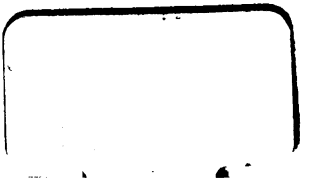


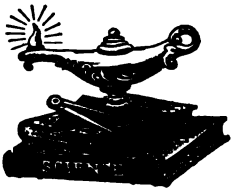
CONCRETE FROM SAND MOLDS

CONCRETE FROM SAND MOLDS

A Practical Treatise
Explaining a Simple System of Molding Ornamental and Plain Concrete or "Cast Stone" with Molds of Wet Sand. This process heretofore held as a Trade Secret will successfully Mold every class of Ornamental Concrete work desired.

By A. A. HOUGHTON

Author of "Ornamental Concrete Without Molds," "Clay Models and Plaster Molds for Ornamental Concrete," "Practical Use of Concrete," Etc.



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PREFACE

It is not the purpose of the writer to make this a book filled with technical explanations, that cannot be grasped by the average reader, but to give in the plainest language a complete and comprehensive explanation of the process of molding every class of concrete work or "cast stone" with the use of molds made from wet sand. Every care has been used to make the exact meaning clear, as the writer must assume that the reader is entirely unacquainted with the principia of this process, and wants information that will enable him to apply it to his every-day work.

The work that can be accomplished with sand molds is unlimited in scope, the undeniable fact that the combination of a clay pattern with an easily separable material for the mold places at the command of anyone, a means for the reproduction in concrete of any work, without limit to the size, shape, or the degree of ornamentation upon its surface. The sand of mold permits it to be broken up and removed from the center of a vase or jug, the inside of a ball or any work

even where the opening is but an inch and a half in diameter; it permits the removal of cores from a design that has under-cutting extending horizontally with the face of the work; these features alone which are possible in no other class of material available for concrete molds, make the wet sand mold process ideal for every class of ornamental concrete work.

The low cost of molds, using simply the cheapest and most common of materials; the ease and rapidity with which work may be produced; the increased density and strength of the concrete; perfect details to the lines of ornamental designs, together with the perfect curing of the work without the least attention, as it remains enclosed by the wet sand until the final set or hardening of the cement has taken place; these facts alone are convincing that this process is not only the one probably first employed in this work, to produce ornamental effects in concrete, but will be the *first* in efficiency at the present day to enable the concrete worker to mold any design he may desire, without restrictions as to releasing the mold from the finished work.

A. A. HOUGHTON.

MAY, 1910.

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CHAPTER I

THE ORIGIN OF THE SAND MOLD PROCESS OF MOLDING CONCRETE AND THE VALUE OF SAME

THERE is a wide difference of opinion among concrete men as to the exact origin of this method of producing "cast stone" or concrete. To all those who have made it a subject of study everything points to the apparent fact that it is but a modern adaptation of one of the arts of the first Roman architects; this is well within reason, for it is an established fact that the Romans employed wood forms in molding concrete work, and, as the many examples of intricate ornamentation appearing upon these works show positively that they could not have been produced with wood molds, and in many exam-

ples where there is deep under-cutting, the use of plaster molds would have been impracticable; looking at the matter from this view-point the fact is obvious that our ancient workers turned to the easiest solution of this problem, which would be that the pattern or model of the ornament was modeled in clay; a form of plaster or some easily worked material that was within the possibility of being worked by their crude tools, then an impression or mold of this model formed in sand, or some easily separable material, so that the completed work and mold could be separated without injury to the ornamentation, was made.

Looking at the subject from the point of practicability this is to the thinking student the only logical way in which many of the elaborate ornaments of the Roman architects could be formed, when we consider the tools with which they must work at that period.

This system or art, as it may be termed, has not been revived until within the last few years as a method of producing "cast stone" or concrete, while the knowledge is known to but few

concrete workers to-day, and by them has been held a secret, yet it has been employed in a desultory manner by such as knew how to employ it, for a number of years. In this the first complete explanation of this valuable process I shall present the various ways of employing the system to produce a wide range of work; such as is needed by the every-day worker in his daily employment; giving the most practical and easiest ways of securing the desired results.

All concrete men are agreed upon the fact that for many purposes the wet mixture of concrete has advantages over a semi-moist mixture; in this work the molds permit either a very wet mixture or one that is just wet enough so it does not have to be tamped, and in event the molds are baked or hardened the concrete placed in same may be lightly rammed or tamped and a semi-moist mixture employed. The best results are obtained when the mold is filled with liquid concrete or so that it may be poured into the mold; the sand absorbs the excess moisture in the concrete and this dries

out slowly, thus retarding the "set" or hardening of the concrete and removing all necessity of sprinkling the work or covering with wet blankets while "green," thus giving the maximum of strength with the minimum of labor and cost.

Where there is much under-cutting or an ornament which overhangs, giving a deep hollow beneath same, this process is of the greatest value when it is necessary to remove the work from the molds; the sand when unbaked and the moisture has evaporated from same, is easily separable into small pieces, so that the portion of the mold which is in the hollow, or the core, simply breaks into small grains again and is removed without the least danger of injury to the work molded. These cores can be made a part of the mold; made at the same time as the impression of pattern is taken or they may be made separately, as in the event of intricate and deep hollows in the work that require a core that would not hold for the removal of the pattern; by forming these as a separate unit and adding to the mold, work may be pro-

duced that cannot be accomplished in any other mold in use to-day.

The surface finish of concrete to-day as molded in the ordinary wood and metal molds is far from perfect when considered from the standpoint of beauty; the coating of the outside face or particles of aggregate with cement, gives to the work an appearance of dullness, or lifelessness, as compared with the sparkle and luster of the grains of natural stone; when this is remedied by the use of acids, the restoration is not complete and the method is laborious and expensive. With the sand mold process the face of the mold may be composed of crushed granite, white sand, marble flour, or any extra facing you may wish; this simply retains its shape until the mortar is poured into the mold and is a separate part of the mold, thus permitting the facing material to become a part of the finished work free from any coating of cement upon its face; thus producing work that has all the beauty of natural stone in every way.

Another advantage is the great adaptability

of the process to every style of work that it is desired to produce; the requisite of a pattern is supplied by the wood pattern, clay model, cut or cast stone, or even many other articles that give the desired shape; it is thus possible for the worker to secure a mold to suit his own ideas and desires as he has the use of many patterns and can build them up to perfect the design he may wish to mold in concrete, from various units—thus making the range of work within his power practically without limit.

In addition to the foregoing arguments that make this process appeal to every concrete worker, the item of cost is one that cannot be overlooked. In the wood and metal molds that are offered the worker to-day, the first expense is very large; it requires that a number of pieces be produced and sold to repay the initial outlay, which in many cases is not practicable. In molding varying sizes of any piece a separate mold is required that often makes the cost prohibitive and the result is that something else is substituted with a loss in appearance.

With this process a pattern and sand are the

requirements of as many molds as you desire or your work demands; the cost in comparison to any other form of mold is so slight as to be hardly worth considering, thus permitting a free rein to the wishes of the worker as to size, style and variety of the molds he wishes to use, without the expense and bother of moving from place to place a vast number of cumbersome molds.

CHAPTER II

The Principle of the Process. Mixing and Preparing the Sand for Plain Sand Molds. Various Ways of Mixing

When making a mold from sand, that requires moving, as is the case with those for small work, the sand must be enclosed or retained in a box form; which is best made in the shape employed by the metal molder in constructing his "flask" or form for holding the sand of mold, with the exception of several points in which the two lines of work differ.

The "flask" is a box-like form in two sections without top or bottom; these are provided by building flat board forms just a trifle larger than the box-like form or flask, and which are placed upon the top of same to act as a cover, when it is desired to turn over or move the flask. These cover boards should be built

strongly so they will not warp, by placing cleats across same to brace rigidly.

The two sections of flask are provided with a "lock" or dowels, the same as those for metal molding, as it is necessary that the two sections may be taken apart and then be placed together in the identical manner as they were before being separated; to do this some guide must be arranged and this is the most simple and positive that can be used. The lower section of the flask is termed in the metal molders' parlance a "drag," and the upper section a "cope," which may be a convenience to the student in classing the different parts of the flask for a sand mold.

A departure from the metal workers' flask is the iron rods arranged upon two cleats on opposite sides of the flask; in both upper and lower sections of the flask or form. These rods should fit tightly so that they will aid in supporting the sand when the cope or upper section of flask is lifted; the cleats are arranged in the manner shown at (c) in Fig. 1, so they will not interfere with the model and yet place

the supporting strength for sand where the most needed.

In Fig. 1 the drag or lower section is shown at (a); the cope or upper section at (b); the strips that lock the two sections together, at the proper point, are shown at (d) and (e), while the cover boards or bottom and tops to the flask are not shown; these are always separate and never fastened to the flask in any manner. At (*f*) is shown a beveled strip that is placed around the inside of both sections of flask, this must be at the point the two sections are to be divided when the mold is complete, and is for the purpose of supporting the sand as well as making the division or "parting" of the mold much easier and exact; this strip may be used at both top and bottom of each section if any trouble is experienced in lifting the mold and having the sand hold securely.

This style of flask is employed where the pattern permits the mold to be in two sections; where it requires four sections a different style is used and in event of simple bas-relief or raised ornamentation, one section of flask is all

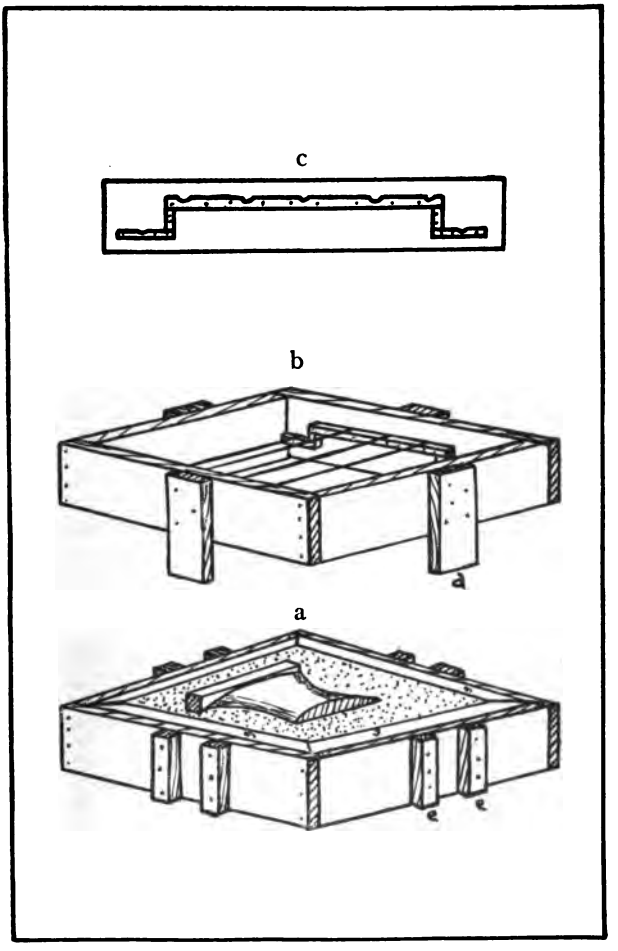

FIG. 1.--Construction of Flask.

that is demanded; as will be explained in a later chapter.

As the reader will understand the pattern is placed upon one of the cover boards, if in halves or for bas-relief work, and the sand tamped down upon same; the sand is rammed as tightly as possible with the hand tool used, and then a cover board placed over same when this section is filled to top; it is then a simple matter to turn the mold or flask over and the pattern is then upon the top ready to be removed; this is all that is required in molding work where only a portion of the ornament projects from the block as with a bas-relief design, for a box form may be erected around this design, as a mold for the body of the block, and the concrete poured into same, employing the sand mold simply as a face plate.

Where the work must be ornamented upon all sides, as a baluster or pedestal, etc., the cope or upper section of the flask is used and a second section of mold made, which will be explained in detail in a later chapter.

These general explanations will show that

the sand must be of a certain quality of adhesiveness so that it will pack together solidly and retain its shape under strain as well as be capable of taking a smooth face and to conform to the most minute lines of the pattern.

To secure this result there are several ways of preparing the sand that may be employed; the easiest is to use any very fine sand, lake or beach sand is the best; this may be mixed with about twenty-five per cent its volume of clay. This should be the ordinary red or yellow clay that has been cleaned from all particles of loam or any gravel, then dried and pulverized; this is mixed thoroughly with the sand, which should be screened to free it from any pebbles or stone, and the whole mass wet with water until it is thoroughly damp; it should be so that when a handful is picked up and pressed in the palm of the hand that it will retain all the marks of the fingers without crumbling, when the fingers are removed. It is not difficult to secure this consistency, as the lake or beach sand has, when thoroughly wet with water, nearly this much consistency in itself; but without the

strength or adhesive power to be lifted without injury with the cope or upper section of flask; hence the addition of enough clay to the mixture to enable it to be rammed or tamped tightly enough to permit this lifting without the sand falling out of the cope.

In such molds that do not have to be subjected to being lifted or moved, from the time of removing pattern to the time of pouring in the concrete, the addition of clay is not so necessary as the sand will retain its form if not subjected to any shock or sudden jar; this may be employed where the mold is simply as a face plate and is employed while laying flat upon the molding table.

Where the flask is large and the shape of pattern is such as to make the use of rods through the sand impossible, as when using a number of flasks set one upon the other to mold large work, the sand may be mixed or wet with water into which one pound of ground glue is dissolved to each two gallons of water; this binds the sand together into a solid mass, and while it can be broken into small pieces,

yet for deep cores is not as available, as the work is apt to be injured in removing the sand. The sand and glue-water mixture is prevented from adhering to the pattern by sprinkling it with fine dry sand, which is usually employed for any of the mold mixtures.

Where a strengthening liquid is desired or one to bond the sand together, the use of flour and water can be employed in place of the glue-water; this is far more satisfactory in all ordinary work that requires a very hard mold, but is best not to be used if it can be dispensed with, for any of these is positive to make the mold much harder to remove from the completed work where any portion of same projects in the form of a core. In the ordinary molding sand of sand and clay the mold, when it has dried with the work, may be broken up into fine particles with the fingers or a small strip of wood, thus freeing any portion of the completed work no matter how much under-cutting it may contain; when any adhesive material is added to the mixture, other than clay, this is not so easily accomplished, and a greater

risk is run in freeing the work of the sand that composes the mold.

The use of powdered talc or soapstone is often used as a material to aid in bonding the sand together, in making the mold; this is valuable for fine work, but as the cost is greater than the use of ordinary clay, the average worker does not usually employ same. The quantity is about the same as for the sand and clay mixture and is best determined by tests for it should be varied with the difference in sand; this can be very easily done by mixing a small quantity with a known amount of sand and adding more until the desired consistency is obtained, which may easily be known when the material will retain the imprint of the fingers perfectly without crumbling, when squeezed in the hand.

The object desired in preparing a mixture for molds of this kind is to secure a material that has enough adhesiveness, or the quality to hang together, to make a mold that may stand a moderate amount of handling while pouring in the concrete; this mixture must also

be porous enough to admit of the addition of considerable moisture without the mixture becoming muddy; in many classes of sand the latter must be guarded against, as in the use of sand that contains dirt or similar foreign matter. Where this is the case the addition of from one-sixteenth to one-fourth the volume of clean dry sawdust, before wetting with water, will be found satisfactory in results.

Many and varied methods may be employed for this purpose as using fine sifted fireclay or the use of whiting in a small quantity, where nothing better offers, has accomplished the desired results. The worker can, by experimenting with the sand that he must work with, obtain the correct proportions and materials necessary to mix with same, to produce a mixture of the proper adhesiveness and porosity for his purpose.

CHAPTER III

Preparing the Material for and Hardening Molds

The worker often demands a mold that will make a number of casts; this where there is no very marked under-cutting is easily possible to accomplish by baking or hardening the mold, so that it is durable and will make a number of casts or pieces of work before it outlives its usefulness. Where the design is very intricate and with deep under-cutting this method is impossible, as it will be found impracticable to remove the cores from the deep hollows; but in the majority of designs it works very well, and with all the success of a sectional plaster mold.

The chief requisite for a baked mold is a material that, when subjected to moderate heat, will harden or "bake" until it is not easily penetrated by anything it comes in con-

tact with, as well as being strong enough to stand a moderate amount of handling without danger of breaking.

This can be obtained by the use of common molasses mixed with your molding sand; the molasses makes a very strong adhesive, and when subjected to a moderate heat hardens nicely, and makes a core or mold that will secure a number of casts in concrete without injury to the mold. The quantity to use must be determined by the sand you are working with; the best guide is to mix it slowly with the sand, adding until the sand is of a putty-like consistency or so it can be modeled with the fingers and will retain its shape. It can then be packed into the flask, over the pattern, first covering the pattern with dry sand sprinkled over same so the molasses and sand mixture will not stick to the pattern, when you wish to remove same.

Another excellent mixture is the use of sand and a thin paste made of flour and water; this bakes quite hard and is excellent for a hardened mold, as well as having the advantage of being cheap in cost. It is used in the same manner

as the molasses, mixing with the sand until the necessary quality of adhesiveness is secured, then pack into mold over pattern.

There are many other similar compounds that may be used, as sand and sour beer or sand and thin glue-water; anything that will harden under heat until it is not easily penetrated, or broken.

The flask for a hardened or baked mold must be such that it can be removed before putting in the oven, as the wood would take fire from even the moderate heat required to bake or harden the mold. This is secured by making the flask or mold form in a box form, but hinged at three of the corners with the fourth corner to fasten with a hook and eyelet; this enables the hook to be unfastened and the wood flask folded back from the sand mixture, inside same, thus removing it before placing in the oven.

To prevent the sand mixture from falling down or breaking, as well as cracking or checking from the heat, there must be some uninflammable material to enclose the mold; this need not be strong and can be made of a strip of tin,

sheet iron or any metal riveted together so it will just sit or go inside the flask; the sand mixture is packed inside this and when the wood part of flask is removed the metal casing remains, to hold the mold in shape while it is being hardened by the heat of oven.

The same as the wood flask, a substitute for the cover board, or board on which the mold rests, must be secured; otherwise the heat of oven would burn that also. This may be secured in any heavy metal sheet or a flat grate from the oven of a stove or any similar flat sheet of metal which can be supplied by the scrap heap at your local foundry.

The oven can be anything to generate the heat to harden or bake the material, of which the mold is composed; as these are not usually large an old cook-stove for small work will be ideal; the mold is placed on the flat sheet of metal and then the wood flask unfastened and removed, by folding back carefully from the work; it is then ready for the oven as the pattern has been removed before the wood flask, it is then a simple matter to place in the oven

and generate heat for from four to six hours, even less is often ample, as the only requirement is to harden the material, and when that is accomplished the mold is ready for removal. It is often advisable where a mold is valuable to again encase it with the wood flask, after baking, so that any rough usage to which it might be subjected would not be so apt to injure it.

This material is valuable in the event of cores that are to be a separate part of mold, these can be baked hard and so stand rough handling without danger of breakage.

Where the worker has at his command the regular iron flasks, as used for this work in the metal foundry, he can work more rapidly, as they will not require removal before placing in the oven, which does not generate heat enough to have any effect upon the metal, as that is not required.

It is not general in practice, but I have found it to be of value to protect the molding surface of such molds before using, as when a number of casts were required from the same mold the

life of that mold can be increased by a protective coating. This is given in the ordinary shellac, several coats of same are painted over the molding surface of the mold, after baking, allowing each one to dry before applying the next, this if properly applied makes a very smooth finish and also increases the life of the mold.

As is often demanded, the work should have a rough cast finish or the effect of tool dressed stone and in such event the smooth surface of the shellac must be roughened; this is accomplished by applying three coats, having the first one heavy and over same while yet fresh or sticky, sprinkle sand using care to have it evenly distributed and just to cover the surface; with the second coat you can remedy any places where the sand in first coat is not perfect, or to your liking, and with the third coat of shellac make a coating over all that is impervious to water and so capable of making a large number of casts, each with the true effect of tool dressed stone. Thin glue may be employed instead of the shellac with success, if it is more convenient.

CHAPTER IV

Making Sand Molds from Wood and Metal Patterns

The method of making the mold must depend on the shape and condition of the pattern; if from a wood baluster, as shown in Fig. 2, the pattern may be divided in the center and the mold made to part along this division line. Where the pattern is to be simply a face plate as with a bas-relief design, but one section of the flask is required, and it is a simple matter to make the mold; in event the pattern cannot be divided there are several ways of securing the desired results, as will be explained in the following chapters.

The manner of making a sand mold from a pattern in two sections is illustrated in Fig. 2, which also applies to the making of bas-relief designs as well. The flask is built in two sec-

tions so that it will be several inches larger each way than the pattern, and a cover or board slightly larger than the flask is laid upon the molding table; upon this the pattern is laid in the center, or in event of a sectional pattern one-half of same is placed on this board as shown at (c) in Fig. 2. The pattern is covered with fine dry sand, lightly sifted over same; this is in addition to the coating placed on pattern to prevent sticking; the molding sand or mixture of clay and sand is now placed in the box or flask in the same manner as filling a mold with concrete, using care not to disturb the position in which the pattern lays; the sand mixture is now rammed down tightly all over the surface and more sand added and tamped until it is solid, and the tamper will not make any decided impression on the surface of the sand; the top is then leveled off with a straight-edged piece of board, and it is then ready to be reversed or turned over.

It is difficult to direct exactly how much the mold must be tamped, to enable it to lift without the sand falling out; the worker can easily

learn this with a few attempts, as the mold that is too loosely tamped will not lift without injury; there is little danger from over-tamping for this work, which is a decided difference from the sand molds of the metal worker, who must guard against tamping too tightly as much as against not tamping the mold enough.

The rods of ¼″ iron laid into the sand, across from one side of the flask to the other, as shown in illustration, are placed at the same time the sand is placed and the material packed tightly around same; these are a great aid in holding the sand into the flask when being lifted, and for the beginner or less experienced worker are invaluable, for they save many molds from breaking in the necessary handling. The rods must not touch the pattern and there should be at least 1 ½″ of sand between the pattern and the nearest rod; by having the flask large enough this can be arranged and the rods placed so that they will be even, between the top of pattern and the top edge of flask; where they will do the most service.

The tamper shown at (b) is easily made from

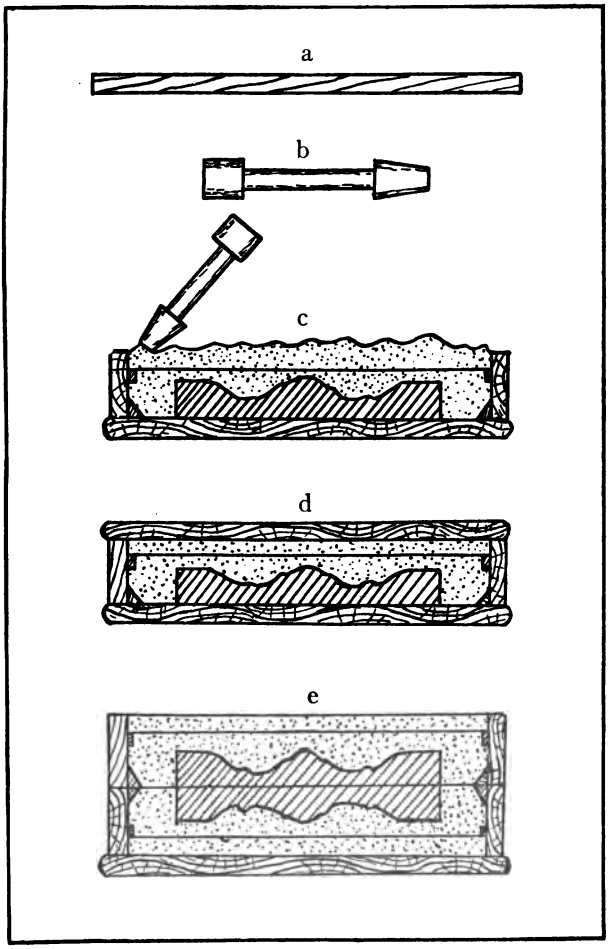

FIG. 2.—How the Sand Mold is Made.

any block of hard wood; this should be about 15″ long and 3x3″ in size or 3″ in diameter, the center is cut out and worked down to make a good handle, so it can be grasped by one or both hands as may be desired. The one end is left in a broad mallet form, which is most useful in leveling the top of mold just before using the straight-edge on same; the opposite end is worked down into a wedge-shaped form that is about ¾″ to 1″ on the point; this is the entire width of the tamper, and is used in packing the sand mixture down solidly. In using this tamper do not strike straight down all the time, but vary by packing the sand with a slanting stroke, as is shown by the position of tamper in (c); by covering the surface of mold in all directions in this manner as well as with straight downward strokes, the sand mixture is packed evenly and solidly over the entire sufrace.

This tamper is best for small work, but of course any style of tamping machinery that will pack the sand mixture solidly is as well; in large work where it is practical, the large sidewalk tampers may be employed to pack the

sand, except around the pattern, where it must be tamped with a surface small enough to press the sand mixture into all the lines of pattern, to make an exact impression of same.

The straight-edge shown at (a) is easily made of any straight piece of board and is used so that the top edge of flask is made level, without any chance of the sand slipping away from the pattern when the mold is turned over.

After the mold or flask is filled and leveled, a cover board is placed upon the top of same, and by grasping both top and bottom boards the flask may be turned over so that the pattern is on top of the flask or simply reversed in position; the cover board that was formerly under the flask is now on top, and is removed, thus exposing to view the pattern and dividing part of the mold. As will be noted, the beveled strips on the inside edge of flask are at this point, or the "parting" of the two sections of mold and aid in making this dividing easier.

The second half of pattern is now laid upon the other; this can be arranged by having two pins that fit loosely into holes bored in both

ends of the pattern; these pins hold the two sections of pattern together at the proper point, but do not interfere with the breaking apart or "parting" of the mold when it is finished.

To prevent the sand mixture in the upper mold from adhering to that of the lower mold or flask, a parting must be secured by using some material that will make a division line at this point; the use of fine dry sand sprinkled over the surface of the lower flask will do if nothing better is possible; the use of powdered plumbago or graphite is ideal for this purpose and requires but little for the desired results. Other materials useful for this are fine coal dust and the dust secured from pulverizing cinders and then sifting them to secure only the finest particles. These are sifted over the surface and any that rest upon the pattern are lightly blown off.

The next section of flask is now placed upon the lower one, where it fits and is held by the strips at ends. The inlets or "gates" for pouring in the concrete are now arranged, at highest point of pattern. Provision is made for three

of these, one at end and two in the side of the mold; the ones that enter at the end or at any point through the flask, must have a hole bored in the wood of flask at that point, so the gate will be exact with the opening in the flask. The molding of these inlets is accomplished by placing a block of wood at the point they are to be and then packing the sand mixture around same, thus making an ample opening for pouring in the concrete; the blocks used for molding inlet are easily removed with the pattern.

The location of inlets or gates must be carefully planned so they will not interfere with the lines of the design; this is done by having them at the highest point of the pattern and if possible upon a flat surface; then in filling mold a small projection will appear here, which can easily be broken off with chisel and the roughness removed with a carborundum brick or stone. The size of the gate should be large enough to permit the mortar to enter easily, and for average work 1 ½″ or 2″ in diameter is ample, as a funnel can be used in pouring the semi-liquid concrete.

Fine dry sand is now sifted over the surface of pattern lightly, just enough to keep the sand mixture from adhering to same, and the sand mixture packed into this section of flask; it is tamped as solidly as for the first section and then leveled off and a cover board placed upon same; then this upper section is carefully lifted up and turned over so it rests upon the cover board that was placed upon the top, but which is now the bottom of this section of flask. This operation of lifting the cope or upper section of the flask is a test of the mold, as it is then that the faults of tamping will appear if at any time; the iron rods across the flask are the more needed in the cope than in any other part of the mold, but with the practice of making a few sand molds the beginner can easily learn to tamp them correctly, and lift the upper section without the least danger of breakage.

The two sections are now apart with one-half of the pattern in each one; the pattern is removed by having a sharp-pointed rod, which may be lightly driven into the pattern and thus lift same easily; or in event of large patterns a

medium-sized gimlet may be sunk into the pattern at each end and then by lifting upon the two at the same moment, the pattern can be "drawn" or lifted without trouble, as every care has been taken to prevent the sand mixture from adhering to the pattern. With metal patterns a hole is drilled into the pattern and threaded, and a rod with threads to match is then screwed into same and thus it "draws" without injury to the mold. The blocks used to mold the inlets for mortar or gates are removed, and the two sections of mold are then ready to place together again and the concrete poured into same.

In the case of simple bas-relief designs the cope is not required, as the lower section of flask makes the entire face plate or sand mold; where a block or body is required to the stone to be cast, a box form is erected around the sand mold and the concrete poured into same; completing the cast or work.

CHAPTER V

Making Molds from Clay, Plaster, or Concrete Patterns

In securing a pattern for the mold it is not always possible to have it of such material, or in such condition that it can be divided where we wish; hence we must construct the flask so as to correct the deficiency of the pattern. Again, with a mold to be made from a clay model, that has cost a large amount of work to complete and has many lines and under-cuttings, the worker should not risk making the mold in the usual manner, as failure may mean the loss of clay model as well as mold; but by having the flask so divided that it is an easy matter to remove the pattern from the sand, as well as to remove the work from the mold; when cast in concrete, the most intricate or unusual shaped pattern may be molded with success.

Concrete From Sand Molds

In making molds from clay, plaster, or concrete patterns, as well as from wood patterns, the surface of pattern must be protected from the moisture in the sand mixture. With the wood pattern this moisture is apt to warp the lumber, when the pattern is used more than once or twice, but by coating with oil several times, so as to fill the pores of the wood with the oil, and then varnishing the pattern with any good varnish, the wood pattern is unaffected by the moisture.

With the clay or plaster pattern the surface requires a coating that will give it a hard finish; not only impervious to the moisture in the sand but to enable the clay or plaster to withstand the pressure exerted by the tamping of the sand in mold; if this is not done any material as plastic as modeling clay would be pressed entirely out of shape by this pressure.

There are several ways of securing the desired result of which the most simple is to coat with shellac; several coats are carefully applied to the surface, allowing each one to dry well before applying the next; this makes a hard

coating over the entire surface, conforming to every line and curve with exactness; thus securing a protective surface that will preserve the model while making the mold.

Another method is to coat lightly with shellac and then over this coat with thin glue; placing one coat upon the other until a shell is secured of a thickness of $\frac{1}{16}$" to $\frac{1}{8}$"; this is valuable where the pattern presents a very broad surface, as in the center it is apt to be depressed by the tamping of the sand, but with a hard protective coating to hold the material in pattern exactly in place, the sand may be tamped solidly without injury to the softest of pattern material, as well as being entirely unaffected by the moisture in the material for mold.

In large and intricate patterns, that will require separate cores, it is often valuable to color the shellac or varnish so that you can quickly locate on pattern the point where these cores will be placed; thus if the pattern is coated with the ordinary shellac, the core points may be painted with a red color mixed with the shellac. Or two parts of a pattern may be

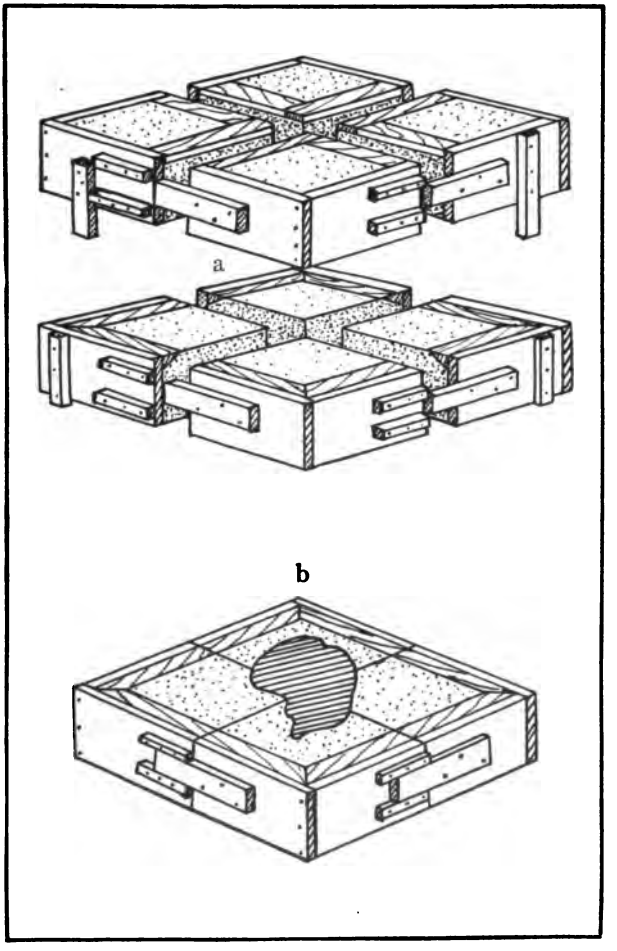

FIG. 3.—Dividing the Sand Molds into Quarter Sections.

coated with different colors of shellac or varnish so that the upper and lower one can be easily distinguished, without the possibility of getting them wrong and having the work to do over.

In the illustration at (b) Fig. 3 is shown the method of dividing the flask into quarters, to make a mold for a face plate of a design difficult to remove from an ordinary mold.

The sides of the flask are held together with strips of wood nailed so to make a "lock," as with the strips used to have the upper and lower sections of flask meet at the proper point each time. The inside surface of this flask is covered with 8-d. nails driven into the wood so that they project about one inch, and so engage with the sand mixture packed into the flask; this enables the mold to "hold" when it is moved sideways as well as when lifted up.

A parting or division line must be arranged, so the mold can be separated into quarters without disturbing the sand from the lines upon which you desire it to separate. This is accomplished by placing the pattern upon the

cover board in the usual manner. Then cut from some thin tough cardboard, four short strips so that they will reach exactly to the center of the flask and also go between the joints of each quarter of the flask, as shown at (a) Fig. 4; where these strips of cardboard touch the pattern they should be cut out into an exact outline of the surface of pattern upon which they rest; this permits them to be placed so as to divide the center of the mold into four quarters; the center of the four strips may be fastened with strips of paper or cloth pasted upon them as shown in (a) Fig. 4. The sand is now carefully placed into the flask; care must be used not to displace the strips of cardboard, which can be done by placing an equal amount of sand mixture upon each side of the strips, then tamping this down with care and adding more in the same manner until the flask is filled. Then the connecting strips in center of the flask, that hold the four pieces of cardboard together at the point, which are placed close to top so as to be easily reached, can be cut apart and the flask is ready to be turned or reversed.

A cover board is now made that is cut into four quarters, to conform to the size of the quarters of mold; this is placed upon the top of flask and covered with a second cover board that is entire or in one piece; then by grasping both upper and lower boards the flask can be turned without danger of breakage. The cover board on top is now removed and a rod or gimlet placed in pattern to secure a hold upon same; now by slightly lifting on the pattern and at the same time drawing out any one of the quarters of mold, carefully, you can release any of the most intricate patterns without injury to the mold.

The worker must bear in mind the shape of his pattern, so that he is able to release the corner that will draw the easiest; then the other three can be easily removed.

The cardboard strips can be removed, and the sections placed together and work molded in the same manner as with any other face plate mold; what applies to releasing the pattern is as valuable for the concrete work cast in mold; so that an ordinary mold of a "green" sand mix-

ture can be made to produce a number of pieces of work.

The drawing at (a) Fig 3, illustrates the flask used where the mold must be made of the entire surface of pattern; it is divided into the eight sections, in the manner illustrated, and held together while in use by the strips connecting the sides, while the upper and lower sections have at corners two strips to "lock" together, so the two upper and lower parts of flask will join and be held in exact position.

The parting of the four quarters of each section, or the cope and drag of flask, is secured with the cardboard strips, as previously explained, while the parting of the upper and lower sections is secured by the graphite or other material that you employ for this purpose.

A method of strengthening the four quarters of each section is shown in the upper section illustrated at (a), short strips of lumber are cut to join and form a protective strip around the inside edge of each quarter section; these strips are imbedded into the sand mixture in making mold and aid in holding the sand at the exact

place it is demanded, as well as making the mold strong enough to be lifted in quarter sections, when done with care. These strips must be placed only on one side of each section of flask, and at the side farthest from the pattern, otherwise they would interfere with the placing of pattern in the flask.

While all clay and plaster molds do not require the flask to be quartered, yet it will be found needful to do so with large patterns of any material, where the shape of pattern and the lines upon the surface of same make this method necessary, so as to release it without injury to the mold.

This method is valuable with molds made of a material to be baked or hardened; as the divided sections of the mold permit the easy removal of work thus securing a large number of casts from each mold before it outlives its usefulness.

CHAPTER VI

Using Division Plates Between Sections of Flask to Make the Parting

As explained in a former chapter it is often necessary to make the flask and mold into quarter or eighth sections, and to make this possible division plates must be arranged to separate the sand mixture, without any possibility of its parting at a point it is not desired to have it do.

These division plates may be made of any material that will serve the purpose; thin metal is best, as a strip or sheet of tin, sheet iron, or any metal that can be easily cut into the shape desired; this is cut so that it fits around the pattern; making a complete outline of the pattern, hence it fits up very closely to same, thus making the mold perfect in parting at all points.

A thin tough cardboard can also be used;

this is far better if treated with a waterproof coating; by dipping it in a pan of melted paraffine wax the cardboard is made impervious to the moisture in the sand and at the same time cannot adhere to the sand mixture in the least, thus insuring a smooth parting to the sections of mold.

At (a) Fig. 4 is shown the method employed to divide either the upper or lower sections of flask into quarters; the division strips are cut so as to meet at a common point in the center of flask, and this center is held by small strips of paper or cloth pasted to the sides of the plates, in the manner illustrated, where cardboard is used for such plates. When tin or metal strips are used this center may be held with a small piece of wax, or by using a small block of wood and into same sawing two slots or saw kerfs at right angles to each other; these need not be over ¾″ in depth, and this block of wood thus sets down over the strips of metal used as plates, thus holding them accurately to the center.

Any fastenings of this kind must be placed

at the top, or close to the top of the flask, so that they can be very easily taken out before turning over the flask; thus with the block of wood it can be removed and the space filled with sand before reversing the flask; as the sand mixture will easily hold the strips in place when the flask is once filled.

The division plates are set over the pattern in the manner illustrated at (a), when cut out; when the pattern can be divided as with a wood pattern, cut into quarters, the plates may set between the division lines of pattern, thus requiring simple straight strips as division plates, and the quarter sections of pattern acting as a block to hold the strips in place. The strips must be long enough so that they will go between the joints of flask on the outside, which holds them securely in position at that point.

The mold in flask is separated by removing the corner that has the most simple part of design, first, the pattern is lifted slightly and the one quarter of mold is carefully drawn outward at the same time, so to release it from the pattern at the one movement, thus enabling the

most intricate and deeply cut lines in pattern to be separated from the sand mold without injury to the molding surface.

These metal or cardboard division plates may also be employed in making the parting between the cope and drag of flask, instead of using the graphite or other material. They are cut in outline of the pattern as shown in the drawing at (b) Fig. 4; the metal or cardboard division plate is made exactly one-half the size of the surface of flask; thus the two plates are cut in an outline of one-half of the pattern, from each edge of the plates, and when placed together permit the pattern to go between them in the manner shown at (c) Fig. 4; this allows the pattern to be in one piece and divides the mold so that the impression of but one-half of the surface of pattern is imprinted in each section of mold.

Where the pattern is in one piece, the mold is made in the following manner: a box form the size of flask is built; this is in height exactly equal to one-half the height of the pattern, so that when this form is placed on a cover board

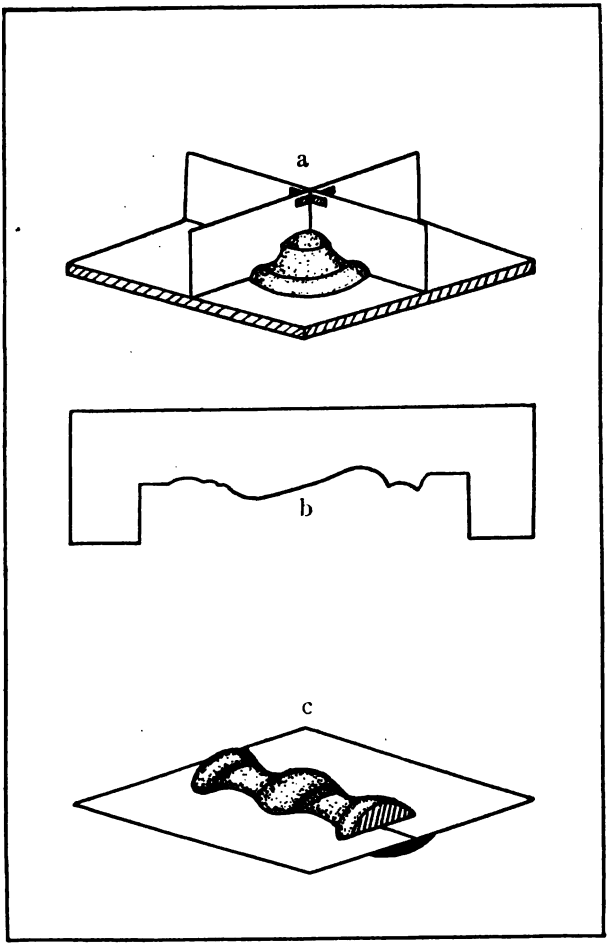

FIG. 4.—Division Plates to Make the Parting in Flask Easier.

and the pattern laid in center of same, the top edge of the form is even with the center line of pattern if it were cut in halves. This box form is now filled with dry sand, all around the pattern and up to the edge; this is simply to support the division plate at the proper point, and to make a solid support for same so the sand mixture that is to make the mold may be tamped above it; the division plates are laid upon this form, that is filled with dry sand and the first section of flask placed upon that; the drag or first section of flask is now filled with the sand mixture in the ordinary manner, as described for making mold. The dry sand in lower box is simply to hold the pattern solid and exactly in center while this first section of mold is made.

As soon as drag is filled with sand mixture, a coverboard is placed upon same and the whole thing reversed or turned over, bringing the box form with the dry sand uppermost; this is now removed, thus exposing the other half of pattern. The cope or upper section of flask is now placed over this and the second section of mold made with the sand mixture; in making

this section cover the pattern carefully with the sifted dry sand as when the cope is lifted it must part from the pattern. Either the pattern, which is in one piece, must draw from the cope or the drag section of flask, as you grasp the metal division plate with the cope or upper section of flask and lift both together, thus parting the two sections of mold and at the same time drawing the pattern from one section of the mold.

This is a necessary part of the work where it is an impossibility to divide the pattern, and the pattern is in such shape that exactly one-half must be imprinted in each section of mold; with concrete patterns or those made of metal this manner of dividing the mold will be found invaluable.

The same idea may be adapted to the use of wood patterns that are in halves; the two halves of the pattern are nailed to opposite sides of a coverboard, so they will be exactly in line with each other, but on opposite sides of the board; in making the first section of mold, the coverboard rests upon an empty section of flask,

and by reversing same brings the other half of pattern uppermost, when it is desired to make the second section of mold.

In preparing clay models for a two-piece pattern, it is of great advantage to make exactly one-half of the model on each of two modeling boards; these should be spaced so that the center of model is exactly in the center of modeling board and a line drawn around same, on the board, to designate where the section of flask is to be placed. This is important, so that each section of flask will be placed at the same distance from the model at all points, thus bringing the model in the exact center of each section of flask, and when the two sections of flask are placed together, for molding work, the impressions of model will meet perfectly, as if the pattern were in one piece.

This method permits easy work in using clay models, as one-half of a clay model is quite easily built up on the modeling board, when impossible to model the entire piece and have in shape for making a mold from same; again

the clay model does not require handling, the mold or impression is taken of same as it rests on the modeling board, hence the danger of injury to model is lessened and a more successful mold assured.

CHAPTER VII

Cores, How to Make and Use with Sand Molds

The proper making and use of cores is one of the most difficult operations connected with the molding of concrete with sand molds. The core must be carefully planned with a view to the fact that it must remain in position with exactness, while the concrete is being poured and must be so planned that it can be easily removed, if a hard baked core is employed. For all small cores that are of such shape as to permit their removal from the work in one piece, it is advisable to make them of a sand mixture that permits hardening or baking; this is an advantage from the fact that a green sand core is very apt to be swept away, or a portion of same disintegrated by the action of the concrete poured into mold, which would not be the case with one of a hardened mate-

rial; this is the more liable to happen where the core has not body enough to be able to resist the action of the wet concrete.

The material for cores may be of many different mixtures; where to be modeled by hand the sand mixture, either green or to be baked, is the best and most easily worked. Where the same core is to be used in a number of casts it can be made of plaster of Paris, wall plaster, or even of concrete with success; the practice of using wood cores is not advisable as the excessive moisture in the concrete used is very liable to swell the wood and injure same.

The value of a separate core is shown most strongly in the illustration at (a) Fig. 5; the core is designated by the dotted lines and as illustrated, shows it extending at an angle into the face of the pattern, which would be the case in many deep under-cuttings; in the ordinary process of molding it would be an impossibility to mold this core with the pattern, as the lifting of the pattern would disturb the sand at the point of core in every case; hence the necessity of making this a separate part of the mold.

As shown by dotted lines the base of core sets into the sand of mold, so that the action of pouring in the concrete will not displace same. In making the sand mold, a small block of wood or anything of the exact size of the body of core is placed over the opening in pattern where the core is demanded; this molds in the sand the opening where the core is to be placed, and as well prevents the sand mixture from entering the part of pattern that is to be molded with a separate core.

After the sand mold is finished and pattern freed, a small box form is placed on the face of pattern, this box form should be the exact size or a trifle smaller, on the inside; than the block of wood used to mold the opening for core in sand mold; the mixture for core is now placed inside this box, using every care that it fills completely the opening in pattern. When a plaster mixture is used it is allowed to harden and can then be removed by turning to conform to the curve of the opening in the pattern. With a sand mixture the pattern must be turned over so to be uppermost and then by turning

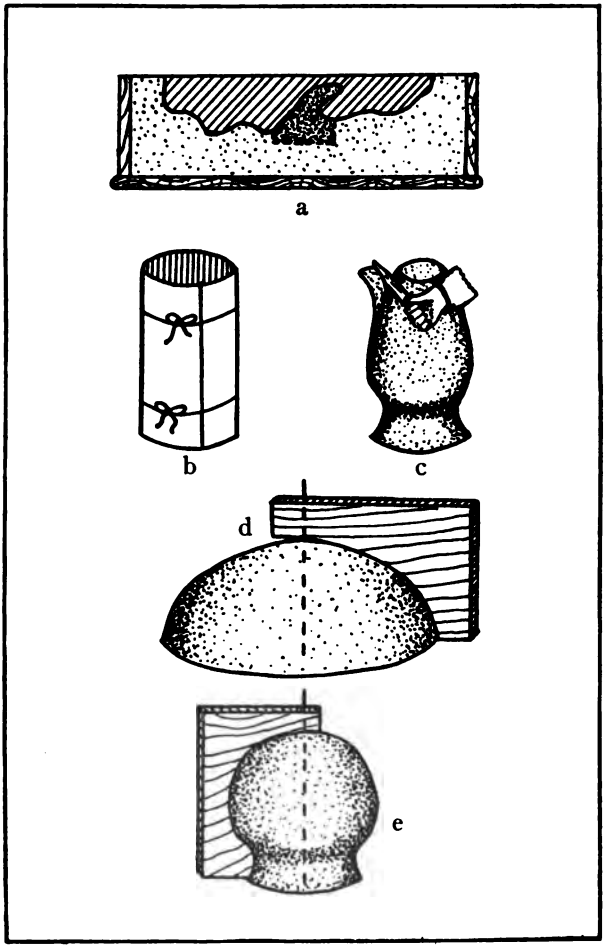

FIG. 5.—The Various Methods of Making Cores.

the pattern to conform to the curve of opening in same, it can be removed from the core easily.

In molding the work in concrete, this separate core is placed within the opening made by the block of wood and the cast made; when it is to be removed from the mold, if possible to remove without injuring mold, the core lifts or draws from the main body of mold, when made of a hardened material, and is then removed from the concrete cast in the same manner as the core is removed from the pattern. When made of green sand the core is of course broken into small particles, the same as mold, in removing the concrete cast from the mold; this allows the easy removal of the material for core from any design, such as a very deep and curved opening in the work, or from the inside of a hollow ball cast in concrete.

The style of core employed to mold the opening inside a vase, jug, or any similar article is shown at (b) and (c); this must be of the green sand mixture for the reason that the neck of the article cast is smaller than the largest part of core, hence the core cannot be removed only in

small pieces; the sand mixture when dry easily disintegrates and in many cases can be removed by breaking up with a small stick, then is easily poured out of the inside of the concrete work. This is the only method of molding concrete work that permits a concrete article to be molded in one piece, with an opening many times smaller than the body of core, as by this method the opening to jug may be even 1 ½" in diameter and the diameter of the main body of core ten or fifteen inches and yet be easily removed; in such work the core is held upright by a round piece of wood placed at the neck and to extend up into the core, so to support it; this piece of wood must not be larger than the neck to the jug or vase, and thus is easily withdrawn first and the main body of core removed by breaking into pieces and pouring out. For practical purposes the method of molding such articles in two sections and then joining with cement cannot be recommended, for while it is strong enough if not subjected to usage, yet for practical use it cannot compare with the strength of a monolithic piece of work.

The method of making the rough form of core is shown at (b); this is simply a sheet of tin bent into a circular form and held in place by strings; the sand mixture is packed inside same and then the strings and tin removed, while the sand is wet.

The cylinder thus molded is then modeled by hand into the shape of core; using a sharp knife and a flat, smooth stick. With the knife cut away the sand mixture, as shown at (c) into a rough form of the core and then smooth off all the roughness with the stick, until it is in the form you desire it. This is the most simple way, but requires care and some skill to make the core exactly symmetrical. To the unskilled worker this will be far easier if the sand is mixed one-half or three-quarters clay, as it will then be more plastic and the easier modeled; where the opening to jug or vase is not too small this works very well, as the increase in percentage of clay makes the core harder to break up and remove from the finished work.

The method of making a core for to mold the inside of a large lawn vase is shown at (d);

this is very simply done and requires that the sand mixture be piled up in the center of a modeling board, around an iron rod, that projects up above the mass of sand and clay, as shown by the dotted lines in drawing. A template is now cut from wood in the exact outline of one-half of the core to be modeled, a hole is bored through this at one end so it will go over the rod and thus swing on same as on a pivot; your sand mixture is now formed with hands or trowel into a rough form of the core and the template swung around on same to form it into the exact shape desired, any parts that are not high enough can be added, and all surplus sand mixture is cut away by the action of swinging the template around the core.

At (e) is shown the template in modeling the core for a vase or jug; this is far easier for the beginner to master than the modeling of core by hand and knife; the template is in exact outline of the shape you wish; hence the core cannot but be modeled in the same shape; symmetrical and without the requisite of any skill upon the part of the operator.

When the template is employed, it will be found to work much easier if the sand mixture is in the usual proportion of one-quarter clay to three-quarters of sand; with this the template will work easier and cut away the surplus without breaking out pieces of the material, as would happen with a larger percentage of clay in your core mixture. In many pieces of work where the neck of core is not too small, sand alone can be employed, when made very wet, as the material for core.

CHAPTER VIII

Combining Molds to Mold Large Work Monolithic

With sand molds, as with any other method of using molds to cast concrete work, there are two ways possible to perfect large work; the most simple is to mold the different units separately and then lay up with concrete mortar to make the completed design. Where it is desired to have the finished work in one solid mass or monolithic the manner of combining the sand molds, as shown in Fig. 6, will permit the concrete for the work to all be placed at the one operation, thus allowing any reinforcement you may wish, to be placed within the mold and imbedded into the concrete.

This is of value in the case of any shaft or column, as the mortar joints between different sections or units is certain to detract from the neat and finished appearance of the work, as

well as to lessen the strength of the shaft, for under the average conditions and method of making these joints, with the different units fully cured, each particle of the aggregate is covered with a coating of cement, thus preventing a perfect bonding of the two sections; this can be remedied by the use of muriatic acid and water to eat away this coating of cement and expose the surface of the aggregate, but as few masons employ it the monolithic method of molding such work is by far the best.

The monument shown at Fig. 6 can be molded in sand molds, for which the patterns are simple articles and very easily prepared. The first section, at bottom, as shown by dotted line this may be made in two sections, is made from a clay model pattern; this can be modeled with a template to form the ball perfectly, and the sand mold made from this model; the pattern for each section must be placed so to center exactly in the center of each flask, so that the next section of mold will come exactly over the one beneath it; a point very essential to the molding of perfect work.

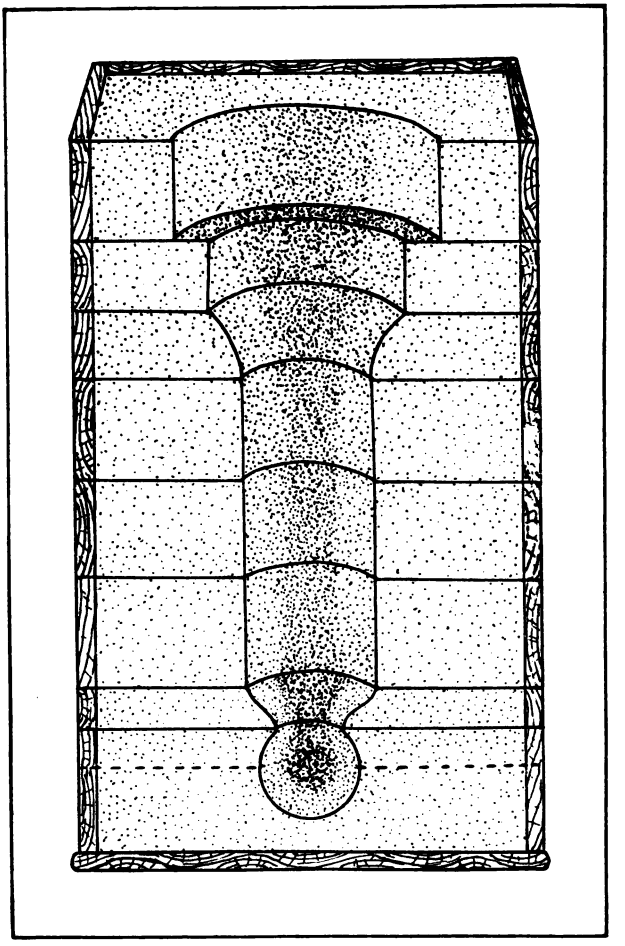

FIG. 6.—Combining Sand Molds to Mold a Monument.

The support to ball can also be made from a clay model, which is easily formed with a template in the circular form demanded and forms the second section of mold, so to make the making and assembling of the whole mold the more simple.

The next three sections, as shown in Fig. 6, compose the shaft to the monument; the pattern for these is simply a cylinder of wood or tin, that is of the size you wish and extends through the entire mold, as is the case with all but the first or bottom section of the mold.

The sixth section of mold can be easily made from a clay model formed with template; this should at the upper part be the exact size of the unit above same, while the lower end is the size of the shaft, and this reduction in circumference can be arranged in the manner shown in Fig. 6 or by a series of ornamental moulding faces as you may desire. The explanations made are for the monument in the position shown in Fig. 6, or upside down; so to permit the concrete to be the easier placed and also to bring the smallest openings in the mold at the

bottom of the whole mold; otherwise the weight of the sand would cause the mold to collapse, while in the position shown, the sand in lower sections is a support to that in the upper sections, with no possible danger of the mold falling down.

The seventh section is simply a cylinder that is the same size as the top opening in the sixth section; this can be made of tin or wood bent around to the size desired and that employed as a pattern. The sides of an old cheese box make an excellent pattern for large cylinder molds; the box is taken apart and the wood immersed in water until it can be bent into the shape desired, easily, then a small strip of wood is cut exactly the height of the cylinder, the same as the part of cheese box is cut the exact height and also the circumference so that when the two ends come together, without lapping, it is the exact size desired. These two ends are then nailed to the wood strip, making a butt joint, which leaves the surface of the cylinder perfectly smooth and without the joint showing in the mold, when neatly joined. The

cylinder is braced by cutting boards the exact diameter of same and then placing these across, inside same, and truing up until it is perfectly symmetrical.

The eighth or top section is made from a cylinder as a pattern, the same as the one beneath it, with the exception of being larger so as to give this part of the work the projection over the other units you may desire.

The concrete is thus easily placed and when it is desired to remove the work from the mold; this should not be done before it is thoroughly cured or the concrete has taken its permanent set and is strong enough to stand handling and the strain consequent to the reversing of the entire work, the three upper sections are removed and as the removal of these will release the sand mixture, it can be taken away from the work and braces set against the concrete to use in lowering it carefully to the ground; if desired one or two more sections of mold can be removed as well, as the braces will hold the work from falling with the support of the sand in the lower sections of mold.

The work, as well as the molds or lower sections are now lowered or turned over, until the work rests on its side upon the ground, then the remaining sections of mold can be easily and quickly removed, and the work set upright in the position it is to occupy.

If ordinary care is used there is no danger of breakage, for the sand from the molds makes a cushion or soft resting place for the work, so even if it should fall there is every chance that striking and imbedding into the sand would break the force of the fall without injury to the concrete.

CHAPTER IX

Methods of Combining Molds to Cast Large Monolithic Concrete Work

The use of a number of sand molds combined to mold the concrete cast in one piece, is invaluable with many classes of work, as will be easily noted by referring to the drawing of the lawn vase mold shown in Fig. 7; with work of this class it is essential that they be molded monolithic, as when molded in sections it is a very difficult matter to join these several sections together, but what they may be injured by the wind displacing same, unless laid up with mortar and that is not as strong as a monolithic piece of work.

The illustration of the lawn vase or urn in Fig. 7, shows a one-half section of the sand molds combined to produce the design complete and ready for use. The first section, from the bottom, or the rim to the vase is easily

made from a clay model pattern; this can be formed with a template and the model for rim is made solid, as the core to form the inside of bowl is made separately, hence the models for the outside of urn or vase do not have to be cut out in center to allow for core.

The second section is also made from a clay model, which you can fashion with a wood template; as will be noted the size of the different flasks varies in height; this must be done so as to bring the parting of the different flasks at the point that permits the easy removal of the pattern or model from the sand mold; if this was not done you would have difficulty in removing your patterns from the mold and with the case of clay models would have to spoil the model to remove; with the idea of making the parting at the points where the pattern is easily removed, you can use the same clay model for any number of molds

The third section or bowl of the urn can be made from a clay model, or you can use as a pattern an ordinary butter-bowl or chopping bowl of the right size and contour; this section

of mold has a parting at the point where the outside edge of stem joins upon the bottom of bowl; hence in using a wood bowl as a pattern it must have a flat surface at the bottom equal to the diameter of the stem, or must project beyond the surface of flask enough so that the next section, containing sand mold of stem, will set down closely to the bowl, so the stem joins with same entirely around the circumference of stem.

The fourth and fifth sections of mold can be made with the same pattern, by simply reversing same, as the half round moulding placed in the center of stem is directly in the line of parting of the two sections, so is molded half in one section and half in the other. This permits the easy removal of pattern from the sand mold and saves making an extra pattern.

The sixth section is easily made from a clay model, in the form illustrated or in any other form you wish for same, and the shape permits its easy removal from mold.

The seventh and eighth sections are molded from patterns made from pieces of tin, a part

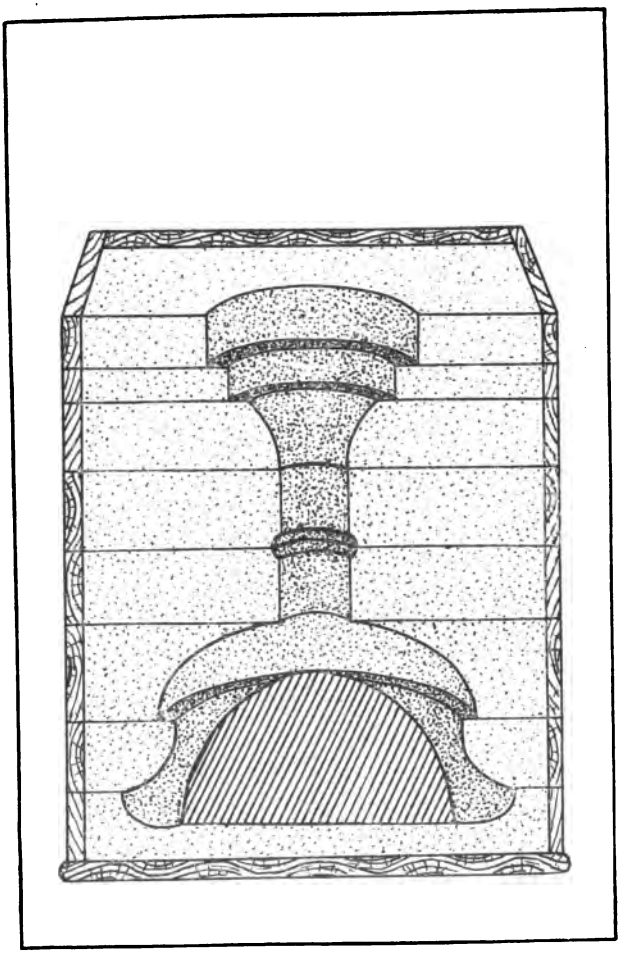

FIG. 7.—Sand Molds Combined to Mold a Large Lawn Vase.

of a cheese box or round blocks of wood. These two sections can be made as one, if desired, as the two patterns can be combined and by drawing or lifting upon the largest section of pattern it is easily removed from the mold.

This mold may be placed either way, in the position shown, or with the bowl of vase uppermost; the only advantage is that by having the bowl downward the concrete is the easier placed. The core to mold the inside of the bowl can be made of any material, sand, plaster, clay, or concrete, as it is a simple form easily modeled with the aid of a wood template. It should be modeled upon a circular board, exactly the size of the core, so that it can be handled and placed without breaking apart; as soon as first section of mold is in position, the core is set within same, using care to have it properly spaced so to be exactly in the center, the other sections of mold are placed around same. When the work is molded in the opposite position to that illustrated, the core must be dispensed with and the space inside bowl modeled with a template or trowel; which is

more labor, hence the plan of molding vase upside down as illustrated.

The centering of your patterns may be accomplished by using a cover board that is absolutely square, in the center of same bore a ¼" hole, if the pattern is circular—if a square pattern bore two of these holes, into same place iron rods which go through ¼" holes in the pattern, and so hold the pattern exactly in the center of the cover board or modeling board. The placing of flask can be guided by placing upon this board and then by measurements securing the exact point it must rest, to have the space between pattern and flask equal at every side; small blocks of wood may then be nailed to the cover board, on the outside of flask, as guides so that the flask, or any other flask of the same size, will set exactly in the same place. By using this cover board for all sections you thus mold the various sections of pattern in the sand, so that they go together exactly, as perfect as if pattern was in one piece.

The work to which this method of combin-

ing molds may be applied is unlimited, as it lends itself to every style of large work, no matter what the size, with perfect and exact results, thus enabling the worker to produce monolithic pieces of work that heretofore he judged could only be produced in separate units and then built up.

The molding of a column with base and capital attached is easily accomplished; this may be done either by having the pattern in sections, as shown for the lawn vase, and then combining the sections to make the entire mold, or dividing the column into halves as well as base and capital, which can be attached to the two sections of column. For the latter way a flask is built that is about 6″ wider than the greatest diameter of the pattern and as much longer than the greatest length of the complete pattern; then the mold is made in the usual manner by laying pattern in bottom of flask and filling in with sand, reversing the mold, making the parting and then placing the other half of pattern upon the first half with the cope of flask around same and finishing the mold; the gate

or inlet is provided at one end and the concrete poured from that end. This enables a complete column to be molded, from the use of any of the wood columns, divided in halves, and employed as a pattern, or the metal division plates cut in outline of pattern may be employed when it is desired not to divide the column.

In building up the sand molds in sections for a round column the base may be a clay model, made with template, as well as the shaft and capital and the sections set upon each other to make a perfect and complete mold. With the square column the pattern can easily be built of wood forms ornamented with the usual mouldings cut with miter joints, so to fit perfectly around the surface of pattern; the sections must be so arranged as to permit the easy removal of pattern from the sand mold without disturbing the sand mixture.

The sand mold has the advantage that it can mold any article with as much ornamentation or under-cutting as any mold, and even far more than the average metal or plaster molds

permit; for the sand mold is easily taken apart or broken into small particles to release the work—this is something not possible with any other style of mold; hence the only limit to the shape or degree of ornamentation to work cast in a sand mold, is the removal of the pattern from the mold, and in the case of a clay model this can be removed in pieces, if only one cast is desired, hence the sand mold easily and successfully accomplishes what is impossible with any other system of molding ornamental concrete, known to the concrete worker to-day.

CHAPTER X

Making Rock Effects with Sand Molds

The ornamenting of concrete work with rock face effects is desirable for many purposes and is easily accomplished with sand molds in two different ways; the method shown at (a) in Fig. 8, employs a face plate made from the sand mixture in the same manner as the impression is taken from a pattern, and gives a sand mold that can be employed for many purposes.

The cover board is placed under the flask and this is covered with spalls or pieces of broken stone; these must be laid with care, tightly together, so to form the outline of broken rock that you wish to imitate and then by placing the sand mixture upon this and tamping down, you make a mold that will cast an exact fac-simile of the face of the broken stone, laid in the bottom of flask.

Another way in which this can be employed, as for instance if you wish to ornament one or four sides of a die, or the center piece to a pilaster, column or any square piece of concrete work, with a rock face effect, you can prepare the four boards that make the square pattern and have them so that the boards on two sides overlap those on the other two sides, as shown at (a) in Fig. 9; these are held together when making mold with screws and when removing the pattern from sand mold, the two inside pieces of pattern draw toward the center of pattern, when screws are removed, thus causing the pattern to collapse so to easily free it from the mold.

Each of these sides is laid flat on the work bench and the face thickly coated with glue; while this is sticky small pieces of broken rock are pressed into the glue coating and thus are cemented to the board, making the pattern for any rock effect you may desire.

This may also be done by using small blocks of stone, that have been dressed to the size desired, and laid up in the center of flask with a

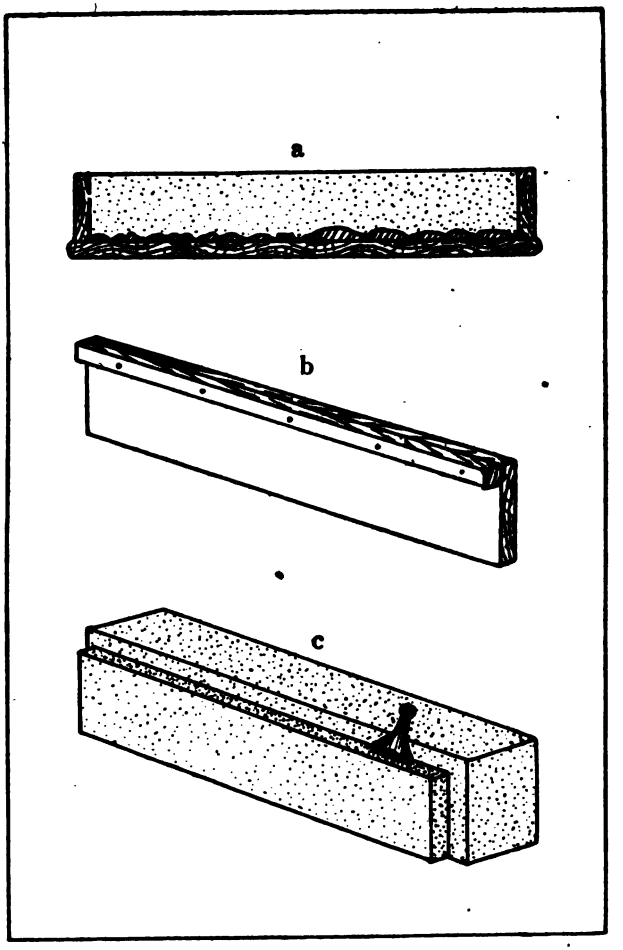

FIG. 8.—Producing Rock Face Effects with Sand Molds.

hollow in the center, so that to remove the pattern you have only to draw the pieces of stone towards the center and thus the parting of the stone from the sand is horizontal and will not disturb the impression of the rock face made in the sand of mold.

In this way any design you may wish can be built up so to produce a broken rock effect, rubble or ashlar surface, and by combining the sand molds, mold the entire piece of work in this manner. Where it is desired to have the entire column in imitation of masonry, with no two stones exactly alike, the pattern can be laid up in rock in the usual manner and then the flasks quartered, with outline division plates between each quarter section of flask; the first section is placed around the column, the sand placed in same and a parting arranged and the next section placed upon that; in this manner the entire sections of the combined mold can be made with a parting between every one. If you have used nails to hold the sand inside your quarters of flask and tamped the sand down tightly, you can begin at the top section and

draw out one-quarter of the flask, horizontally, sliding it upon a cover board and in this manner remove all the quarters of the different sections of mold. If you have numbered these as you removed them, you can erect again in the same way they were taken down, thus giving you a complete sand mold for the entire column, ready for the pouring of concrete. When care is taken this mold can be made to cast several columns, if there is no deep under-cutting to destroy the face of the molding surface.

At (b) Fig. 8 is shown the method of producing rock face effects of which no two are alike, and for its simplicity is to be recommended to the unskilled worker as well as to those who wish to produce the work as rapidly as possible, and do not care for an absolutely perfect surface.

The mold is provided, on the inside, with small strips of wood nailed to the inside or molding surface of the mold, if a wood mold is employed; if an entire sand mold is used these strips are reproduced in the sand mold by having the pattern with a channel or groove in

same at the point the strip is to be, which molds the projection on the inside or molding surface of the sand mold. This produces on the finished work the effect of pitched-faced masonry and as well supplies a guide to the use of chisel in finishing the work.

The work is thus molded with a projecting panel as is shown at (c) Fig. 8, and the rock face effect is secured by using a pitching chisel or tool with a face or edge that has a width of 2″ or 2½″; this is held at an angle of from 60 to 70 degrees, where it is desired to have the rock effect project or extend out beyond the plane of the work; the head of tool is then struck a light blow with mallet, just enough to break off a portion of the projecting panel. Where it is desired to have the face of work nearly even with the edges or true plane, the tool should be held directly upright and where the surface is to recede into the body of the work the tool should be held outward from same at an angle of from 90 to 95 degrees, thus breaking off the concrete to form a concave surface. Care must be used in this, as the tool

if not properly held is apt to break off too much of the body of block, and it is best to break off in as small pieces as possible thus lessening the danger of spoiling the work.

This simple method will enable the worker to secure any ornamental rock faced effect he may wish, with each one entirely different; for block work this method is excellent as it permits the rapid finishing of the work and when they are laid in the wall the effect is all that can be desired. The surface of the broken concrete can be greatly improved by coating with neat cement and water; the cement alone is mixed with water to the consistency of cream and is then applied to the surface with a brush, filling all the pores in the concrete and giving the blocks a more satisfactory and durable finish.

CHAPTER XI

Ornamental Work from Simple Patterns

With sand molds the concrete worker has at his command a wide range of objects available as patterns, the most simple of every-day objects when properly used will aid in making a mold that will produce excellent ornamental effects, and by combining a number of these molds together the design you wish to perfect can be accomplished in so easy a manner that it would not be deemed possible until you have made a trial of it.

The illustration at (a), Fig. 9, shows the manner of making the pattern collapsible, so that it may be withdrawn from the sand mold horizontally, thus permitting a greater amount of ornamentation to be placed upon a circular or square form and yet allow it to be removed from the mold without injury to the impression of the pattern in the sand. This method is use-

ful in many classes of work where it is not possible or convenient to use the flask divided into quarters, and will draw with greater ease than from a flask so divided.

The form is made of boards, enough smaller than the completed pattern to permit of the design to be fastened to the sides of same; two sides are cut long enough to lap over the other side boards, to which are fastened cleats at each end; these cleats are fastened securely to the two inside boards and attached, when making mold, to the outside boards with screws; this permits these screws to be removed, when ready to draw the pattern, and the two inside boards to be drawn toward center of pattern and taken out, thus freeing the two longer side boards in the same manner, without injury to the sand mold.

At (b) is shown a panel which illustrates the possibility of a simple piece of rope as a pattern; the rope is nailed to a cover board or molding board in the design you wish to reproduce, and then well covered with shellac so to make a smooth surface but not to ob-

literate the texture and strands of the rope; the flask is now placed and in the bottom of same dry sand is sifted until the rope is about one-half covered, as this would be all you would wish to appear on the panel, the sand mixture is placed upon this, completing the mold.

The design of pedestal shown at (c) Fig. 9, is made from a pattern that is simply a log or block of wood, with the bark upon same; the bark is smoothed as much as possible and all divisions or cracks between the pieces of bark made as deep as you wish, so to make the detail more perfect; the log is now cut into halves and the outside surface treated to a coating of shellac or varnish, so to give a smooth molding surface.

One-half of pattern is now placed upon the molding board and the flask placed around same and the sand mold made in the usual manner; the second section of flask and also of pattern is placed and the parting made between sections of flask; the balance of mold is completed in the usual manner which allows for pouring the concrete from one end.

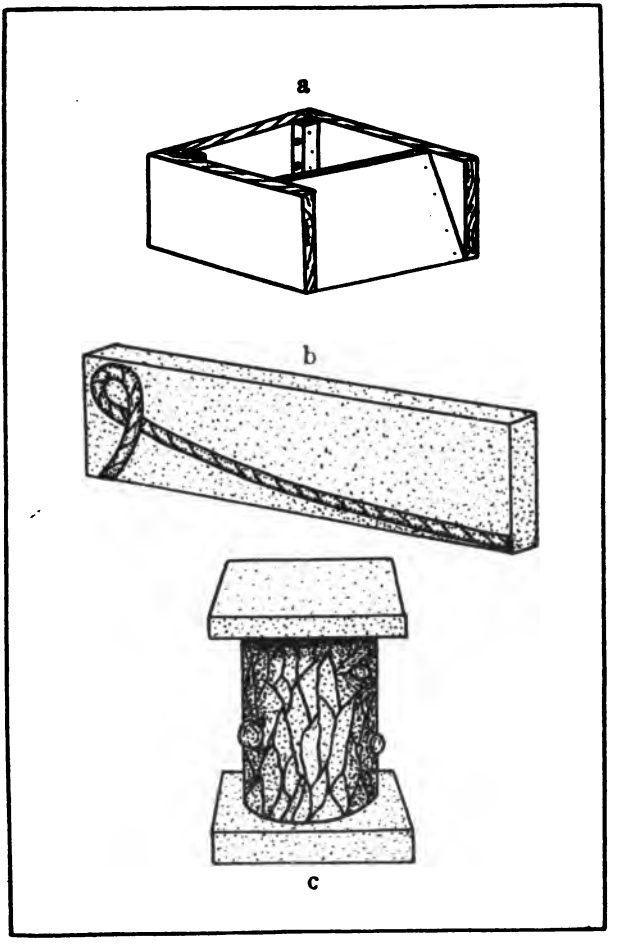

FIG. 9.—Collapsible Core and Simple Patterns for Sand Molds.

Two square slabs of the proper size are now molded as a base and cap to the pedestal or if desired these may be cast with the die, by attaching a square block as a pattern to each end of the halves of log and making the mold in the usual way, thus making the entire pedestal monolithic.

This design makes an attractive jardinière by having the log of the exact height the jardinière is to be made and then treating in the same way as for pedestal, making the sand mold of the two halves of log. When ready to mold the work in concrete, place a core at one end of sand mold, to form the bowl or opening in the jardinière as was explained for the molding of lawn vase. This makes a very excellent piece of work that is always sure to attract attention. The same idea is as useful as a pattern for a concrete grave-marker or small monument, with a plate attached for placing the inscription upon, also for a column for a pergola or arbor.

Many useful patterns can be made by using the ordinary stock mouldings secured at any

lumber yard; these can be cut and joined over a form so to make a pattern that will enable you to perfect a number of ornamental designs, such as the base or capital to the square column or pedestal.

The ordinary wood brackets, which can be secured at your local lumber dealer's, make excellent patterns for many kinds of ornamental designs; these can be cut so to use the part you wish and the sand mold is easily made from same, in the manner explained for other work. Large and small wood or metal rosettes can be employed in making a pleasing design, by attaching to any part of the pattern where you wish them to be reproduced. The common wood or metal buttons can be well used to work out a pleasing ornamental design, by attaching to the pattern along the lines of the design you desire. A common wood butter-bowl or chopping bowl makes an excellent pattern for the rounded part to an urn or vase of large size, and when combined with a good design for rim the result is highly satisfactory.

The many designs of metal ceilings and or-

namental work stamped in metal are also useful as patterns; by the use of ceiling and cornice metal, cut into the size you desire, you can produce a number of ornamental effects, as they may be combined to perfect the design you wish and with their smooth surface make a most excellent pattern.

The use of the plaster of Paris figures or statuary opens to the beginner an unlimited field for producing the crowning figures for fountains and many other classes of work. The cast is easily reproduced from these figures in the following manner: the plaster is first covered with shellac to prevent the moisture in the sand mixture from injuring same, it is then imbedded into dry sand placed within one section of flask; the dry sand should come up to about one-half the thickness of figure, which is so placed that it will draw from the sand mold easily, thus where there is an extending arm this must come at the point of parting, as well as any other projection that would cause trouble in removing the plaster pattern from the sand mold. The dry sand is simply to make a solid

support for the figure while one-half of the mold is made, as well as to aid in making the parting at the point you wish same, the flask is placed around the figure, and the one-half of sand mold made in the usual manner and turned over; the parting is provided by the use of graphite and the second section of flask placed and the mold finished. The gates or inlets must be carefully arranged, so that when the sand mold stands in the position you wish in pouring concrete, the inlet will place the concrete at the highest point of the figure; this will require that you have several inlets, with any pattern that has a projecting member at right angles to the main body of figure. The only care required is in the making of mold and releasing the pattern from same; in many cases the pattern can be divided so to more easily draw from mold; the work is easily freed from mold by breaking up the sand mixture as previously explained. This permits any statuary with many deep under-cuttings to be successfully molded in concrete by even a beginner at the work.

Concrete From Sand Molds

The value of strawboard or pulpboard as a pattern material is unknown to almost every concrete worker; this is a material that is easily fashioned in the shape you wish, and fully retains its shape until the mold is made. The design is first drawn or transferred to the flat sheet of heavy strawboard, and is then cut out from same; this can be done with a sharp knife by laying the sheet upon any hard surface and cutting along the lines of design; enough duplicates of design are cut so to give the pattern the desired projection you wish; these are glued together exactly, and then glued to a flat sheet of the strawboard so the different parts of design will remain in position while the mold is made; this gives you the completed design projecting from a flat sheet of the board. The whole pattern is now coated with shellac or varnish, to prevent it from being damaged by the moisture, and the pattern is laid upon cover board and the sand mold made.

By this method the beginner can reproduce any large drawing with bold lines, in bas-relief upon the work he is molding, as the drawing is

easily transferred to the strawboard by the use of a sheet of carbon paper and it is then a simple matter to cut out and glue the duplicates together to get the projection wanted. In this way inscriptions, figures, and ornaments in bas-relief, that would not be possible for the unskilled worker to model in clay, can be reproduced in concrete, in perfect outline, in the easiest manner conceivable.

CHAPTER XII

A Simple Lathe for Turning Sand Molds, Patterns, and Cores

In producing a number of sand molds of the same design of such simple outline as to permit their being fashioned by the aid of a template, the use of a lathe will make the work far more rapid as well as less laborious, and in a plant producing concrete work from sand molds on a commercial scale will be found invaluable, as the mold is turned in a moment's time; even quicker than the pattern can be placed in the usual manner of making mold.

The lathe illustrated is very simply made and while it will do the work successfully, can doubtless be improved upon, where such a tool is in every-day use and must be built more durable. The framework is built of 2x4″ pieces to which is attached the treadle and wheel, to furnish the drive to the shaft by the means of a belt and pulley, as shown in Fig. 10, in which

space forbids the illustration of more than the upper portion of the machine.

The bed of the lathe is made of a 2x10" plank and at the end the pulley is attached, a standard is erected perpendicularly, that is 24" in height; this can be made from a plank with a slot or bearing for the shaft to turn in and is placed high enough from the bed of lathe to permit the average size of flask to be manipulated beneath same. The second standard is placed about four feet from the one at the drive end of lathe as this will permit the average size of work to be turned between same.

The second standard is placed about two feet from the end of machine so that a template may be attached to the end of shaft for cutting out many styles of molds, as shown in drawing.

The template between standards is bolted to the shaft by clips, as illustrated, and the edges of template has a cutting edge of metal which is bolted to the wood part of template on opposite sides, so that the sand cut from the mold will be thrown away from the worker operating the lathe.

Guide boards should be erected upon the bed of the lathe so to permit the placing of the flask in the exact position you wish same, as well as a guide to holding it in that position. With heavy molds this will be difficult, so a separate table should be made to go upon the bed of lathe; this is made the size of the largest molds to be turned so that it will support them perfectly; to raise and lower this table evenly, two screws as used for wood vises can be placed underneath same so that the simple turning of the handle or wheel to screw will raise the table exactly and with ease. The template is adjusted to the shaft, in the manner shown for the template of urn in illustration, and the flask filled with sand placed upon the table; the shaft is now revolved at high speed and the table and flask raised with the screws gradually, so the lowest cutting edge of template just strikes the sand, cutting it out in the shape of template and throwing it away from operator; as fast as the mold is cut the table can be raised until the one-half of design is complete or the flask touches the shaft. In making the template it

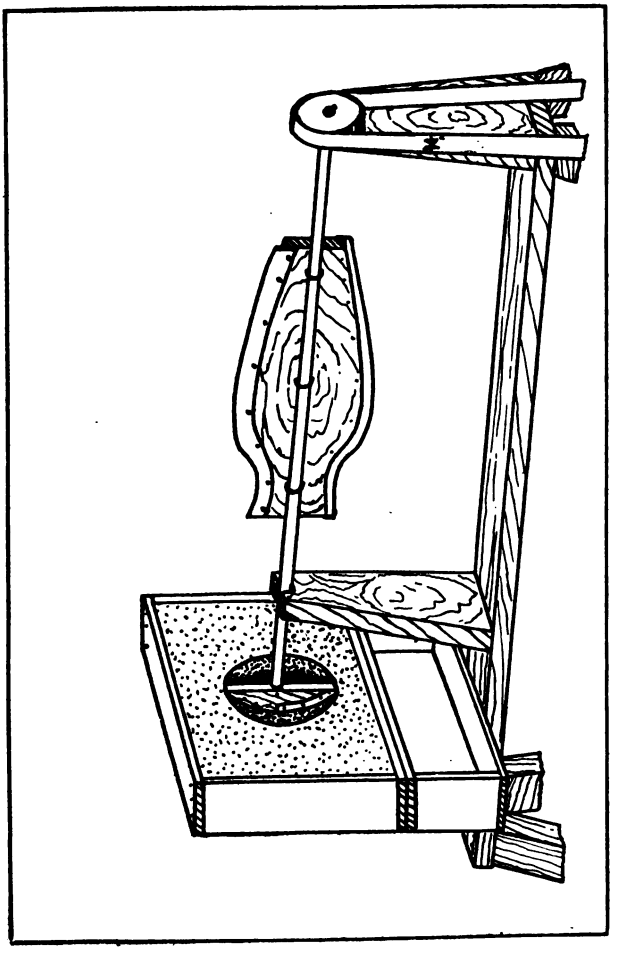

FIG. 10.—Lathe for Turning Sand Molds, Patterns, and Cores.

must be planned so that the width of template is one-half the diameter of the shaft, beyond the exact outline of design; as the flask cannot be raised beyond the shaft and if the template is made the exact size the mold will be one-half the diameter of shaft smaller than desired.

By having your guides so that the flasks filled with sand can be placed in the same position each time, two halves of the mold can be turned or cut, so that when put together to mold the work, they will meet exactly and thus make the mold perfect. In turned work it is advisable to cut the gates or inlets to double molds by hand, as they can be very easily placed in that way at the point desired and any sharp cutting tool will fashion same in the sand. For making molds for vases, jardinières, jugs, flower pots, capitals and bases, sections of columns, pedestals, balusters, or any circular work, as well as many other purposes, this method of making molds is invaluable, where rapid and accurate work is desired, as would be required in the practical use of sand molds in a large plant producing work for commercial

purposes on a large scale. The mold is made far quicker than by any other method and as the curing of the work is completed by the wet sand, without the least attention, the sand mold process is one that has a great advantage over molds made of any other material.

The template placed at the end of shaft is of the greatest use in turning the many designs, that could not be very well done from the center of shaft. The template can be attached to shaft by a clip to set over the shaft, which has been squared at that point to receive same and thus prevent the template from turning on shaft under the pressure of working.

The flask is placed upon its side and blocked up, as illustrated, so the template will strike the sand exactly in the center, the flask is then moved toward the template as fast as the sand is cut away, until the design is turned. For pateras, rosettes, center-pieces and even bases and capitals, as well as many other styles of work, this will be found of great value. The table feature for raising the flask as well as sliding it toward the template can be employed

with this as well; the table is placed upon the bed of lathe, on a track so to easily slide, then the screw is attached to the table and through the standard, supporting shaft at this end; the operator can then work the treadle of the lathe and at the same time draw the table and flask up against the template, thus avoiding the services of a helper for this purpose.

The material for molds to be turned in this manner can be the ordinary sand mixture or they may be made simply of wet sand, where the molds are to be filled soon after they are made, before the sand has a chance to dry out; with molds of simple and bold design the sand alone has an advantage in the fact, that is can be easily turned and in releasing the work from mold breaks up into particles with ease, the moment the flask is taken from around same. The flasks or blanks are made by tamping the sand into them solidly; this may be done by any tamping machinery, thus making the cost of preparing the blanks very slight, as well as increasing the output of your plant.

In making a number of cores or patterns

from any material that will stick together tightly, this lathe will be of value; the blank for core is molded in the circular form, equal to the greatest diameter of core, in plaster of Paris or sand and some adhesive liquid; in the center of same a short section of pipe is molded, the exact length of the core; this is of a size to permit it to just slip over the shaft where it is held solid by placing a pin through the section of pipe and down through a hole drilled in shaft for the purpose. The template or cutting tool is now placed on a rest, as with a wood or metal worker's lathe, and the core blank revolved with the shaft; it is then possible to turn the core to any shape you wish.

The core compound must be judged so that it is just strong enough to bear handling and turning and yet when used inside a vase or jug it can be broken up and removed without injury to the concrete work.

CHAPTER XIII

Molding "Cast Stone" Concrete Blocks for Hollow Wall. A New Block and Wall

The sand mold process is invaluable in the manufacture of concrete blocks, for the reason that a large number of molds may be provided at slight expense of time and money and these molds filled with a wet mixture of concrete, thus producing a "cast stone" block that has a far greater density and consequently a less percentage of absorption than the block made with a semi-moist mixture of concrete and tamped in the ordinary way by hand. While it cannot equal in density the block made under an enormous pressure, yet the machine for the production of such blocks are costly and far slower in operation than the simple filling of the molds with the concrete, hence the wet mix block mold is to the ordinary contractor the best process, from the fact of the low cost

of molds and operation and the excellent quality of the work. The sand mold produces a cast stone, with all or more than the strength of nature's product and with the added advantage that you absolutely control the size, shape, and surface of same.

The style of wall shown at (e) Fig. 11 is in many ways entirely different from the walls made of two-piece blocks, laid into the wall to make a continuous dead air space entirely around the building. There are at present a number of blocks made in L shape or similar to that form, with square faced projections toward the center of wall; such projections are in danger of being broken off with the handling of the block, unless care is used from the moment it is molded until placed in wall; but by having this projection in a wedge-shaped form, as shown by the illustration at (e) Fig. 11, the greatest strength to the projection is placed at the point where it joins with the block; this is where it is most needed, to prevent injury to same in the necessary handling it must undergo before being used. This added strength to block is

transferred to the wall from the simple fact that it provides a larger bearing surface to each section or block, at the very point most needed, hence cannot but give a wall of greater strength and stability.

The projection in center of the block makes it very easy to handle, as when picked up by the mason it is practically evenly balanced and when a large block of this design is to be moved by a derrick it simplifies the placing of the sling or chains, to have the block move without slipping from the chains. The joints are easily broken, in laying up the wall, as will be noted by referring to the detail at (e) which shows one course of blocks laid in position. The projection can be placed so that from the end or point of same there is one-half or one inch space between that and the block in the opposite wall; this makes a continuous air chamber entirely around the building and can be sealed up by placing a slab of concrete as the finishing course, or using solid blocks for that purpose thus making a wall that is non-conductive to either heat or cold.

The method of molding this style of block is shown at (d) Fig. 11, two planks are prepared that are the length of the string of blocks you wish to mold, as the height of the block extends along the length of these side planks, a 12′ plank will make molds for fourteen 8″ blocks, if the cross pieces are made from 1″ lumber. The side planks are marked at the point the height of blocks will extend along their length, with allowance for the width of cross pieces, and a slot cut into each plank, one-half its thickness, for the cross pieces to set into. The cross pieces are now prepared; these are the same width as the width or thickness of blocks, from the point of projection to the outside edge of block; which is also the width of the outside planks. The length of the cross pieces is 8″ more than the length of the block to be molded, so that they can be cut one-half through their width at a point 4″ from each end, and thus allow them to set down into the slots cut in each of the side planks and to project 2″ beyond the side planks; where a hole is bored in each end of the cross pieces and

a pin or spike inserted to hold the wood forms securely together, without any danger of their spreading with the weight of concrete placed within them.

These forms are very quickly made and as easily taken apart and erected again, as the removal of the pins in each end of cross pieces releases the side forms and when inserted holds the forms rigidly in position.

A wood pattern is made the exact size and shape of the inside projection on block; this is provided with a handle and as the shape is slanting on the sides it can be drawn from the sand with ease. This wood pattern is set in the center of the mold, between the side planks, and the sand mixture placed upon each side of same and tamped down until the sand fills the space between side planks to the top edge of core; the core or pattern for projection is now lifted and placed in the next space and the operation repeated. This requires but an instant, if the sand is so placed that it can be easily reached by the operator, and a string of fourteen of these molds is but a few moments' work.

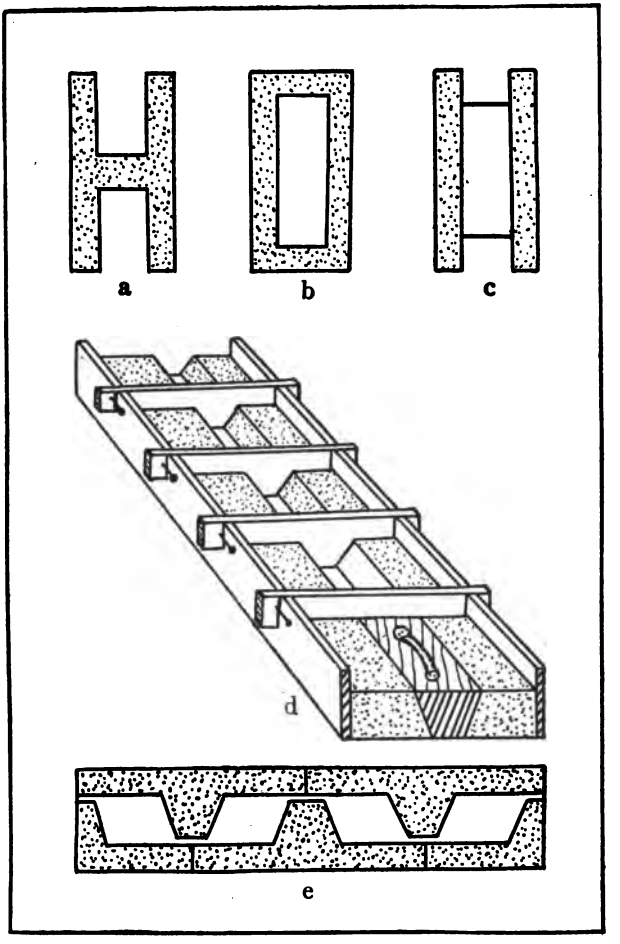

FIG. 11.—Four Styles of "Cast Stone" Blocks Easily Molded with Sand Molds.

If any trouble is experienced in placing this pattern exactly in the center of the space each time, a block can be nailed to the top of the pattern at each end; this should be about two inches high above pattern; upon this block a strip is nailed to exactly reach from one side plank to the other, on the inside; this makes it certain that the pattern will be placed exactly in the center of the space each time without any attention other than the operator dropping it into place.

The reader will note by referring to (d) Fig. 11, that the space for the projection is arranged in the sand, placed in the bottom of mold, that the space between top of sand and the top of mold provides the space for molding the thickness of each wall section of block, hence the concrete has only to be placed or poured into the mold and the top edge struck off with a straight-edge and finished with trowel. This permits any surface you wish to be added to the blocks, or you can mold the paneled projection shown in (b) and (c) Fig. 8 and then with pitching tool make rock faced blocks of

which no two are alike. By having a small metal roller with sharp projections around its circumference, as used for sidewalk work, you can produce an accurate imitation of tool dressed stone; by running the roller diagonally over the surface of block you can produce the effect of *broached* work and by going over the surface the second time with roller and placing the indentations between those first imprinted, the effect of *pointed* work is secured; by running the roller across the block in the direction of the height and placing the lines as close together as possible the effect of *patent-hammered* finish is secured; while with the lines or indentations at the distance apart they are on the roller and operated in the same direction, will secure an imitation of the *tooled* finish; the *crandalled* finish can be imitated by running the roller over the work once, in each direction, diagonally over the surface of the block. The imprinting into the surface of the green concrete, any article that has a series of sharp points upon its surface, such as the tool employed in the kitchen to make the steak more

tender, will give an imitation of *bush-hammered* work, by leaving the surface of the block full of points.

A very pleasing and simple manner of finishing blocks is to have the surface of the block very wet and then to cover it with a layer of dry sand of any attractive color, or crushed granite may be employed for this purpose, the concrete will bond with same, enough of this layer of sand or granite to make an attractive surface to the block, and with the advantage that the outside particles of the finishing course are not coated with cement, thus having all the sparkle and lustre of the natural stone with the advantage of being quickly applied.

At (a) is shown another style of block, that can be easily molded by this system. The two side boards are erected and have a width or height equal to the height of block, the space between same is equal to the length of block, thus the cross pieces, when used, are placed at a distance apart to equal the width or thickness of the complete block.

A form is made of boards to use as a pat-

tern that is the exact size and shape of the block, as illustrated at (a); this is placed between the cross pieces of plank form and the sand cores made by tamping in the sand between the two side pieces of the wood pattern; this makes two projecting sand cores to mold a concrete block in the form of a letter H, as illustrated. Where desired the cross pieces may be discarded, and the sand mixture tamped entirely around the pattern, thus making a complete sand mold except at the two ends; this requires more work in making mold with additional care in removing pattern, than the block shown at (d), but makes a block that is a complete section of wall.

The style of block shown at (b) is the same as has been in use for years; this is also molded upright or in the position it is to be used in wall; the two side planks are employed as for the block shown at (a) and the wood pattern made the size and shape of block; the sand is tamped into the center of same thus making a sand core inside the block. The cross pieces can also be dispensed with, between side planks,

if desired and the sand tamped entirely around the wood pattern, which forms an entire sand mold for the block, except at ends, and is ready for the concrete to be simply poured into the spaces molded in the sand.

The block shown at (c) Fig. 11, is simply two sections of wall connected with a metal tie imbedded into the concrete. This can be molded with the sand molds by having the side boards as for blocks (a) and (c), the wood pattern for block is merely two pieces of plank the size of the sections of wall; these are set upright and the sand packed between same, and if the cross pieces in wood forms are not used, around the wood pattern also; before drawing the pattern from sand, use a flat tool of the right width and thickness and force it down into the sand between the two pieces of wood pattern, then the pattern may be withdrawn and the metal ties dropped into these slots to project into the space for concrete, and so imbed into the concrete and bind the block together. If more convenient a small piece of board can be set into the sand and the sand

mixture tamped around same, to mold this slot for placing ties; these slots should be nearly in the center of the height of block at a point near each end of block, thus making an excellent handle for the mason to grasp in placing the block as well as tying same together; the concrete that enters the slot above wall tie can be easily broken off when removing the block from molds.

These blocks can be molded in a series of sand molds, so as to take the entire contents of mixer at one pouring, and as the sand is not baked it can be used many times for this work.

CHAPTER XIV

Molding Concrete Brick With Sand Molds

The sand mold process is adaptable to the molding of every style of cement or concrete brick, and is invaluable to the concrete worker where but a few of a certain size of brick are demanded at once; the pattern can be placed in the flask, the mold made and the brick cast, in but a fraction of the time required to construct the wood mold for same.

As applied to all concrete work cast in sand molds, the wet sand around the work enables each brick to be perfectly cured, without the usual trouble in sprinkling them several times to properly assist the final setting of the cement.

The sand mold process permits the molding of the plain style of brick shown at (a) in Fig. 12; the pattern can be made from a block of wood of the right size or from several boards nailed together; these are the easiest used when

a number of patterns are made and attached to the cover board with enough space between each one to permit a wall of sand between each brick, as shown at (d) Fig. 12, the cover board containing your series of patterns is placed upon the bottom of a flask and the sand mixture tamped upon same, in the usual manner, when removing patterns from the sand mold; simply reverse the mold and lift up the cover board, evenly, which draws the series of brick patterns from the sand mold.

The plain brick with one surface concave, as shown at (b) Fig. 12, is easily made from wood patterns, made in the same way as employed for the style at (a), in placing upon the cover board, nail the flat surface to the board, so the concave surface is uppermost and forms the pattern imprint in the sand; the mold is made and filled with the concrete, all in one section of flask as the top edge of bricks can be smoothed with a straight-edge, resting upon each side of flask and drawn across same, thus making the filling and finishing of the concrete in the mold a very rapid operation.

The pattern for hollow brick is shown at (e) Fig. 12; the pattern consists of four strips which are the length and width of the brick, with the thickness of the lumber equal to the thickness of the brick you wish to mold; these four pieces are joined at each corner with a halved joint, made by cutting into the end of each piece half-way at a distance from end equal to the width of the strips; the four pieces are then nailed together in a square form, in the way shown at (e), and a number of these patterns made and nailed at equal distances apart to the surface of a cover board; the sand mold is then made by tamping the sand mixture upon these patterns and then when the flask is reversed, the cover board may be lifted and with it the entire series of patterns nailed to same. Care must be used in lifting the patterns so as not to disturb the core in center; this is not difficult to accomplish if the patterns have been coated several times with shellac or varnish, before making mold. The concrete is placed as for plain brick and the top leveled with a straight-edge. This style of brick makes a most excel-

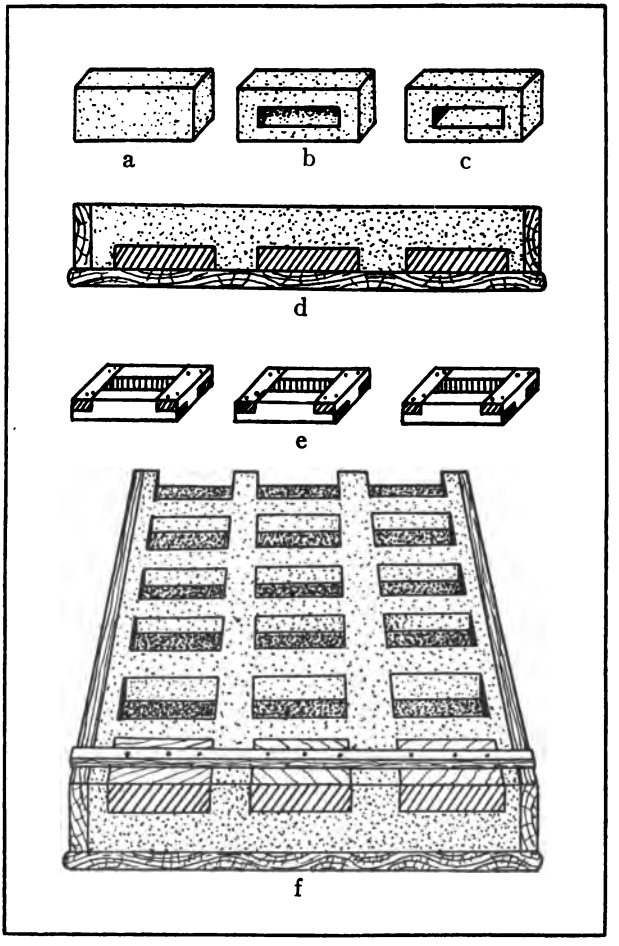

FIG. 12.—Molding Brick with Sand Molds.

lent wall as it gives a strong bond to the mortar, used in laying up the wall, which enters the hollow in center of brick, and can be made to bond or tie to that in the course below, by filling the hollow with mortar; this requires more mortar than the other style of brick but this is gained by the mortar or concrete saved in the construction of the brick.

The same idea for wood patterns, for the hollow brick, can also be applied in making the patterns for a chimney block mold as well as for small building blocks or large brick:

The ornamentation of the one face of brick with rock faced effects is easily secured by making your pattern ½" to ¾" wider than the brick is to be made, when finished, the pattern has a channel or groove cut into its face the depth of this extra projection as explained in Chapter X; this molds the brick with a projecing panel upon one side, which is broken off with the aid of a pitching tool or chisel. Another way is to place the brick pattern upon the cover board resting upon its side, thus bringing the face to be decorated with rock

effect uppermost; this is thickly coated with glue and into this spalls or small stone are imbedded to produce the effect you wish, the sand then makes a mold of these patterns to reproduce fac-similes in concrete. Where the end of brick is to have a rock face the pattern may be made ½" longer and this broken off with chisel, thus making the bearing surface of brick all the same size with the rock face projection beyond that, so that they will lay easier for the mason in the wall.

A series of patterns is shown at (f) Fig. 12; the patterns are connected to a strip of lumber to reach from one side of the large flask to the other, and these strips are held in position while making mold by resting in notches cut into the side boards of flask. The sand is tamped into mold until it is the thickness of the brick from the top and then the strips, with the patterns attached, are placed into the notches in the side boards to reach from one side of flask to the other; the sand mixture is then tamped around these patterns, thus completing the mold, when patterns are lifted. In this way a large number

of molds for brick can be made in a very short time as the flask containing molds does not have to be reversed and by having a number of molds together the entire contents of the mixer can be used in one set of molds.

This method of making the molds for concrete brick is practically as rapid as many concrete brick machines that require tamping a semi-moist mixture of concrete by hand, as the time spent in emptying the brick machine and carrying the brick away is nearly equal to the making of the sand molds, with the advantage in favor of the sand molds from the fact that the brick require no further attention in hardening or curing, and that the placing of a wet mixture of concrete is quicker and makes a stronger brick than the semi-moist concrete tamped into the hand machine.

CHAPTER XV

Facing Molds with White Sand, Crushed Granite, etc. Mixing and Placing Concrete in Sand Molds

The use of a very wet mixture of concrete permits the easy bonding of any facing mixture you may wish to use; this is placed in a different manner than for the usual style of molds. The white sand, crushed granite, marble dust, or flour, or any other facing mixture you may wish to employ, is sifted into the mold before pouring the concrete, the surface of mold being composed of wet sand the dry mixture will adhere to the surface sufficiently to hold a thin coating of it entirely over the surface of mold; the sections of flask are then placed together and the concrete poured into same.

With the sand mold made in one section of flask only, and employed as a face plate or to mold bas-relief designs the facing course may

be mixed with cement and water, if a thick coating is demanded, and plastered over the molding surface of sand mold and the balance of ordinary concrete added to same, thus insuring a perfect bond.

The dry facing mixture sifted into molds is usually ample, as it will cover the surface completely with a thin facing of the higher grade aggregate and as the wet concrete is placed behind same it bonds this dry material firmly into the work, with the added advantage that if handled with care the outside surface of the facing material will not be coated with cement, thus avoiding the labor of washing with an acid, to expose this surface, and giving the work a beautiful appearance, with all the brilliancy and effect of natural stone.

The mixing of the concrete for use in sand molds should be thoroughly done, as it is not practical to add additional moisture after the concrete is placed, which is not a practice to be recommended with any mold but often employed; if for oramental work, the sand should be well screened so as to remove all large pebbles,

and when mixed with the cement dry can be wet until it is a semi-liquid mass, or of a consistency to enable it to be poured from a pail into the gate or inlet to the mold; with small molds about one-half the concrete is poured and then if the opening permits a small stick is used to "puddle" or stir the concrete, forcing it into all the lines of design, but using care not to disturb the sand of mold.

Where the inlet is small, this cannot be done, hence the concrete must be made with more moisture so it will run to every part of the mold with freedom and thus fill same completely; as the sand mixture will in drying absorb all the moisture in the concrete, the material may be made very wet, just so it will carry the sand and cement easily; it is necessary in using a very wet mixture to pour a part of it at different times, as for instance with a small vase about one-quarter of the mold is filled and the concrete allowed to flow into the lines of mold, also for the sand to absorb a portion of the moisture in the concrete, thus causing it to settle or become more dense; within ten to

twenty minutes the second batch may be poured and allowed to remain for a short time as well as the third and fourth pourings. This is necessary only on such work that you desire to have a perfect surface, also with such molds as have many lines and deep under-cuttings in the molding surface, as the concrete must have time to fill these lines which cannot be done if the entire mold is filled at one pouring. By filling a number of molds at one time this will not be the least hindrance, as you can go from one to the other in turn until all are finished.

Where the work is in plain simple lines, as is usual with practically all the metal molds, the concrete may be poured all at one time or in two pourings at the most, also in large work where a number of sections are combined together to complete one design, the weight of the concrete placed at the top will press that which is below into all the lines and indentations of the design.

Where a very wet mixture must be employed the worker may be required to repair some imperfections in the surface of work, which may

be easily done with a trowel or even a putty knife and concrete mortar mixed to a paste consistency. Where the design is a face plate only, the concrete may be used in a paste form or semi-moist, as the worker can plaster it into all parts of the mold and thus insure a perfect cast.

The proportions of the concrete for use in sand molds need not differ from that employed for any other style of mold, except in the fact that for all ornamental work the use of clean sharp sand as an aggregate is required, all pebbles of over $\frac{3}{16}''$ should be screened from the gravel, as these would not permit the concrete to perfectly fill the fine lines of any intricate design. A mix of 1 : 3 or 1 : 3½ is usually most satisfactory for ornamental work, but this may be made slightly richer for a design with very deep under-cutting and leaner when employed in a design that has a greater body.

A valuable way of molding large work is to have a form made of tin that is at least 3″ smaller in diameter than the form or inside of mold, as in a column or any similar design this

tin form may be erected in the center of mold and the rich mixture of concrete poured around it; as soon as this is placed or even partly placed, a leaner mixture made with an aggregate of sand and broken stone, about ½" in diameter, can be placed inside the tin form and as fast as this is placed the tin form raised, thus bonding the two mixes of concrete together and effecting a saving in the cost of the work on such jobs as it can be employed.

The reinforcing of the work may be done by using almost any kind of the usual material for that purpose on the market, as well as plain iron rods, woven wire, or twisted wire.

The placing of any reinforcing material must be done before the concrete is poured, as for a column the iron rods are set upright in the mold so to be imbedded in the concrete at a point within 1½" of the surface; with woven wire it is formed into a cylinder and set into the form, thus allowing the concrete to be placed around same. The reinforcement to a vase or jug, that has a core inside a mold in two sections, can be placed by forming reinforcment to the size and

then placing over the core, which is inserted into the mold and the work molded, the reinforcement will not show on the inside if properly placed, as on three sides a wire can be used to extend in toward core, to hold the woven wire frame at the proper distance from the core so the only part to show on the inside is the end of this wire, which can be covered with concrete after work is finished.

In this manner all work can be reinforced, if you wish, as iron rods to be laid horizontally can be held in place at the distance of 1 ½″ from the face of work, by binding together with wire to keep them properly spaced apart, then from this wire at distances of 6″ to 8″ apart have a single wire extend downward to the face of mold to act as a leg or support to the reinforcement, thus placing it exact and with only the end of wire support to show on face, which can be covered up; this idea is a valuable one where any reinforcing material is to be placed in the center of the concrete work without showing upon either side.

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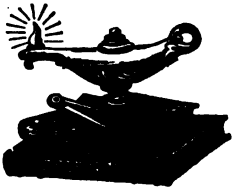

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