick, by the yard cube, with so much extra for hoisting to any height.

A specification of plastering executed in a proper manner is here given :—The lime must be fresh, well-burnt, fat chalk lime, free from cinders, and must be run into putty at least one month before use. The hair must be sound long back hair, well beaten when dry. The coarse stuff must be composed of three parts, by measure, of sand to one of lime, with 9 lbs. of hair added to every cubic yard. The fine stuff or setting coat to be composed of lime putty and sand, in the proportion of 1 part of sand to from 3 to 6 parts of lime. The putty to be used pure for mouldings, etc. The putty must be composed of pure lime. The sand must be clean, sharp river or pit sand, and must be washed if required.

# CHAPTER VIII.

## REPAIRING PLASTERED SURFACES.

VERY few dwelling houses have plaster ceilings free from cracks, no care being taken, as a rule, to repair them, chiefly on account of the expense incurred if the work is done properly, which in some cases means pulling down the ceiling, and either stiffening the joints with herring-bone strutting, or putting up ceiling joists and re-lathing and plastering as before.

Cracks in plaster ceilings may result from many causes, such as the natural settlement of the building, inferior material, bad lathing, defective plastering, forced drying, laying on one coat before the one beneath has properly set, or by using too little sand or cowhair. The vibration of the building, caused by heavy street traffic, may cause a ceiling to crack ; so will also the moving of heavy articles of furniture above the floors, especially if the joists are of too small a scantling.

It will generally be found that the joists are the cause of the cracks in the ceiling, either by their being too weak, or by their being unseasoned ; in the latter case, the timber dries after the floor has been laid, and the ceiling-plaster is loosened. Some of the joists may sag, whilst others may spring the reverse way, pulling the laths and plaster with them, and causing cracks in the ceiling.

In repairing or renovating a cracked ceiling, it is a very common plan to paper it with strong lining or flock paper, which is either distempered, or painted and decorated. If this method is adopted, care should be taken, in hanging the paper, to arrange the joints across the light.

Another plan is to cut out the cracks and stop them



with plaster ; if the cracks are only slight, they may be stopped with Keene's or Parian cement, but should they be large, or should the key be defective, it is best to cut away a portion of the plaster, and replace it with new material. The patch of new plaster should be painted over before being distempered, in order to conceal it as much as possible. The tendency to cracking is, of course, largely reduced by adopting ceiling joists, but their use is generally confined to first-class work.

Ceilings sometimes crack because the joists are not stiffened with herringbone strutting or bridging, which is an effective means of support. No joists carrying a ceiling should be allowed to be covered up until they have been stiffened with at least three rows of herring-bone strutting or bridging.

It frequently happens that the joist lines can be seen on ceilings owing to the plaster being too thin, or on account of the timber used for the joists being damp. These lines can be prevented by putting on a thick layer of plaster, and working it well, so as to make it hard and non-absorbent.

Great attention should be paid to the laths used for ceilings. The defects to be avoided when selecting ceiling laths are knots, sap, crookedness, and unnecessary smoothness. The knots weaken the laths, and the sap soon rots them ; crookedness prevents the plaster being laid evenly, and smoothness does not afford a sufficient grip for the plaster. Oak laths were formerly used, but they are liable to warp, and have been superseded by laths from Baltic fir. Although sawn laths are cheaper than riven laths, and are rapidly superseding them, they are not desirable in good work. Riven laths, split from the log along its fibres, are stronger, and form a better grip for the plaster, while in sawn laths the fibres of the wood are often cut through, and the laths thus considerably weakened.

The thicker laths, called double ($\frac{3}{8}$ in. to $\frac{1}{2}$ in. thick), should be used for ceilings, on account of the great strain which they have to bear. They should

be fastened with $1\frac{1}{4}$-in. nails, so as to break joint entirely, as for various reasons the plaster has a tendency to crack along the line of the joints if the laths are all nailed with the butt ends in a row. Odd lengths of lath (say 3 ft. or 4 ft.) can be used alternately. Every lath should be nailed at each end, and nailed also where it crosses a joist. No lap joints at the ends of the laths should be made, as the layer of plaster left by this method will be too thin, and will soon crack; the laths should, therefore, always be butt-jointed, lap-jointing being only a device to save time and nails. When the joists are more than 2 in. thick, small fillets should be nailed to their undersides, so as not to interfere with the key for the plaster.

In every 3 cubic ft. of course stuff for ceilings, there should be about 1 lb. of good cowhair, free from grease and other impurities, and well mixed. The first coat of coarse stuff (called "pricking up") should be used very stiff, in order to obtain the proper key, and prevent dropping off.

In patching a ceiling, the first thing is to ensure that all the loose plastering, or that which has lost its key, is removed, and that the patch has a more or less even outline, acute angles being avoided as far as possible. Next see to the lathing, and, if it is weak or broken, secure it or replace it with new work, as may be requisite. With small patches it is usual to bring the work forward ready to receive the setting coat at one application; but it is always advisable, if time can be allowed for it, to execute the patch with three-coat work, as in new plastering, except that patching is usually done with gauged stuff. Before applying the coarse stuff, the edges of the old work should be wetted, but it is not advisable to splash water from a brush over plaster and laths alike, for if the laths are thoroughly wetted they are liable to swell and twist. Sometimes the edges of the old plastering are painted to prevent the new work from discolouring the old, but more or less discoloration is sure to be the accompaniment of



repairs. The setting coat should be of lime putty, gauged with fine plaster and a little size water, and it should, after being ruled flush with the old work, be smartly trowelled off; but it should not be scoured, as scouring kills the plaster, and therefore weakens the material. For small patches, either Keene's or Parian cement may be employed, and these materials have the advantage that the work can be completed at one operation instead of, as with lime plastering, waiting for one coat to dry before another can be applied; but it is necessary to protect the nails of the lathing by painting them or otherwise, or they will quickly become rusted.

The trouble in a mended ceiling consists in the fact that the new plaster is more absorbent than the old, and is likely to show in the finished work. Where mending has taken place, an extra coat of size should be given.

In the case of a very cracked, or even new, ceiling, it is a good plan to cover it with lining-paper, which should be pasted on to the ceiling in lengths towards the windows. Some paperhangers lap the edges of the paper, some butt the edges; but the aim in each case is to make the joints quite level and inconspicuous. If the joints are butted, a little filling up is required; if lapped, they require to be rubbed down with glasspaper on a flat cork. The great object is to hang the paper smooth and straight. Very much depends on the laying of the first length. It must be laid perfectly true to a straight line; the other lengths will then follow straight. A straight line, struck by means of a chalk line down the centre of the space to be lined, will serve as a correct start and hold all the other lengths to accuracy. For work that butts, a straight-edge with a steel edge to it and a trimming knife are necessary. Many manage to do the work with a pair of scissors, but in that case the edges never meet accurately; a roller is also of service to rub the edges well down. A roll of paper held in the left hand is useful; it helps to hold up the limp pasted

lining-paper when applying it to the ceiling, leaving the right hand to fix the paper to the joint. It is then easy to sweep the paper up with the roll in the left hand, continuing to butt or lap the paper with the other hand. When the paper is pasted and folded, take in the left hand the roll that is being used to help in laying the pasted paper, and place it under the middle of the paper; then unfold the right end of the paper, which should be the shortest fold. In this way carry it up the steps. The short way of the ceiling allows shorter and more manageable lengths to be hung, but the lap should be away from the light, so as to be less perceptible. Begin at the light, and work away from it so that the laps do not show. Some prefer to lap the paper, as it is less liable to curl up from the ceiling than when it is butted.

If a ceiling is distempered before the plaster is dry, the distemper will fall off in powder in a few months' time. The remedy is a simple one; all that is necessary to do is to use a stiff brush on the ceiling, when the plaster is dry, making the ceiling quite level, and then distemper over again. If the face of the ceiling continues to fall away, the best plan will be to strip the setting coat and set with lime putty.

As already mentioned, slight cracks in a ceiling may be stopped with Keene's cement; if wide, or if the key of the plastering is at all defective, it is advisable to cut away a portion on each side, and to replaster. The ceiling should present as good an appearance as when originally finished, if the job is done carefully, and if the stain caused by the patch is painted over before re-distempering.

When a ceiling, finished with neat Parian cement, shows numerous narrow cracks, add a small quantity of oil-varnish or boiled oil to some gold-size and white-lead, and use the mixture as a stopping. The varnish or oil retards the setting, as the gold-size sets quickly. The stopping in a little time dries hard enough to be rubbed down, either with glasspaper or pumice stone. If the cracks are well painted and any loose plaster is removed,



then no trouble need be experienced in making the white lead stopping stay in the cracks.

A plastered porch may need replastering before going to the expense of painting. Hack off the whole of the existing plaster, and rake out the joints in the brickwork; pick the faces of the bricks with a hard broom, brush off all dust from one face of the wall, and wet thoroughly with water. Cover the walls with fluid stucco (Roman cement) applied with a broad hog's-bristle brush. When nearly dry, lay on stucco composed of three parts of clean sharp sand and one part of Roman cement, as in common rendering, unless the work is to be floated, when the process is nearly similar to that in floated plastering. Screeds must be formed at the highest and lowest extremities of the wall, perfectly straight and plumb. As the work is made good it must be well rubbed with the hand float to compress the material and produce a hard, even, and glossy surface, When the stucco is perfectly dry, it may be painted in oil colour, and will then be ready to be coloured in distemper.

The materials required for repairing damaged plasterwork in an old house, if wanted to dry quickly, would be—Keene's, Parian, granite, and Robinson's cements for painting or papering. If the work is to be distempered, lime putty and plaster floated with ordinary mortar will do for the same purpose. All loose work should be taken off and the edges well wetted. The new work should be straightened from the old, the materials being used and finished in the usual way. In making new work good after other trades, the repairs should be done in the same material as the new work; if plaster and lime work, the stuff should be gauged strong, and if the original work is in patent cements, the repairs should be done with the same materials, the work being straightened and finished in the usual way.

When an addition is made to a room, the new work should be plumbed and straightened from the old. The edges of the old work may be painted to stop the suction, or well wetted with water. The new cornice

should be in line with the old. A piece of the old cornice should be taken down and well cleaned, and the profile of the mould should be marked from it. The enrichments should be well cleaned, and if in low relief may be moulded in wax; if in high relief, they should be in gelatine. To repair an old cornice, the loose parts should be taken out and then well wetted. If the work is wanted to dry quickly for painting, it should be done with patent cements, the stuff being put on and worked off with a joint rule.

# INDEX.

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