CHAPTER 7

PLASTERING, STUCCOING, AND CERAMIC TILE

Plaster and stucco are like concrete in that they are construction materials applied in a plastic condition that harden in place. They are also basically the same material. The fundamental difference between the two is location. If used internally, the material is called plaster; if used externally, it is called stucco. Ceramic tile is generally used to partially or entirely cover interior walls, such as those in bathrooms, showers, galleys, and corridors. The tile is made of clay, pressed into shape, and baked in an oven.

This chapter provides information on the procedures, methods, and techniques used in plastering, stuccoing, and tile setting. Also described are various tools, equipment, and materials the Builder uses when working with these materials.

PLASTER

LEARNING OBJECTIVE: Upon completing this section, you should be able to identify plaster ingredients, state the principles of mix design, and describe common types and uses of gypsum plaster.

A plaster mix, like a concrete mix, is made plastic by the addition of water to dry ingredients (binders and aggregates). Also, like concrete, a chemical reaction of the binder and the water, called hydration, causes the mix to harden.

The binders most commonly used in plaster are gypsum, lime, and portland cement. Because gypsum plaster should not be exposed to water or severe moisture conditions, it is usually restricted to interior use. Lime and portland cement plaster maybe used both internally and externally. The most commonly used aggregates are sand, vermiculite, and perlite.

GYPSUM PLASTER

Gypsum is a naturally occurring sedimentary gray, white, or pink rock. The natural rock is crushed, then heated to a high temperature. This process (known as calcining) drives off about three-quarters of the water of crystallization, which forms about 20 percent of the weight of the rock in its natural state. The calcined material is then ground to a fine powder. Additives are used to control set, stabilization, and other physical or chemical characteristics.

For a type of gypsum plaster called Keene's cement, the crushed gypsum rock is heated until nearly all the crystallization water is removed. The resulting material, called Keene's cement, produces a very hard, fine-textured finish coat.

The removal of crystallization water from natural gypsum is a dehydration process. In the course of setting, mixing water (water of hydration) added to the mix dehydrates with the gypsum, causing recrystallization. Recrystallization results in hardening of the plaster.

Base Coats

There are four common types of gypsum base coat plasters. Gypsum neat plaster is gypsum plaster without aggregate, intended for mixing with aggregate and water on the job. Gypsum ready-mixed plaster consists of gypsum and ordinary mineral aggregate. On the job, you just add water. Gypsum wood-fibered plaster consists of calcined gypsum combined with at least 0.75 percent by weight of nonstaining wood fibers. It maybe used as is or mixed with one part sand to produce base coats of superior strength and hardness. Gypsum bond plaster is designed to bond to properly prepared monolithic concrete. This type of plaster is basically calcined gypsum mixed with from 2-to 5-percent lime by weight.

Finish Coats

There are five common types of gypsum-finish coat plasters.

Ready-mix gypsum-finish plasters are designed for use over gypsum-plaster base coats. They consist of finely ground calcined gypsum, some with aggregate and others without. On the job, just add water.

Gypsum acoustical plasters are designed to reduce sound reverberation. Gypsum gauging plasters contain lime putty. The putty provides desirable setting properties, increases dimensional stability during drying, and provides initial surface hardness.

Gauging plasters are obtainable in slow-set, quick-set, and special high-strength mixtures.

Gypsum molding plaster is used primarily in casting and ornamental plasterwork. It is available neat (that is, without admixtures) or with lime. As with Portland cement mortar, the addition of lime to a plaster mix makes the mix more "buttery."

Keene's cement is a fine, high-density plaster capable of a highly polished surface. It is customarily used with fine sand, which provides crack resistance.

LIME PLASTER

Lime is obtained principally from the calcining of limestone, a very common mineral. Chemical changes occur that transform the limestone into quicklime, a very caustic material. When it comes in contact with water, a violent reaction, hot enough to boil the water, occurs.

Today, the lime manufacturers slake the lime as part of the process of producing lime for mortar. Slaking is done in large tanks where water is added to convert the quicklime to hydrated lime without saturating it with water. The hydrated lime is a dry powder with just enough water added to supply the chemical reaction. Hydration is usually a continuous process and is done in equipment similar to that used in calcining. After the hydrating process, the lime is pulverized and bagged. When received by the plasterer, hydrated lime still requires soaking with water.

In mixing medium-slaking and slow-slaking limes, you should add the water to the lime. Slow-slaking lime must be mixed under ideal conditions. It is necessary to heat the water in cold west.kr. Magnesium lime is easily drowned, so be careful you don't add too much water to quick-slaking calcium lime. When too little water is added to calcium and magnesium limes, they can be burned. Whenever lime is burned or drowned, a part of it is spoiled It will not harden and the paste will not be as viscous and plastic as it should be. To produce plastic lime putty, soak the quicklime for an extended period, as much as 21 days.

Because of the delays involved in the slaking process of quicklime, most building lime is the hydrated type. Normal hydrated lime is converted into lime putty by soaking it for at least 16 hours. Special hydrated lime develops immediate plasticity when mixed with water and may be used right after mixing. Like calcined gypsum, lime plaster tends to return to its original rock-like state after application.

For interior base coat work, lime plaster has been largely replaced by gypsum plaster. Lime plaster is now used mainly for interior finish coats. Because lime putty is the most plastic and workable of the cementitious materials used in plaster, it is often added to other less workable plaster materials to improve plasticity. For lime plaster, lime (in the form of either dry hydrate or lime putty) is mixed with sand, water, and a gauging material. The gauging material is intended to produce early strength and to counteract shrinkage tendencies. It can be either gypsum gauging plaster or Keene's cement for interior work or portland cement for exterior work. When using gauging plaster or Keene's cement, mix only the amount you can apply within the initial set time of the material.

PORTLAND CEMENT PLASTER

Portland cement plaster is similar to the Portland cement mortar used in masonry. Although it may contain only cement, sand, and water, lime or some other plasterizing material is usually added for "butteriness."

Portland cement plaster can be applied directly to exterior and interior masonry walls and over metal lath. Never apply portland cement plaster over gypsum plasterboard or over gypsum tile. Portland cement plaster is recommended for use in plastering walls and ceilings of large walk-in refrigerators and cold-storage spaces, basements, toilets, showers, and similar areas where an extra hard or highly water-resistant surface is required.

AGGREGATES

As we mentioned earlier, there are three main aggregates used in plaster: sand, vermiculite, and perlite. Less frequently used aggregates are wood fiber and pumice.

Sand

Sand for plaster, like sand for concrete, must contain no more than specified amounts of organic impurities and harmful chemicals. Tests for these impurities and chemicals are conducted by Engineering Aids.

Proper aggregate gradation influences plaster strength and workability. It also has an effect on the tendency of the material to shrink or expand while setting. Plaster strength is reduced if excessive fine aggregate material is present in a mix. The greater quantity of mixing water required raises the water-cement ratio, thereby reducing the dry-set density. The cementitious material becomes over-extended since it must coat a relatively larger overall aggregate surface. An excess of coarse aggregate adversely affects workability-the mix becomes harsh working and difficult to apply.

Plaster shrinkage during drying can be caused by an excess of either fine or coarse aggregate. You can minimize this problem by properly proportioning the raw material, and using good, sharp, properly size-graded sand.

Generally, any sand retained on a No. 4 sieve is too coarse to use in plaster. Only a small percentage of the material (about 5 percent) should pass the No. 200 sieve.

Vermiculite

Vermiculite is a micaceous mineral (that is, each particle is laminated or made up of adjoining layers). When vermiculite particles are exposed to intense heat, steam forms between the layers, forcing them apart. Each particle increases from 6 to 20 times in volume. The expanded material is soft and pliable with a color varying between silver and gold.

For ordinary plasterwork vermiculite is used only with gypsum plaster; therefore, its use is generally restricted to interior applications. For acoustical plaster, vermiculite is combined with a special acoustical binder.

The approximate dry weight of a cubic foot of 1:2 gypsum-vermiculite plaster is 50 to 55 pounds. The dry weight of a cubic foot of comparable sand plaster is 104 to 120 pounds.

Perlite

Raw perlite is a volcanic glass that, when flash-roasted, expands to form irregularly shaped frothy particles containing innumerable minute air cells. The mass is 4 to 20 times the volume of the raw partlicles. The color of expanded perlite ranges from pearly white to grayish white.

Perlite is used with calcined gypsum or portland cement for interior plastering. It is also used with special binders for acoustical plaster. The approximate dry weight of a cubic foot of 1:2 gypsum-perlite plaster is 50 to 55 pounds, or about half the weight or a cubic foot of sand plaster.

Wood Fiber and Pumice

Although sand, vermiculite, and perlite makeup the great majority of plaster aggregate, other materials, such as wood fiber and pumice, are also used. Wood fiber may be added to neat gypsum plaster, at the time of manufacture, to improve its working qualities. Pumice is a naturally formed volcanic glass similar to perlite, but heavier (28 to 32 pounds per cubic foot versus 7.5 to 15 pounds for perlite). The weight differential gives perlite an economic advantage and limits the use of pumice to localities near where it is produced.

WATER

In plaster, mixing water performs two functions. First, it transforms the dry ingredients into a plastic, workable mass. Second, it combines with the binder to induce hardening. As with concrete, there is a maximum quantity of water per unit of binder required for complete hydration; an excess over this amount reduces the plaster strength.

In all plaster mixing, though, more water is added than is necessary for complete hydration of the binder. The excess is necessary to bring the mix to workable consistency. The amount to be added for workability depends on several factors: the characteristics and age of the binder, application method, drying conditions, and the tendency of the base to absorb water. A porous masonry base, for example, draws a good deal of water out of a plaster mix. If this reduces the water content of the mix below the maximum required for hydration, incomplete curing will result.

As a general rule, only the amount of water required to attain workability is added to a mix. The water should be potable and contain no dissolved chemicals that might accelerate or retard the set. **Never use water previously used to wash plastering tools for mixing plaster.** It may contain particles of set plaster that may accelerate setting. Also avoid stagnant water; it may contain organic material that can retard setting and possibly cause staining.

PLASTER BASE INSTALLATION

LEARNING OBJECTIVE: Upon completing this section, you should be able to associate the names and purposes of each type of lath used as a plaster base. You should also be able to describe the procedures used in plastering, including estimating materials and the procedures for mixing and applying plaster bases.

For plastering, there must be a continuous surface to which the plaster can be applied and to which it will cling—the plaster base. A continuous concrete or masonry surface may serve as a base without further treatment.

BASES

For plaster bases, such as those defined by the inner edges of the studs or the lower edges of the joists, a base material, called lath, must be installed to form a continuous surface spanning the spaces between the structural members.

Wood Lath

Wood lath is made of white pine, spruce, fir, redwood, and other soft, straight-grained woods. The standard size of wood lath is 5/16 inch by 1 1/2 inches by 4 feet. Each lath is nailed to the studs or joists with 3-penny (3d) blued lathing nails.

Laths are nailed six in a row, one above the other. The next six rows of lath are set over two stud places. The joints of the lath are staggered in this way so cracks will not occur at the joinings. Lath ends should be spaced 1/4 inch apart to allow movement and prevent buckling. Figure 7-1 shows the proper layout of wood lath. To obtain a good key (space for mortar), space the laths not less than 3/8 inch apart. Figure 7-2 shows good spacing with strong keys.

Wood laths come 50 to 100 to the bundle and are sold by the thousand. The wood should be straight-grained, and free of knots and excessive pitch. Don't use old lath; dry or dirty lath offers a poor bonding surface. Lath must be damp when the mortar is applied Dry lath pulls the moisture out of the mortar, preventing proper setting. The best method to prevent dry lath is to wet it thoroughly the day before plastering. This lets the wood swell and reach a stable condition ideal for plaster application.

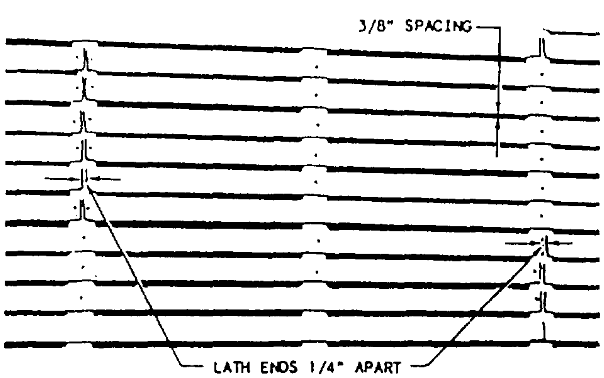

Figure 7-1.—Wood lath with joints staggered every sixth course.

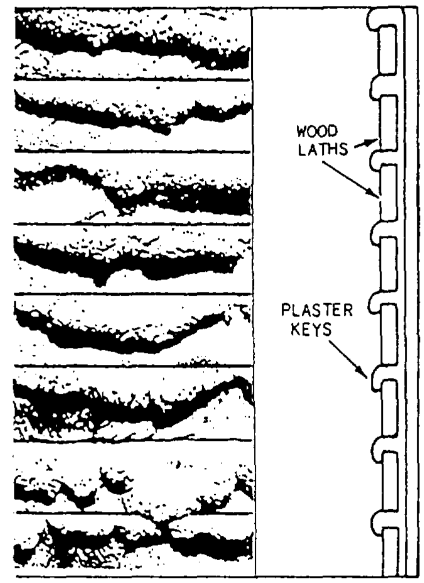

Figure 7-2.—Wood lath, showing proper keys.

Board Lath

Of the many kinds of lathing materials available, board lath is the most widely used today. Board lath is manufactured from mineral and vegetable products. It is produced in board form, and in sizes generally standardized for each application to studs, joists, and various types of wood and metal timing.

Board lath has a number of advantages. It is rigid, strong, stable, and reduces the possibility of dirt filtering through the mortar to stain the surface. It is insulating and strengthens the framework structure. Gypsum board lath is fire resistant. Board lath also requires the least amount of mortar to cover the surface.

Board laths are divided into two main groups: gypsum board and insulation board. Gypsum lath is made in a number of sizes, thicknesses, and types. Each type is used for a specific purpose or condition. Note: Only gypsum mortar can be used over gypsum lath. Never apply lime mortar, portland cement, or any other binding agent to gypsum lath.

The most commonly used size gypsum board lath is the 3/8 inch by 16 inches by 48 inches, either solid or perforated. This lath will not burn or transmit temperatures much in excess of 212°F until the gypsum is completely calcined. The strength of the bond of plaster to gypsum lath is great. It requires a pull of 864 pounds per square foot to separate gypsum plaster from gypsum lath (based on a 2:1 mix of sand and plaster mortar).

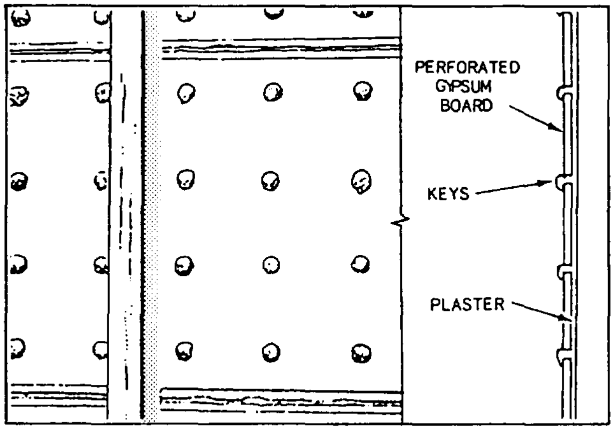

Figure 7-3.—Keys formed with perforated gypsum board.

There is also a special fire-retardant gypsum lath, called type X. It has a specially formulated core, containing minerals giving it additional fire protection.

Use only one manufacturer's materials for a specified job or area. This ensures compatibility. Always strictly follow the manufacturer's specifications for materials and conditions of application.

Plain gypsum lath plaster base is used in several situations: for applying nails and staples to wood and nailable steel framing; for attaching clips to wood framing, steel studs, and suspended metal grillage; and for attaching screws to metal studs and furring channels. Common sizes include 16 by 48 inches, 3/8 or 1/2 inch thick, and 16 by 96 inches, 3/8 inch thick.

Perforated gypsum lath plaster base is the same as plain gypsum lath except that 3/4-inch round holes are punched through the lath 4 inches on center (OC) in each direction. This gives one 3/4-inch hole for each 16 square inches of lath area. This provides mechanical keys in addition to the natural plaster bond and obtains higher fire ratings. Figure 7-3 shows back and side views of a completed application.

Insulating gypsum lath plaster base is the same as plain gypsum lath, but with bright aluminum foil laminated to the back. This creates an effective vapor barrier at no additional labor cost. In addition, it provides positive insulation when installed with the foil facing a 3/4-inch minimum air space. When insulating gypsum lath plaster is used as a ceiling, and under winter heating conditions, its heat-resistance value is approximately the same as that for 1/2-inch insulation board.

Long lengths of gypsum lath are primarily used for furring the interior side of exterior masonry walls. It is available in sizes 24 inches wide, 3/8 inch thick, and up to 12 feet in length.

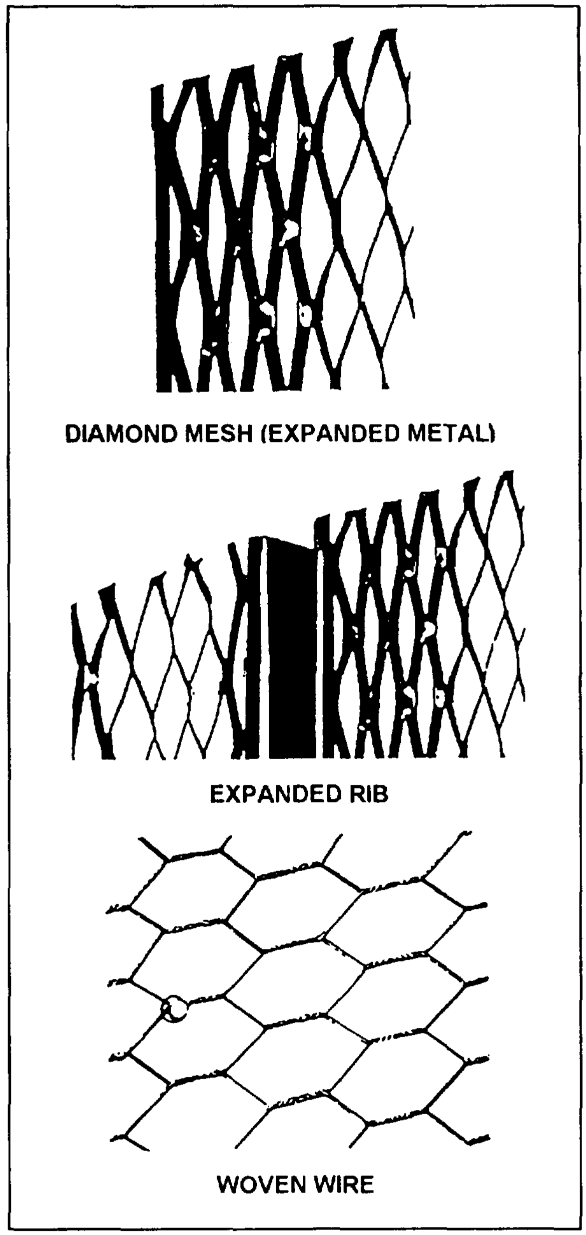

Figure 7-4.-Types of metal lath.

Gypsum lath is easily cut by scoring one or both sides with a utility knife. Break the lath along the scored line. Be sure to make neatly fitted cutouts for utility openings, such as plumbing pipes and electrical outlets.

Metal Lath

Metal lath is perhaps the most versatile of all plaster bases. Essentially a metal screen, the bond is created by keys formed by plaster forced through the openings. As the plaster hardens, it becomes rigidly interlocked with the metal lath.

Three types of metal lath are commonly used: diamond mesh (expanded metal), expanded rib, and wire mesh (woven wire). These are shown in figure 7-4.

DIAMOND MESH.— The terms "diamond mesh" and "expanded metal" refer to the same type of lath (fig. 7-4). It is manufactured by first cutting staggered slits in a sheet and then expanding or stretching the sheet to form the screen openings. The standard diamond mesh lath has a mesh size of 5/16 by 9/16 inch. Lath is made in sheets of 27 by 96 inches and is packed 10 sheets to a bundle (20 square yards).

Diamond mesh lath is also made in a large mesh. This is used for stucco work, concrete reinforcement, and support for rock wool and similar insulating materials. Sheet sizes are the same as for the small mesh. The small diamond mesh lath is also made into a self-furring lath by forming dimples into the surface that hold the lath approximately 1/4 inch away from the wall surface. This lath may be nailed to smooth concrete or masonry surfaces. It is widely used when replastering old walls and ceilings when the removal of the old plaster is not desired. Another lath form is paper-backed where the lath has a waterproof or kraft paper glued to the back of the sheet. The paper acts as a moisture barrier and plaster saver.

EXPANDED RIB.— Expanded rib lath (fig. 7-4) is like diamond mesh lath except that various size ribs are formed in the lath to stiffen it. Ribs run lengthwise of the lath and are made for plastering use in 1/8-, 3/8-, and 3/4-inch rib height. The sheet sizes are 27 to 96 inches in width, and 5-,10-, and 12-foot lengths for the 3/4-inch rib lath.

WIRE MESH.— Woven wire lath (fig. 7-4) is made of galvanized wire of various gauges woven or twisted together to form either squares or hexagons. It is commonly used as a stucco mesh where it is placed over tar paper on open-stud construction or over various sheathing.

INSTALLATION

Let's now look at the basic installation procedures for plaster bases and accessories.

Gypsum Lath

Gypsum lath is applied horizontally with staggered end joints, as shown in figure 7-5. Vertical end joints should be made over the center of studs or joists. Lath joints over openings should not occur at the jamb line. Do not force the boards tightly together; let them butt loosel y so the board is not under compression before the plaster is applied. Use small pieces only where necessary. The most common method of attaching the boards has been the lath nail. More recently, though, staples have gained wider use (due mainly to the ready availability of power guns).

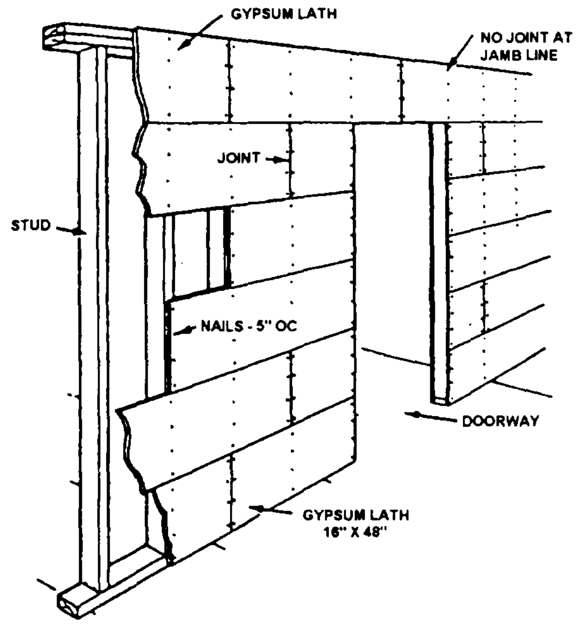

Figure 7-5.-Lath joints.

The nails used are 1 1/8 inches by 13 gauge, flat headed, blued gypsum lath nails for 3/8-inch-thick boards and 1 1/4 inches for 1/2-inch boards. There are also resin-coated nails, barbed-shaft nails, and screw-type nails in use. Staples should be No. 16 U.S. gauge flattened galvanized wire formed with a 7/16-inch-wide crown and 7/8-inch legs with divergent points for 3/8-inch lath. For 1/2-inch lath, use 1-inch-long staples.

Four nails or staples are used on each support for 16-inch-wide lath and five for 2-foot-wide lath. Some special fire ratings, however, require five nails or staples per 16-inch board. Five nails or staples are also recommended when the framing members are spaced 24 inches apart.

Start nailing or stapling 1/2 inch from the edges of the board. Nail on the framing members falling on the center of the board first, then work to either end. This should prevent buckling.

Insulating lath should be installed much the same as gypsum lath except that slightly longer blued nails are used. A special waterproof facing is provided on one type of gypsum board for use as a ceramic tile base when the tile is applied with an adhesive.

Metal Lath

All metal lath is installed with the sides and ends lapped over each other. The laps between supports should be securely tied, using 18-gauge tie wire. In general, metal lath is applied with the long length at right angles to the supports. Rib lath is placed with the ribs against the supports and the ribs nested where the lath overlaps. Generally, metal lath and wire lath are lapped at least 1 inch at the ends and 1/2 inch at the sides. Some wire lath manufacturers specify up to 4 1/2-inch end lapping and 2-inch side laps. This is done to mesh the wires and the paper backing.

Lath is either nailed, stapled, or hog-tied (heavy wire ring installed with a special gun) to the supports at 6-inch intervals. Use 1 1/2-inch barbed roofing nails with 7/16-inch heads or 1 inch 4-gauge staples for the flat lath on wood supports. For ribbed lath, heavy wire lath, and sheet lath, nails or staples must penetrate the wood 1 3/8 inches for horizontal application and at least 3/4 inch for vertical application. When common nails are used, they must be bent across at least three lath strands.

On channel iron supports, the lath is tied with No. 18-gauge tie wire at 4-inch intervals using lathers' nippers. For wire lath, the hog tie gun can be used. Lath must be stretched tight as it is applied so that no sags or buckles occur. Start tying or nailing at the center of the sheet and work toward the ends. Rib lath should have ties looped around each rib at all supports, as the main supporting power for rib lath is the rib.

When you install metal laths at both inside and outside corners, bend the lath to forma comer and carry it at least 4 inches in or around the corner. This provides the proper reinforcement for the angle or comer.

Lath Accessories

A wide variety of metal accessories is produced for use with gypsum and metal lathing. Lathing accessories are usually installed before plastering to form true corners, act as screeds for the plasterer, reinforce possible weak points, provide control joints, and provide structural support.

Lathing accessories consist of structural components and miscellaneous accessories. The principal use of structural components is in the construction of hollow partitions. A hollow partition is one containing no building framing members, such as studs and plates. Structural components are lathing accessories that take the place of the missing framing members supporting

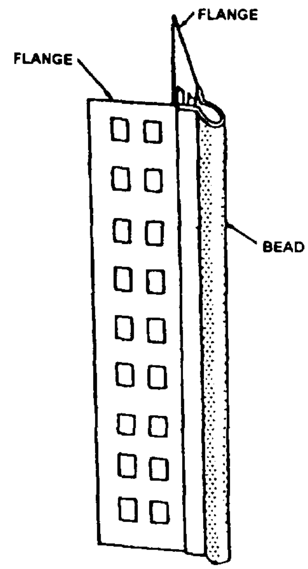

Figure 7-6.—Perforated flanged corner bead.

the lath. These include prefabricated metal studs and floor and ceiling runner tracks. The runner tracks take the place of missing stud top and bottom plates. They usually consist of metal channels. Channels are also used for furring and bracing.

Miscellaneous accessories consist of components attached to the lath at various locations. They serve to define and reinforce comers, provide dividing strips between plaster and the edges of baseboard or other trim, and define plaster edges at unframed openings.

Comer beads fit over gypsum lath outside corners to provide a true, reinforced comer. They are available in either small-nose or bullnose types, with flanges of either solid or perforated (fig. 7-6) metal. They are available with expanded metal flanges.

Casing beads are similar to comer beads and are used both as finish casings around openings in plaster walls and as screeds to obtain true surfaces around doors and windows. They are also used as stops between a plaster surface and another material, such as masonry or wood paneling. Casing beads are available as square sections, modified-square sections, and quarter-rounds.

Base or parting screeds are used to separate plaster from other flush surfaces, such as concrete. Ventilating expansion screed is used on the underside of closed soffits and in protected vertical surfaces for ventilation of enclosed attic spaces. Drip screeds act as terminators of exterior portland cement plaster at concrete foundation walls. They are also used on external horizontal comers of plaster soffits to prevent drip stains

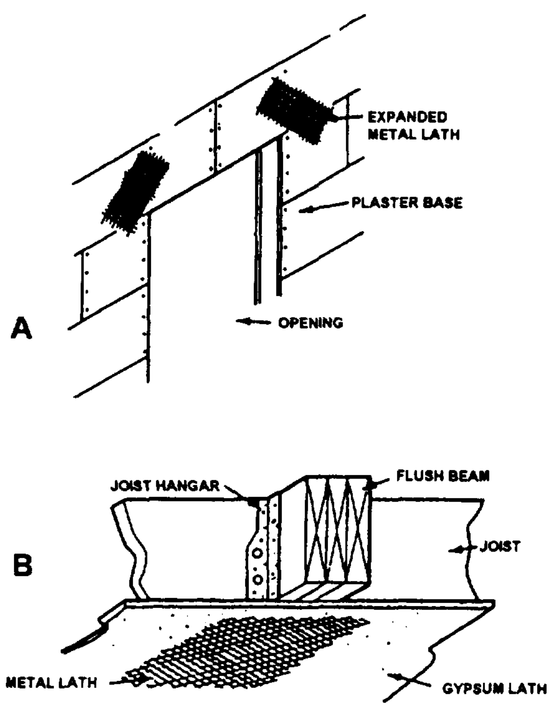

Figure 7-7.-Metal lath used to minimize cracking.

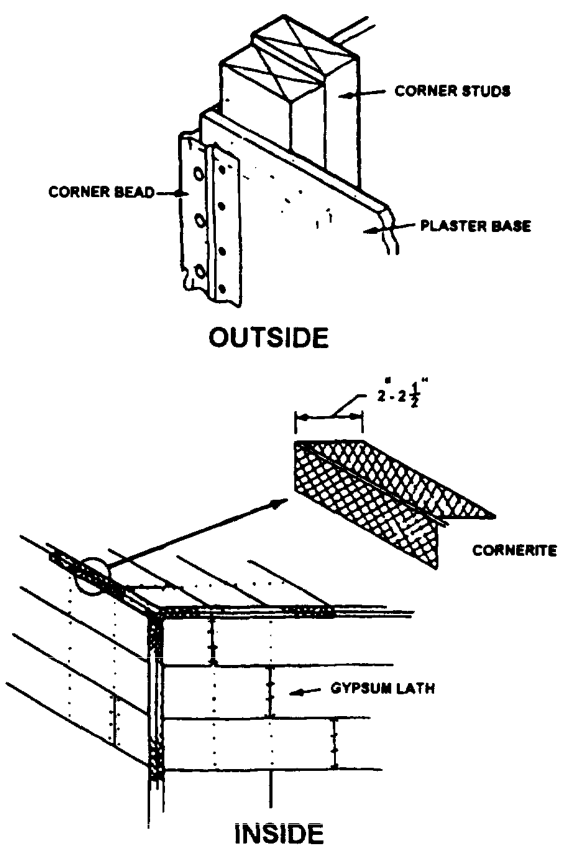

Figure 7-8.-Plaster reinforcing at corners.

on the underside of the soffit. A metal base acts as a flush base at the bottom of a plaster wall. It also serves as a plaster screed.

Joint Reinforcing

Because some drying usually takes place in the wood framing members after a structure is completed, some shrinkage is expected. This, in turn, may cause plaster cracks to develop around openings and in the comers. To minimize, if not eliminate, these cracks, use expanded metal lath in key positions over the plaster-base material as reinforcements. Strip reinforcement (strips of expanded metal lath) can be used over door and window openings (fig. 7-7, view A). A 10- to 20-inch strip is placed diagonally across each upper comer of the opening and tacked in place.

Strip reinforcement should also be used under flush ceiling beams (fig. 7-7, view B) to prevent plaster cracks. On wood drop beams extending below the ceiling line, the metal lath is applied with furring nails to provide space for keying the plaster.

Corner beads of expanded metal lath or of perforated metal (fig. 7-8) should be installed on all outside comers. They should be applied plumb and level. Each bead acts as a leveling edge when walls are plastered and reinforces the comer against mechanical damage. To minimize plaster cracks, reinforce the inside comers at the juncture of walls and ceilings. Metal lath, or wire fabric, is tacked lightly in place in these corners.

Control joints (an example of which is shown in fig. 7-9) are formed metal strips used to relieve stresses and strains in large plaster areas or at junctures of dissimilar materials on walls and ceilings. Cracks can develop in plaster or stucco from a single cause or a combination of causes, such as foundation settlement, material shrinkage, building movement, and so forth. The control joint minimizes plaster cracking and assures proper plaster thickness. The use of control joints is extremely important when Portland cement plaster is used.

Plastering Grounds

Plastering grounds are strips of wood used as plastering guides or strike-off edges and are located around window and door openings and at the base of the walls. Grounds around interior door openings (such as fig. 7-10, view A) are full-width pieces nailed to the sides over the studs and to the underside of the header. They are 5 1/4 inches wide, which coincides with the standard jamb width for interior walls with a plaster

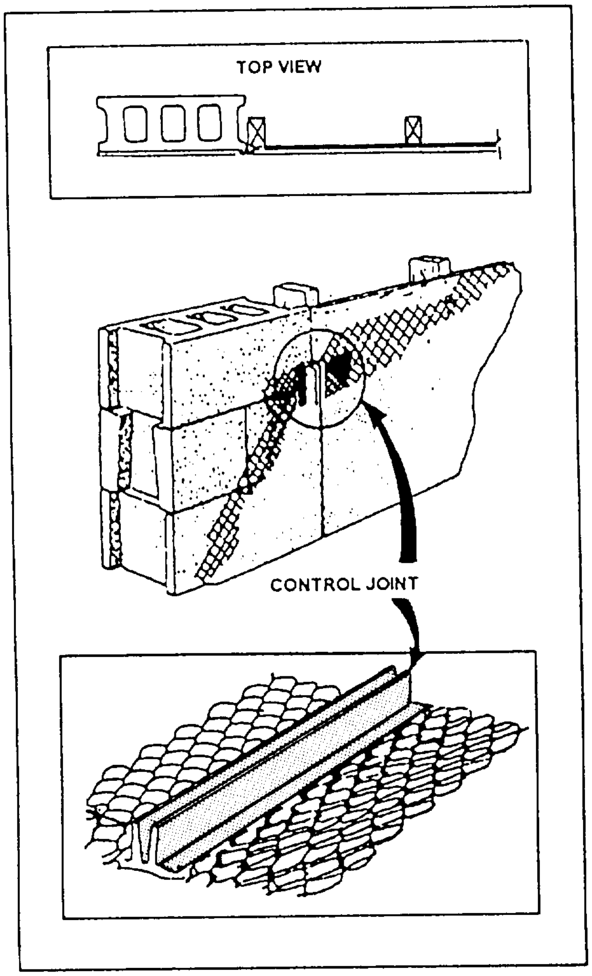

Figure 7-9.-Control joint.

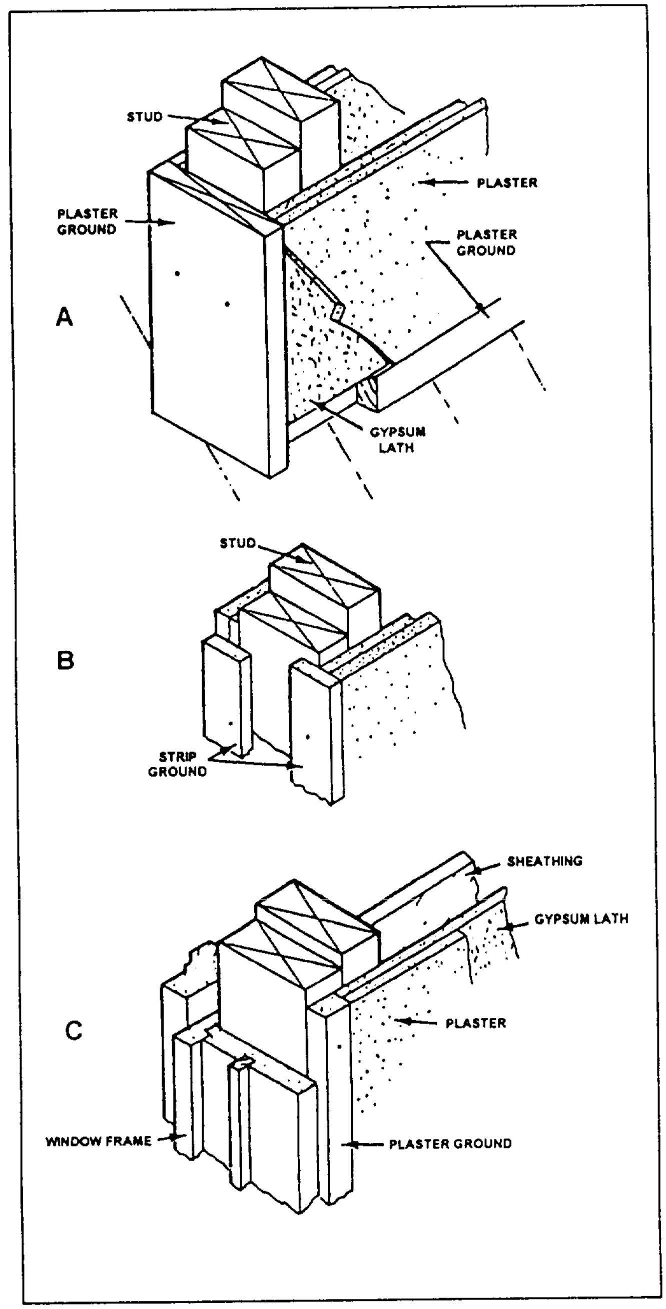

Figure 7-10.—Plaster grounds.

finish. They are removed after the plaster has dried. Narrow strip grounds (fig. 7-10, view B) can also be used around interior openings.

In window and exterior door openings, the frames are normally in place before the plaster is applied. Thus, the inside edges of the side and head jamb can, and often do, serve as grounds. The edge of the window might also be used as a ground, or you can use a narrow 7/8-inch-thick ground strip nailed to the edge of the 2- by 4-inch sill (fig. 7-10, view C). These are normally left in place and covered by the casing.

A similar narrow ground or screed is used at the bottom of the wall to control the thickness of the gypsum plaster and to provide an even surface for the baseboard and molding. This screed is also left in place after the plaster has been applied.

Mixing

Some plaster comes ready-mixed, requiring only the addition of enough water to attain minimum required workability. For job mixing, tables are available giving recommended ingredient proportions for gypsum, lime, lime-portland cement, and portland cement plaster for base coats on lath or on various types of concrete or masonry surfaces, and for finish coats of various types. In this chapter, we'll cover recommended proportions for only the more common types of plastering situations.

In the following discussion, one part of cementitious material means 100 pounds (one sack) of gypsum, 100 pounds (two sacks) of hydrated lime, 1 cubic foot

Table 7-1.—Base Coat Proportions for Different Types of Work

INGREDIENT	PROPORTION
Two-Coat Masonry Work[1]	
Gypsum plaster	1:3
Lime plaster using hydrated lime	1:7.5
Lime plaster using lime putty	1:3.5
Three-Coat Work on a Masonry Base[2]	
Gypsum plaster	Both coats 1:3
Portland cement plaster	Both coats 1:3 to 1:5
Work on a Metal Lath	
Gypsum plaster	Same as for three-coat work on gypsum lath
Lime plaster using hydrated lime	Scratch 1:6.75, brown 1:9
Lime plaster using lime putty	Scratch 1:3, brown 1:4
Portland cement plaster	Both coats 1:3 to 1:5

[1]Portland cement plaster is not used for two-coat work, and two-coat work is not usually done on metal lath

[2]Lime plaster is not usually used for three-coat work on a masonry base

of lime putty, or 94 pounds (one sack) of portland cement. One part of aggregate means 100 pounds of sand or 1 cubic foot of vermiculite or perlite. Note: Vermiculite and perlite are not used with lime plaster. While aggregate parts given for gypsum or portland cement plaster may be presumed to refer to either sand or vermiculite/perlite, the aggregate part given for lime plaster means sand only.

BASE COAT PROPORTIONS.— Two-coat plasterwork consists of a single base coat and a finish coat. Three-coat plasterwork consists of two base coats (the scratch coat and the brown coat) and a finish coat.

Portland cement plaster cannot be applied to a gypsum base. Lime plaster can, but, in practice, only gypsum plaster is applied to gypsum lath as a base coat. For two-coat work on gypsum lath, the recommended base coat proportions for gypsum plaster are 1:2.5. For two-coat work on a masonry (either monolithic concrete or masonry) base, the recommended base coat proportions are shown in table 7-1. Also shown in table 7-1 are proportions for three-coat work on a masonry base and proportions for work on metal lath.

For three-coat work on gypsum lath, the recommended base coat proportions for gypsum plaster are shown in table 7-2.

FINISH COAT PROPORTIONS.— A lime finish can be applied over a lime, gypsum, or portland cement base coat. Other finishes should be applied only to base coats containing the same cementitious material. A gypsum-vermiculite finish should be applied only to a gypsum-vermiculite base coat.

Finish coat proportions vary according to whether the surface is to be finished with a trowel or with a float. (These tools are described later.) The trowel attains a smooth finish; the float produces a textured finish.

For a trowel-finish coat using gypsum plaster, the recommended proportions are 200 pounds of hydrated lime or 5 cubic feet of lime putty to 100 pounds of gypsum gauging plaster.

Table 7-2.—Recommended Base Coat Proportions for Gypsum Plaster

COAT	PROPORTION
Scratch coat	1:2
Brown coat	1:3
Both coats	1:2.5

For a trowel-finish coat using lime-Keene's cement plaster, the recommended proportions are, for a medium-hard finish, 50 pounds of hydrated lime or 100 pounds of lime putty to 100 pounds of Keene's cement. For a hard finish, the recommended proportions are 25 pounds of hydrated lime or 50 pounds of lime putty to 100 pounds of Keene's cement.

For a trowel-finish coat using lime-portland cement plaster, the recommended proportions are 200 prods of hydrated lime or 5 cubic feet of lime putty to 94 pounds of Portland cement.

For a finish coat using portland cement-sand plaster, the recommended proportions are 300 pounds of sand to 94 pounds of Portland cement. This plaster may be either troweled or floated. Hydrated lime up to 10 percent by weight of the portland cement, or lime putty up to 24 percent of the volume of the portland cement, may be added as a plasticizer.

For a trowel-finish coat using gypsum gauging or gypsum neat plaster and vermiculite aggregate, the recommended proportions are 1 cubic foot of vermiculite to 100 pounds of plaster.

Estimates

The total volume of plaster required for a job is the product of the thickness of the plaster times the net area to be covered. Plaster specifications state a minimum thickness, which you must not go under. Also, you should exceed the specs as little as possible due to the increased tendency of plaster to crack with increased thickness.

Mixing Plaster

The two basic operations in mixing plaster are determining the correct proportions and the actual mixing methods used.

PROPORTIONS.— The proper proportions of the raw ingredients required for any plastering job are found in the job specifications. The specs also list the types of materials to use and the type of finish required for each area. Hardness and durability of the plaster surface depend upon how accurately you follow the correct proportions. Too much water gives you a fluid plaster that is hard to apply. It also causes small holes to develop in the finish mortar coat. Too much aggregate in the mix, without sufficient binder to unite the mixture, causes aggregate particles to crumble off. **Without exception, consult the specifications prior to the commencement of any plaster job.**

MIXING METHODS.— As a Builder, you will be mixing plaster either by hand or using a machine.

Hand Mixing.— To hand-mix plaster, you will need a flat, shallow mixing box and a hoe. The hoe usually has one or more holes in the blade. Mixed plaster is transferred from the mixing box to a mortar board, similar to that used in bricklaying. Personnel applying the plaster pick it up from the mortarboard.

In hand mixing, first place the dry ingredients in a mixing box and thoroughly mix until a uniform color is obtained. After thoroughly blending the dry ingredients, you then cone the pile and add water to the mix. Begin mixing by pulling the dry material into the water with short strokes. Mixing is continued until the materials have been thoroughly blended and proper consistency has been attained. With experience, a person squires a feel for proper consistency. Mixing should not be continued for more than 10 to 15 minutes after the materials have been thoroughly blended. Excessive agitation may hasten the rate of solution of the cementitious material and reduce initial set time.

Finish-coat lime plaster is usually hand-mixed on a 5- by 5-foot mortar board called a finishing board. Hydrated lime is first converted to lime putty by soaking in an equal amount of water for 16 hours. In mixing the plaster, you first form the lime putty into a ring on the finishing board. Next, pour water into the ring and sift the gypsum or Keene's cement into the water to avoid lumping. Last, allow the mix to stand for 1 minute, then thoroughly blend the materials. Sand, if used, is then added and mixed in,

Machine Mixing.— For a quicker, more thorough mix, use a plaster mixing machine. A typical plaster mixing machine (shown in fig. 7-11) consists primarily of a metal drum containing mixing blades, mounted on

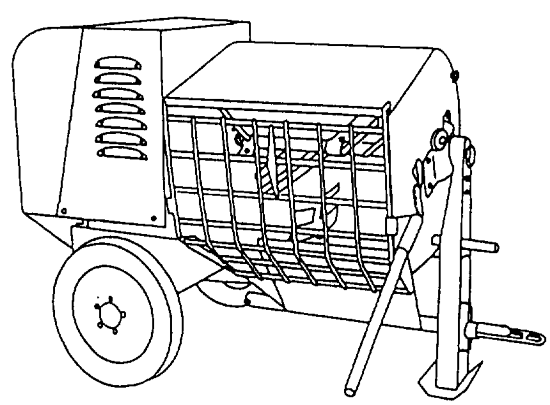

Figure 7-11.—Plaster mixing machine.

a chassis equipped with wheels for road towing. Sizes range from 3 1/2 to 10 cubic feet and can be powered by an electric or a gasoline motor. Mixing takes place either by rotation of the drum or by rotation of the blades inside the drum. Tilt the drum to discharge plaster into a wheelbarrow or other receptacle.

When using a plaster mixer, add the water first, then add about half the sand. Next, add the cement and any admixture desired. Last, add the rest of the sand. Mix until the batch is uniform and has the proper consistency—3 to 4 minutes is usually sufficient. Note that excessive agitation of mortar speeds up the setting time. Most mixers operate at top capacity when the mortar is about 2 inches, at most, above the blades. When the mixer is charged higher than this, proper mixing fails to take place. Instead of blending the materials, the mixer simply folds the material over and over, resulting in excessively dry mix on top and too wet mix underneath-a bad mix. Eliminate this situation by not overloading the machine.

Handling Materials

Personnel handling cement or lime bags should wear recommended personnel protective gear. Always practice personal cleanliness. Never wear clothing that is hard and stiff with cement. Such clothing irritates the skin and may cause serious infection. Any susceptibility of skin to cement and lime bums should be immediately reported to your supervisor.

Don't pile bags of cement or lime more than 10 bags high on a pallet except when stored in bins or enclosures built for such purposes. Place the bags around the outside of the pallet with the tops of the bags facing the center. To prevent piled bags from falling outward, crosspile the first five tiers of bags, each way from any comer, and make a setback starting with the sixth tier. If you have to pile above the 10th tier, make another setback. The back tier, when not resting against a wall of sufficient strength to withstand the pressure, should be set back one bag every five tiers, the same as the end tiers.

During unpiling, the entire top of the pile should be kept level and the setbacks maintained for every five tiers.

Lime and cement must be stored in a dry place to help prevent the lime from crumbling and the cement from hydrating before it is used.

PLASTER APPLICATION TOOLS AND TECHNIQUES

LEARNING OBJECTIVE: Upon completing this section, you should be able to state the uses of plastering tools, and describe the techniques of plastering.

A plaster layer must have uniform thickness to attain complete structural integrity. Also, a plane plaster surface must be flat enough to appear flat to the eye and receive surface-applied materials, such as casings and other trim, without the appearance of noticeable spaces. Specified flatness tolerance is usually 1/8 inch in 10 feet.

TOOLS

Plastering requires the use of a number of tools, some specialized, including trowels, hawk, float, straight and feather edges, darby, scarifier, and plastering machines.

Trowels

Steel trowels are used to apply, spread, and smooth plaster. The shape and size of the trowel blade are determined by the purpose for which the tool is used and the manner of using it.

The four common types of plastering trowels are shown in figure 7-12. The rectangular trowel, with a blade approximately 4 1/2 inches wide by 11 inches long, serves as the principle conveyor and manipulator

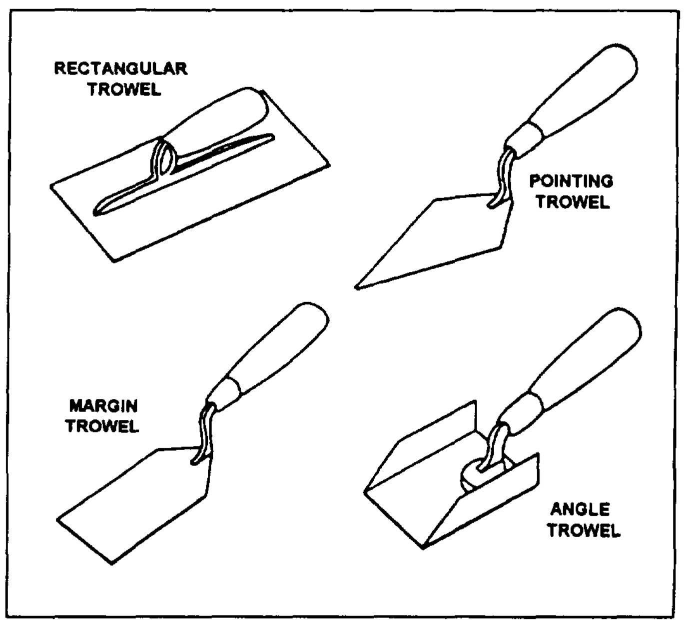

Figure 7-12.—Plasterting trowels.

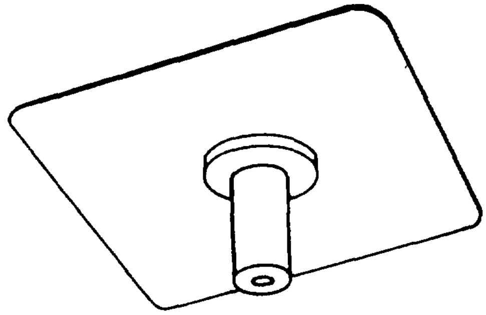

Figure 7-13.—Plasterting hawk.

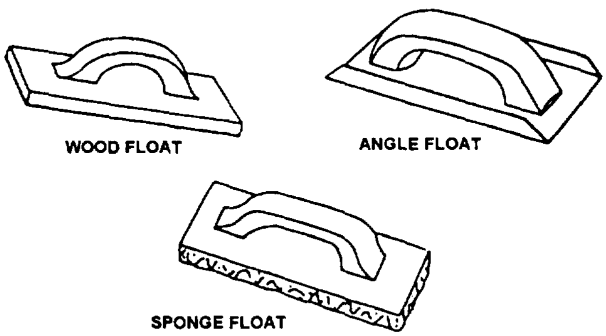

Figure 7-14.—Plastering floats.

of plaster. The pointing trowel, 2 inches wide and about 10 inches long, is used in places where the rectangular trowel doesn't fit. The margin trowel is a smaller trowel, similar to the pointing trowel, but with a square, rather than a pointed, end. The angle trowel is used for finishing comer angles formed by adjoining right-angle plaster surfaces.

Hawk

The hawk (fig. 7-13) is a square, lightweight sheet-metal platform with a vertical central handle, used for carrying mortar from the mortar board to the place where it is to be applied. The plaster is then removed from the hawk with the trowel. The size of a hawk varies from a 10- to a 14-inch square. A hawk can be made in the field from many different available materials.

Float

Afloat is glided over the surface of the plaster to fill voids and hollows, to level bumps left by previous operations, and to impart a texture to the surface. The most common types of float are shown in figure 7-14. The wood float has a wood blade 4 to 5 inches wide and about 10 inches long. The angle float has a stainless steel or aluminum blade. The sponge float is faced with foam rubber or plastic, intended to attain a certain surface texture.

In addition to the floats just mentioned, other floats are also used in plasterwork. A carpet float is similar to a sponge float, but faced with a layer of carpet material. A cork float is faced with cork.

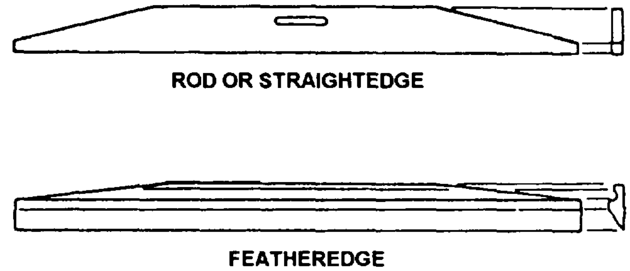

Figure 7-15.-Straightedge and featheredge.

Straight and Feather Edges

The rod or straightedge consists of a wood or lightweight metal blade 6 inches wide and 4 to 8 feet long (see fig. 7-15). This is the first tool used in leveling and straightening applied plaster between the grounds. A wood rod has a slot for a handle cut near the center of the blade. A metal rod usually has a shaped handle running the length of the blade.

The featheredge (fig. 7-15) is similar to the rod except that the blade tapers to a sharp edge. It is used to cut in inside corners and to shape sharp, straight lines at outside comers where walls intersect.

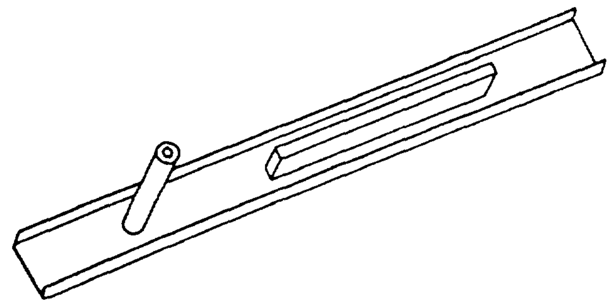

Figure 7-16.-Darby.

Darby

The darby (fig. 7-16) is, in effect, a float with an extra long (3 1/2 to 4 foot) blade, equipped with handles for two-handed manipulation. It is used for further straightening of the base coat, after rodding is

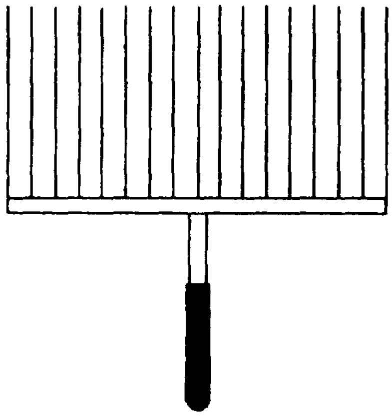

Figure 7-17.-Scarifier.

completed, to level plaster screeds and to level finish coats. The blade of the darby is held nearly flat against the plaster surface, and in such a way that the line of the edge makes an angle 45° with the line of direction of the stroke.

When a plaster surface is being leveled, the leveling tool must move over the plaster smoothly. If the surface is too dry, lubrication must be provided by moistening. In base coat operations, dash or brush on water with a water-carrying brush called a browning brush. This is a fine-bristled brush about 4 to 5 inches wide and 2 inches thick, with bristles about 6 inches long. For finish coat operations, a finishing brush with softer, more pliable bristles is used.

Scarifier

The scarifier (fig. 7-17) is a raking tool that leaves furrows approximately 1/8 inch deep, 1/8 inch wide, and 1/2 inch to 3/4 inch apart. The furrows are intended to improve the bond between the scratch coat and the brown coat.

Plastering Machines

There are two types of plastering machines: wet mix and dry mix. The wet-mix pump type carries mixed plaster from the mixing machine to a hose nozzle. The dry-mix machine carries dry ingredients to a mixing nozzle where water under pressure combines with the mix and provides spraying force. Most plastering machines are of the wet-mix pump variety.

A wet-mix pump may be of the worm-drive, piston-pump, or hand-hopper type. In a worm-drive machine, mixed plaster is fed into a hopper and forced through the hose to the nozzle by the screw action of a rotor and stator assembly in the neck of the machine. A machine of this type has a hopper capacity of from 3 to 5 cubic feet and can deliver from 0.5 to 2 cubic feet of plaster per minute. On a piston-pump machine, a hydraulic, air-operated, or mechanically operated piston supplies the force for moving the wet plaster. On a hand-hopper machine, the dry ingredients are placed in a hand-held hopper just above the nozzle. Hopper capacity is usually around 1/10 cubic foot. These machines are mainly used for applying finish plaster.

Machine application reduces the use of the hawk and trowel in initial plaster application. However, the use of straightening and finishing hand tools remains about the same for machine-applied plaster.

CREWS

A typical plastering crew for hand application consists of a crew leader, two to four plasterers, and two to four tenders. The plasterers, under the crew leader's supervision, set all levels and lines and apply and finish the plaster. The tenders mix the plaster, deliver it to the plasterers, construct scaffolds, handle materials, and do cleanup tasks.

For a machine application, a typical crew consists of a nozzle operator who applies the material, two or three plasterers leveling and finishing, and two to three tenders.

BASE COAT APPLICATION

Lack of uniformity in the thickness of a plaster coat detracts from the structural performance of the plaster, and the thinner the coat, the smaller the permissible variation from uniformity. Specifications usually require that plaster be finished "true and even, within 1/8-inch tolerance in 10 feet, without waves, cracks, or imperfections." The standard of 1/8 inch appears to be the closest practical tolerance to which a plasterer can work by the methods commonly in use.

The importance of adhering to the recommended minimum thickness for the plaster cannot be overstressed. A plaster wall becomes more rigid as thickness over the minimum recommended increases. As a result, the tendency to crack increases as thickness increases. However, tests have shown that a reduction of thickness from a recommended minimum of 1/2 inch to 3/8 inch, with certain plasters, decreases resistance by as much as 60 percent, while reduction to 1/4 inch decreases it as much as 82 percent.

Gypsum

The sequence of operations in three-coat gypsum plastering is as follows:

1. Install the plaster base.
2. Attach the grounds.
3. Apply the scratch coat approximately 3/16 inch thick.
4. Before the scratch coat sets, rake and cross rake.
5. Allow the scratch coat to set firm and hard.
6. Apply plaster screeds (if required).
7. Apply the brown coat to a depth of the screeds.
8. Using the screeds as guides, straighten the surface with a rod.
9. Fill in any hollows and rod again.
10. Level and compact the surface with a darby; then rake and cross rake to receive the finish coat.
11. Define angles sharply with an angle float and a featheredge. Trim back the plaster around the grounds so the finish coat can be applied flush with the grounds.

Lime

The steps for lime base coat work are similar to those for gypsum work except that, for lime, an additional floating is required the day after the brown coat is applied. This extra floating is required to increase the density of the slab and to fill in any cracks that may have developed because of shrinkage of the plaster. A wood float with one or two nails protruding 1/8 inch from the sole (called a devil's float) is used for this purpose.

Portland Cement

Portland cement plaster is actually cement mortar. It is usually applied in three coats, the steps being the same as those described for gypsum plaster. Minimum recommended thicknesses are usually 3/8 inch for the scratch coat and brown coat, and 1/8 inch for the finish coat.

Portland cement plaster should be moist-cured, similar to concrete. The best procedure is fog-spray curing. The scratch coat and the brown coat should both be fog-sprayed cured for 48 hours. The finish coat should not be applied for at least 7 days after the brown coat. It too should be spray-cured for 48 hours.

FINISH COAT APPLICATION

Interior plaster can be finished by troweling, floating, or spraying. Troweling makes a smooth finish; floating or spraying makes a finish of a desired surface texture.

Smooth Finish

Finish plaster made of gypsum gauging plaster and lime putty (called white coat or putty coat) is the most widely used material for smooth finish coats. A putty coat is usually applied by a team of two or more persons. The steps are as follows:

1. One person applies plaster at the angles.
2. Another person follows immediately, straightening the angles with a rod or featheredge.
3. The remaining surface is covered with a skim coat of plaster. Pressure on the trowel must be sufficient to force the material into the rough surface of the base coat to ensure a good bond.
4. The surface is immediately doubled back to bring the finish coat to final thickness.
5. All angles are floated, with additional plaster added if required to fill hollows.
6. The remaining surface is floated, and all hollows filled. This operation is called drawing up. The hollows being filled are called cat faces.
7. The surface is allowed to draw for a few minutes. As the plaster begins to set, the surface-water glaze disappears and the surface becomes dull. At this point, troweling should begin. The plasterer holds the water brush in one hand and the trowel in the other, so troweling can be done immediately after water is brushed on.
8. Water is brushed on lightly, and the entire surface is rapidly troweled with enough pressure to compact the finish coat fully. The troweling operation is repeated until the plaster has set.

The sequence of steps for trowel finishes for other types of finish plasters is about the same. Gypsum-finish plaster requires less troweling than white-coat plaster. Regular Keene's cement requires longer troweling, but quick-setting Keene's cement requires less. Preliminary finishing of portland cement-sand is done with a wood float, after which the steel trowel is used. To avoid excessive drawing of fines to the surface, delay troweling of the portland cement-sand as long as possible. For the same reason, the surface must not be troweled too long.

The steps in float finishing are about the same as those described for trowel finishing except, of course, that the final finish is obtained with the float. A surface is usually floated twice: a rough floating with a wooden float first, then a final floating with a rubber or carpet float. With one hand the plasterer applies with the brush, while moving the float in the other hand in a circular motion immediately behind the brush.

Special Textures

Some special interior-finish textures are obtained by methods other than or in addition to floating. A few of these are listed beow.

STIPPLED.— After the finish coat has been applied, additional plaster is daubed over the surface with a stippling brush or roller.

SPONGE.— By pressing a sponge against the surface of the finish coat, you get a very soft, irregular texture.

DASH.— The dash texture is obtained by throwing plaster onto the surface from a brush. It produces a fairly coarse finish that can be modified by brushing the plaster with water before it sets.

TRAVERTINE.— The plaster is jabbed at random with a whisk broom, wire brush, or other tool that will form a dimpled surface. As the plaster begins to set, it is troweled intermittentl y to form a pattern of rough and smooth areas.

PEGGLE.— A rough finish, called peggle, is obtained by throwing small pebbles or crushed stone against a newly plastered surface. If necessary, a trowel is used to press the stones lightly into the plaster.

STUCCO

LEARNING OBJECTIVE: Upon completing this section, you should be able to identify the composition of stucco, and state the procedures for mixing, applying, and curing.

"Stucco" is the term applied to plaster whenever it is applied to the exterior of a building or structure. Stucco can be applied over wood frames or masonry structures. A stucco finish lends warmth and interest to projects.

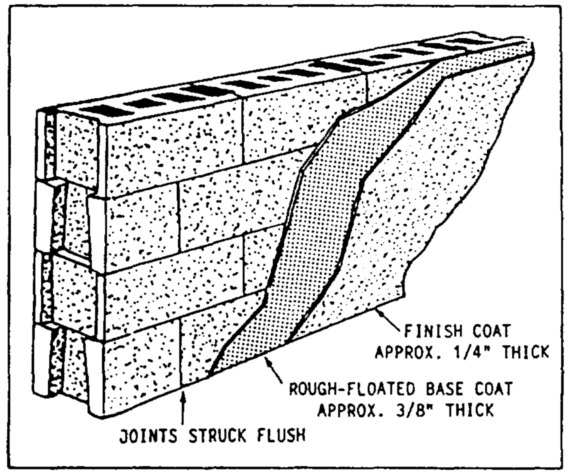

Figure 7-18.—Masonry (two-coat work directly applied).

COMPOSITION

Stucco is a combination of cement or masonry cement, sand and water, and frequently a plasticizing material. Color pigments are often used in the finish coat, which is usually a factory-prepared mix. The end product has all the desirable properties of concrete. Stucco is hard strong, fire resistant, weather resistant, does not deteriorate after repeated wetting and drying, resists rot and fungus, and retains colors.

The material used in a stucco mix should be free of contaminants and unsound particles. Type I normal Portland cement is generally used for stucco, although type II, type III, and air-entraining may be used. The plasticizing material added to the mix is hydrated lime. Mixing water must be potable. The aggregate used in cement stucco can greatly affect the quality and performance of the finished product. It should be well graded, clean, and free from loam, clay, or vegetable matter, which can prevent the cement paste from properly binding the aggregate particles together. Follow the project specifications as to the type of cement, lime, and aggregate to be used.

APPLICATION

Metal reinforcement should be used whenever stucco is applied on wood frame, steel frame, flashing, masonry, or any surface not providing a good bond Stucco may be applied directly on masonry.

The rough-floated base coat is approximately 3/8 inch thick. The finish coat is approximately 1/4 inch thick. Both are shown in figure 7-18 applied to a masonry surface. On open-frame construction

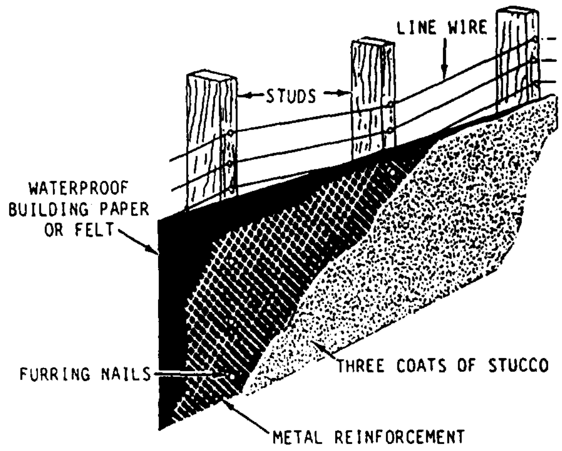

Figure 7-19.-Open-frame construction.

(fig. 7-19), nails are driven one-half their length into the wood. Spacing should be 5 to 6 inches OC from the bottom. Nails should be placed at all corners and openings throughout the entire structure on the exterior.

The next step is to place wire on the nails. This is called installing the line wire. Next, a layer of waterproof paper is applied over the line wire. Laps should be 3 to 4 inches and nailed with roofing nails. Install wire mesh (stucco netting), which is used as the reinforcement for the stucco.

Furring nails (fig. 7-20) are used to hold the wire away from the paper to a thickness of three- eighths of an inch. Stucco or sheathed frame construction is the same as open frame except no line wire is required. The open and sheathed frame construction requires three coats of 3/8-inch scratch coat horizontally scored or scratched, a 3/8-inch brown coat, and a 1/8-inch finish coat.

Stucco is usually applied in three coats. The first coat is the scratch coat; the second the brown coat; and the final coat the finish coat. On masonry where no reinforcement is used, two coats maybe sufficient. Start at the top and work down the wall. This prevents mortar from falling on the completed work. The first, or scratch, coat should be pushed through the mesh to ensure the metal reinforcement is completely embedded for mechanical bond. The second, or brown, coat should be applied as soon as the scratch coat has setup enough to carry the weight of both coats (usually 4 or 5 hours). The brown coat should be moist-cured for about 48 hours and then allowed to dry for about 5 days. Just before the application of the finish coat, the brown coat should be uniformly dampened. The third, or finish, coat is frequently pigmented to obtain decorative colors. Although the colors may be job-mixed, a factory-prepared mix is recommended. The finish coat maybe applied by hand or machine. Stucco finishes are available in a variety of textures, patterns, and colors.

Surface Preparation

Before the various coats of stucco can be applied, the surfaces have to be prepared. Roughen the surfaces of masonry units enough to provide good mechanical key, and clean off paint, oil, dust, soot, or any other material that may prevent a tight bond. Joints may be

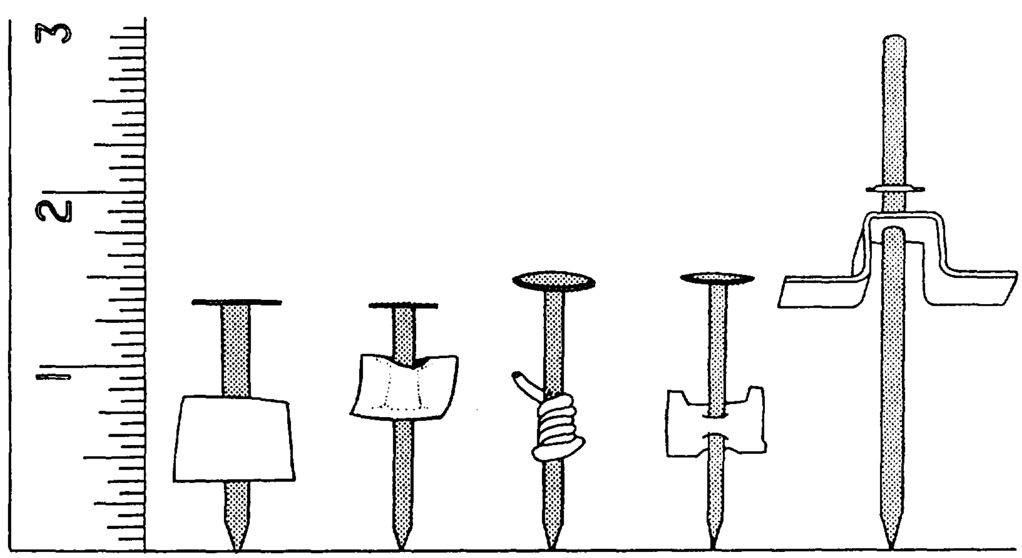

Figure 7-20.-Several types of furring nails.

struck off flush or slightly raked. Old walls softened and disintegrated by weather action, surfaces that cannot be cleaned thoroughly, such as painted brickwork, and all masonry chimneys should be covered with galvanized metal reinforcement before applying the stucco. When masonry surfaces are not rough enough to provide good mechanical key, one or more of the following actions may be taken:

- Old cast-in-place concrete or other masonry may be roughened with bush hammers or other suitable hand tools. Roughen at least 70 percent of the surface with the hammer marks uniformly distributed. Wash the roughened surface free of chips and dust. Let the wall dry thoroughly.

- Concrete surfaces may be roughened with an acid wash. Use a solution of 1 part muriatic acid to 6 parts water. Note: Add muriatic acid to the water; never add water to the acid. First, wet the wall so the acid will act on the surface only. More than one application may be necessary. After the acid treatment, wash the wall thoroughly to remove all acid. Allow the washed wall to dry thoroughly.

CAUTION

When your crew members are using muriatic acid, make sure they wear goggles, rubber gloves, and other protective clothing and equipment.

- You can quickly rough masonry surfaces using a power-driven roughing machine (such as that shown in figure 7-21) equipped with a cylindrical cage fitted with a series of hardened steel cutters. The cutters should be mounted to provide a flailing action that results in a scored pattern. After roughing, wash the wall clean of all chips and dust and let it dry.

Suction is absolutely necessary to attain a proper bond of stucco on concrete and masonry surfaces. It is also necessary in first and second coats so the following coats bond properly. Uniform suction also helps obtain a uniform color. If one part of the wall draws more moisture from the stucco than another, the finish coat may be spotty. Obtain uniform suction by dampening the wall evenly, but not soaking, before applying the stucco. The same applies to the scratch and brown coats. If the surface becomes dry in spots, dampen those areas again to restore suction. Use a fog spray for dampening.

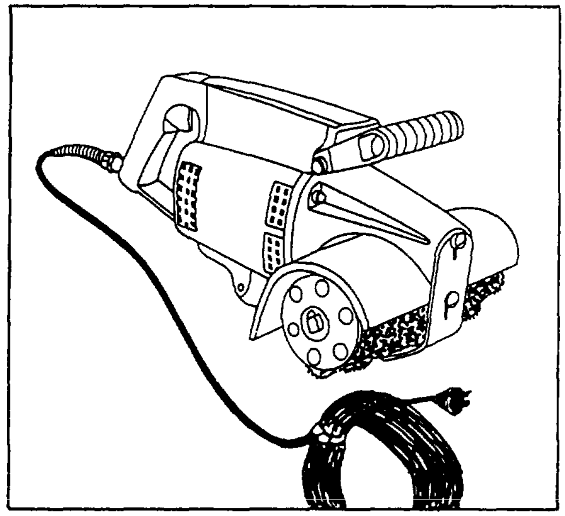

Figure 7-21.—Power-driven roughing machine.

When the masonry surface is not rough enough to ensure an adequate bond for a trowel-applied scratch coat, use the dash method. Acid-treated surfaces usually require a dashed scratch coat. Dashing on the scratch coat aids in getting a good bond by excluding air that might get trapped behind a trowel-applied coat. Apply the dash coat with a fiber brush or whisk broom, using a strong whipping motion at right angles to the wall. A cement gun or other machine that can apply the dash coat with considerable force also produces a suitable bond. Keep the dash coat damp for at least 2 days immediately following its application and then allow it to dry.

Protect the finish coat against exposure to sun and wind for at least 6 days after application. During this time, keep the stucco moist by frequent fog-spraying.

Mixing

Mixing procedures for stucco are similar to those for plaster. Three things you need to consider before mixing begins are the type of material you are going to use, the backing to which the material will be applied, and the method used to mix the material (hand or machine). As with plaster, addition of too much of one raw ingredient or the deletion of a raw material gives you a bad mix. Prevent this by allowing only the required amount of ingredients in the specified mix.

Applying

Stucco can be applied by hand or machine. Machine application allows application of material over a large area without joinings (joinings are a problem for hand-applied finishes). To apply stucco, begin at the top of the wall and work down. Make sure the crew has sufficient personnel to finish the total wall surface without joinings (laps or interruptions).

Curing

The curing of stucco depends on the surface to which it is applied, the thickness if the material, and the weather. Admixtures can be used to increase workability, prevent freezing, and to waterproof the mortar. Using high-early cement reduces the curing time required for the cement to reach its initial strength (3 days instead of 7). Air-entraining cement is used to resist freezing action.

COMMON FAULTS

There are times when the finish you get is not what you expected. Some of the most common reasons for discoloration and stains are listed below:

- Failure to have uniform suction in either of the base coats;
- Improper mixing of the finish coat materials;
- Changes in materials or proportions during the work;
- Variations in the amount of mixing water;
- Use of additional water to retemper mortar; and
- Corrosion and rust from flashing or other metal attachments and failure to provide drips and washes on sills and projecting trim.

CERAMIC TILE

LEARNING OBJECTIVE: Upon completing this section, you should be able to identify the different types of ceramic tile and associated mortars, adhesives, and grouts, and state the procedures for setting tiles.

Ceramic tile is used extensively where sanitation, stain resistance, ease in cleaning, and low maintenance are desired. Ceramic tiles are commonly used for walls and floors in bathrooms, laundry rooms, showers, kitchens, laboratories, swimming pools, and locker rooms. The tremendous range of colors, patterns, and designs available in ceramic tile even includes three-dimensional sculptured tiles. Extensive use has been made of ceramic tile for decorative effects throughout buildings, both inside and outside.

CLASSIFICATIONS

Tile is usually classified by exposure (interior or exterior) and location (walls or floors), although many tiles may be used in all locations. Since exterior tile must be frostproof, the tiles are kiln fired to a point where they have a very low absorption. Tiles vary considerably in quality among manufacturers. This may affect their use in various exposures and locations.

SIZES

Tile is generally available in the following square sizes: 4 1/4 by 4 1/4, 6 by 6, 3 by 3, and 1 3/8 by 1 3/8 inches. Rectangular sizes available include 8 1/2 by 4 1/4, 6 by 4 1/4, and 1 3/8 by 4 1/4 inches. Tile often comes mounted into sheets (usually between 1 and 2 square feet) with some type of backing on the sheet or between the tiles to hold them together.

Tiles with less than 6 square inches of face area and about 1/4 inch thick are called ceramic mosaics. Ceramic mosaic tile sizes range from 3/8 by 3/8 inch to about 2 by 2 inches, and they are available from the manufactures in both sheet and roll form. Often, large tile is scored by the manufacturer to resemble small tiles.

FINISHES

Tile finishes include glazed, unglazed, textured (matte) glazed porcelain, and abrasive. Glazed and matte glazed finishes may be used for light-duty floors but should not be used in areas of heavy traffic where the glazed surface may be worn away. Glazed ceramic wall tiles usually have a natural clay body (nonvitreous, 7-to 9-percent absorption), and a vitreous glaze is fused to the face of the tile. This type of tile is not recommended for exterior use. Glazed tile should never be cleaned with acid, which mars the finish. Use only soap and water. Unglazed ceramic mosaics have dense, nonvitreous bodies uniformly distributed through the tile. Certain glazed mosaics are recommended for interior use only, others for wall use only. Porcelain tiles have a smoother surface than mosaics and are denser, with an impervious body of less than one-half of 1-percent absorption. This type of tile may be used throughout the interior and exterior of a building. An abrasive finish is available as an aggregate embedded in the surface or an irregular surface texture.

Tales are available with self-spacing lugs, square edges, and cushioned edges (slightly rounded) (see