Oct. 7, 1930. W. W. LILLARD 1,777,926

MASONRY CONSTRUCTION

Filed Jan. 29, 1929

Fig. 1.

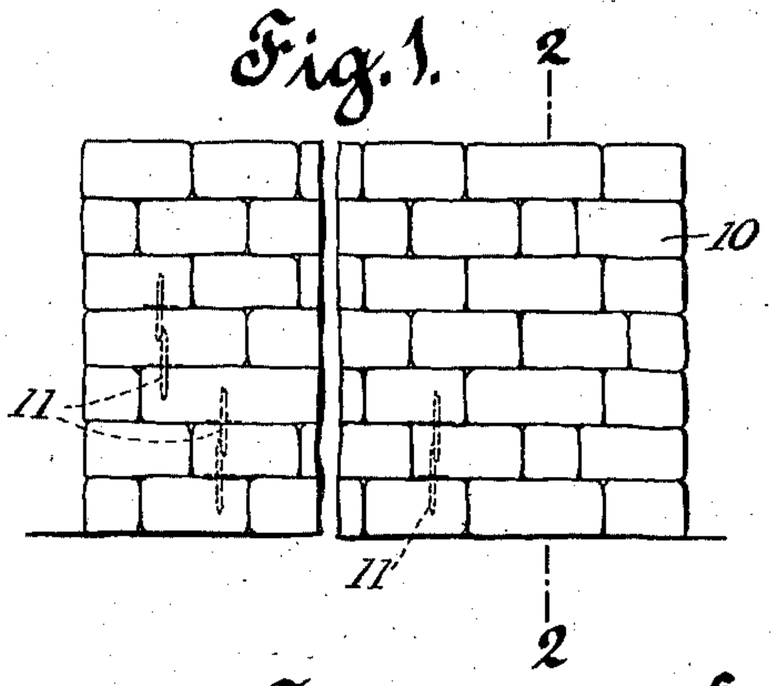


Fig. 2.

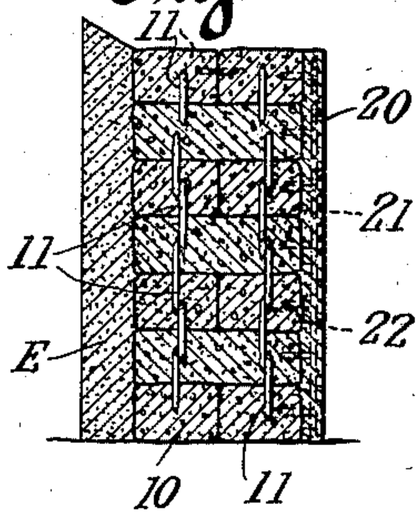


Fig. 3.

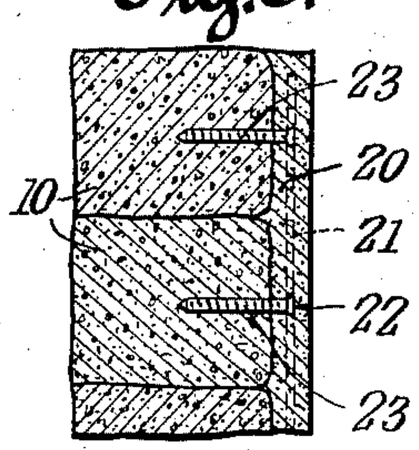


Fig. 4.

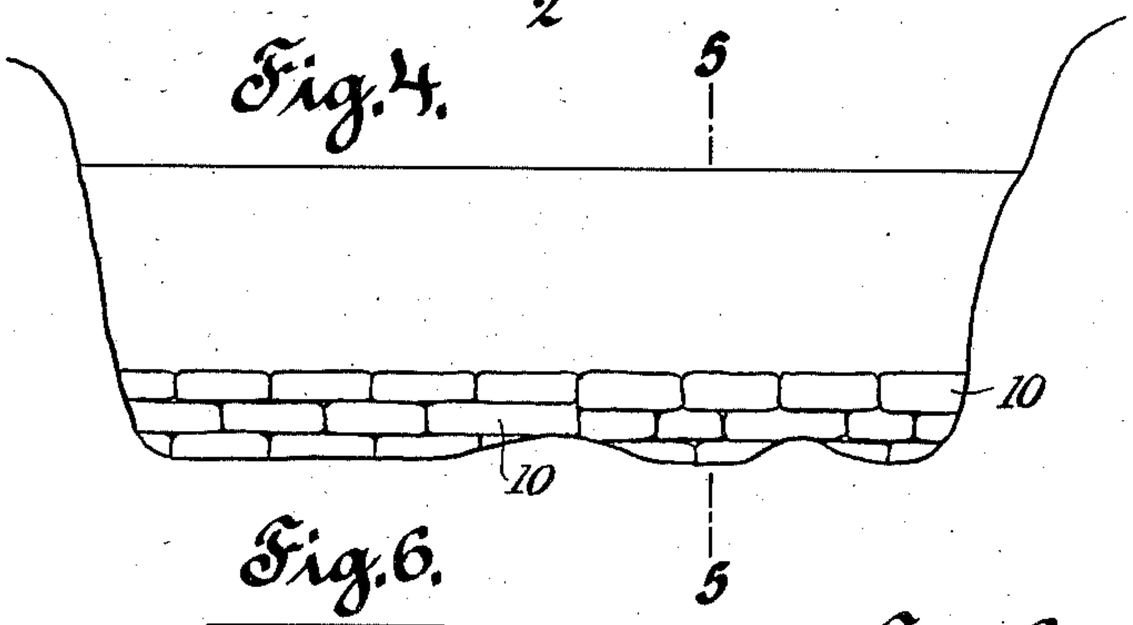


Fig. 5.

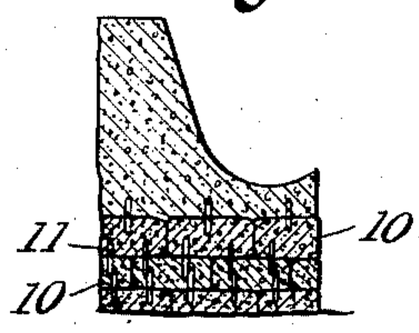


Fig. 6.

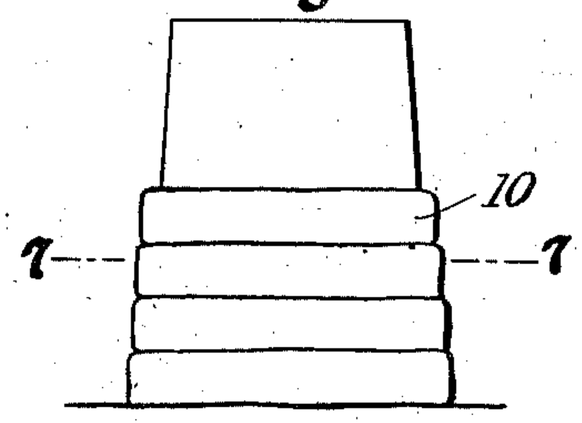


Fig. 7.

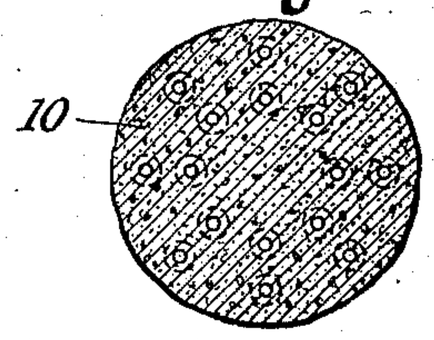


Fig. 8.

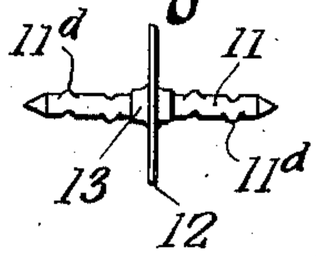


Fig. 9.

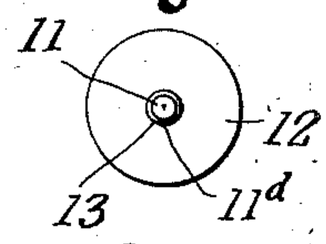


Fig. 10.

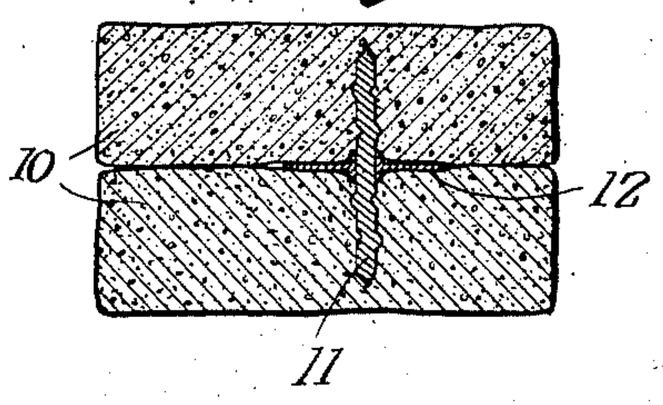
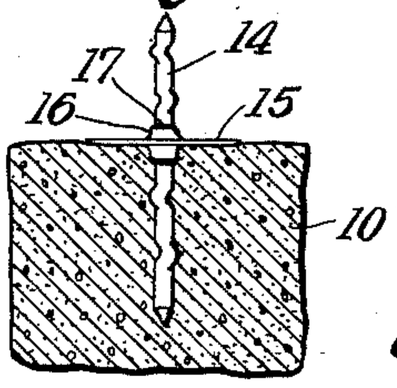


Fig. 11.



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UNITED STATES PATENT OFFICE

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MASONRY CONSTRUCTION

Application filed January 29, 1929. Serial No. 335,761.

This application is a continuation in part of my application, Serial No. 710,742, filed May 3, 1924.

This invention relates to the art of constructing various kinds of structures preferably of concrete or like building materials which are soft and plastic when first prepared and which become hard after a time, and devices therefor. The preferred ingredients of concrete used in my invention are Portland cement, sand, and crushed stone, and water. It will be seen as this specification proceeds that for each of the above mentioned solid ingredients of concrete, other materials can be substituted without departing from the scope of my invention.

One of the objects of my invention is to provide a way of erecting concrete structure without using forms or molds for holding the plastic concrete in place until it hardens or sets. Another object is the provision of means for building masonry structures partly or wholly under water without using a coffer dam or other means for removing the water from the site of the structure. A further object is the provision of simple, easily used means for permanently fastening together elements of a masonry structure without using mortar or other adhesive. Other objects will appear as the description proceeds.

To show more clearly how my improvements in masonry construction are carried out I refer to the accompanying drawing, in which:

Figure 1 is a partial side elevation of a wall constructed according to my invention.

Figure 2 is a vertical section, taken along the line 2—2 of Figure 1.

Figure 3 is an enlarged fragmentary sectional view of the structure shown in Figure 2, illustrating a preferred form of lath-carrying member partially embedded in the sacks of concrete.

Figure 4 is an elevational view of a dam constructed according to my invention.

Figure 5 is a vertical section taken along the line 4—4 of Figure 3.

Figure 6 is an elevational view of a bridge pier constructed according to my invention.

Figure 7 is a section taken along the lines 6—6 of Figure 5.

Figure 8 is a side view of a special metal tie rod which may be employed in practicing my improved masonry construction.

Figure 9 is an end view of the tie rod shown in Figure 8.

Figure 10 is an enlarged sectional view of the tie rod shown in Figure 7, the rod being disclosed as embedded in two sacks of concrete, the latter only partially shown.

Figure 11 is a sectional view of a modified form of the tie rod shown in Figure 8, the lower portion of the rod being shown embedded in a portion of a sack of concrete.

In building such structures as walls, dams and piers of concrete, some means must be provided for holding the plastic concrete in place until it hardens and there is no longer any tendency for it to flow. For this purpose, containers or molds of wood or steel, commonly called "forms", are generally provided. The finished concrete will have substantially the same shape and dimensions as the inside of the forms used in erecting it. The use of wooden or steel forms in concrete construction has some disadvantages. Skilled labor is required to erect the forms. The cost of the material in the forms is considerable. Before forms for a bridge pier or a dam can be erected, it is often necessary to first build an expensive coffer dam and remove the water from inside of it.

Instead of using forms for holding the concrete in place while it is soft and plastic, I place the freshly mixed green concrete in bags or sacks 10 of cloth or other suitable fabric and sew up the mouths of the sacks quickly and place the sacks of concrete without undue delay in the structure to be built. The sacks will preferably be laid in rows and tiers in a similar way that squared stone blocks or bricks are used in the construction of a wall, care being taken to "break joints".

If the sacks are only partly filled with soft concrete before being placed in a structure, closer joints between the sacks may be obtained.

Instead of using some kind of adhesive material to hold sacks of concrete in place on

top of those below, I make use of a short metal rod 11 such as is shown in Figures 8 and 9, which has both ends sharply pointed and is provided with a flange member 12 secured intermediate its ends. Starting with the sacks in the bottom layer, one or more of the tie rods 11 are embedded in the top side of each sack to the flange member 12 (see Figures 2 and 10). The sharply pointed ends of the rods permit them to readily pierce the walls of the sacks. When a sack of soft concrete is properly lowered into place on top of another sack in which has been embedded a rod 11, the sharp pointed upper end of the rod will pierce the upper sack as it descends and be embedded therein to the flange member 12. Thus with approximately one half of the rod 11 embedded in the lower sack and the same amount in the upper sack, when the green concrete in the separate sack hardens and grips the rod 11 the upper and lower sacks will be securely, rigidly, and permanently fastened to each other. Furthermore, it will be seen that nearly every sack of concrete in the structure will be firmly fastened to the sacks above and below it.

In most cases, each tie rod 11 will preferably be made with deformed or roughened elements 11^d to insure that the rod is more firmly and rigidly gripped by the concrete.

One function of the flange member 12 is to prevent the rod 11 from being pushed down too far into the lower sack by its own weight or by the sack immediately above the lower sack when the former is being lowered into place. It is desirable that the flange 12 should be pushed down into the lower sack of soft concrete only a slight amount lest the upper sack fail to fill up the depression over the flange and a void be left between the sacks. To guard against such depressions the area of the flange should be relatively much larger than the cross section of the rod 11.

The flange 12 has another important function. It serves as a brace to hold the partly embedded rod 11 in a substantially perpendicular position so that its upper end will readily pierce the lower wall of the descending sack. Should a tie rod without a large flange be used in place of the tie rod 11 it is advisable after the rod is embedded in the lower sack to hold the rod in an upright position by some suitable means when a sack is being lowered against the rod. Otherwise, I have found in practice, that the upper portion of the tie rod will often become considerably inclined from the vertical and will consequently be pushed over to lie useless against the top wall of the under sack.

To perform satisfactorily the above described functions, the flange 12 should usually have a diameter not less than four times the diameter of the rod 11, when the latter is relatively short. As shown in Figure 10, the flange 12 will usually lie between the upper and lower walls of the two sacks of concrete 10 in which the rod 11 is embedded. This will not be objectionable since the flange is quite thin and the two adjacent sacks will usually meet all around the flange.

A short section of the middle portion of the rod 11 may have a relatively thick coating 13 of some material like lead, copper, or asphalt paint that is substantially free from injurious rust or corrosion. The thickness of this coating as shown in Figure 8 is exaggerated. The flange 12 is positioned on the rod 11 approximately at the middle of the coating 13 and may be secured on the rod 11 by means of the coating in such a way that no part of the flange touches the metal of the rod. Then should the flange rust entirely away, the rod 11 will not be affected. The end portions of the rod 11 which will usually have no protective coating will be protected by the concrete from rusting or corrosion.

In Figure 11 is illustrated a modified form of the tie rod shown in Figure 8. A rod 14 has fastened on it, a flange 15 which is positioned nearer one end than the other, thus leaving a longer portion of the rod on one side of the flange than on the other side. The longer portion of the rod will be embedded downwardly in the top of a sack 10 of soft concrete, and this arrangement will be more effective in holding the shorter protruding portion of the rod upright than would result if the upper and lower portions were the same length. The rod 14 may have a rust-resisting coating 16 which, in certain structures, may need to be extra thick, and when so made may be tapered down at each end as shown at 17.

Where a wall is built of concrete in sacks according to my invention and is two or more sacks thick, (see Figure 2), two laterally adjoining rows of sacks may be tied together in two ways. One way is by placing "a header" sack of concrete crossways through the wall at proper intervals. The other may be carried out by embedding a tie rod 11 in two sacks lying side by side as shown in the case of the two highest sacks in Figure 2. Either one or both of these ways may be used in the same wall or structure.

As illustrated in Figure 2, material designated as E such as earth or coal may be piled high against one side of the wall.

One or both sides of the wall shown in Figure 2 may be finished with a coat of plaster or stucco 20. Means for holding this plaster securely to the side of the wall may include lath designated as 21 which may be fastened on and be supported by projecting portions of a plurality of pointed nail-like members 22, each of which is partly embedded in the side of one of the sacks 10. Each nail member 18 may have small deformations 23 on its inner and pointed end portion i. e. em-

bedded portion, which deformations may be of any suitable well known form. Each nail member 22 will preferably be pushed through the wall of a sack 10 while the concrete therein is soft and plastic; this embedment of the nail being easily done at that time. Later, when the concrete has hardened and gripped the nails 22, the lath 21, which may be made of either wood or metal can be easily and securely fastened on the nails and the plaster 20 may be applied later in a well known way.

It may be seen by those skilled in the art of reinforced concrete construction that the strength of the wall for resisting the overturning action of the material E will be increased by having the upper portion of a tie rod 11 embedded in the lower portion of a sack of concrete to overlap, i. e. extend upwardly beyond the end of the lower portion of the superjacent tie rod, and having the latter disposed closely adjacent to the upper portion of the lower rod. This arrangement of the tie rods considerably increases the tensile strength of the wall in substantially the same way that reinforcing rods function in a concrete wall made in the usual way.

It can be further seen by a person skilled in the art of masonry construction that some of the tie rods 11 adjacent the left hand face of the wall illustrated in Figure 2 will be subjected to severe tensile strain at times when, for example, the material E is piled high against the left hand side of the wall. It will be understood that such tie rods 11 as are subject to severe tensile strain should be made extra large or of a metal having a high tensile strength and be of such length, or arranged with such deformations, as to afford a secure grip or bond between the concrete and the rods proportionate to the strength of the rods.

In certain cases it may be desirable to make the tie rods 11 long enough to extend entirely through two or more sacks 10 on each side of the flange member. It will also be understood that even though the flange member on the tie rod 11 be omitted the device will still come within the scope of my invention.

It will be noted from inspection of Figures 4 and 5 that only the lower part of the dam is constructed of concrete in sacks according to my invention. The upper portion of the dam is shown as constructed of solid concrete. The sacks of concrete forming the bottom portion of the dam can be satisfactorily placed in shallow water without any special machinery. The sacks can be placed in position in deep water by using diving bells or equipping some of the workmen with diving suits. When sacks of concrete are to be placed according to my method of masonry construction in a structure under water, the solid concrete ingredients, cement, sand, and crushed stone may be mixed without water and put into the sacks dry if the water around the structure is satisfactory for use in mixing concrete.

It will be understood that before the lowest layer of sacks is placed in a dam the foundation of the dam should be prepared by removing mud, rotten rocks, etc., from the side of the dam.

While the upper part of the dam is being constructed, the water flowing in the stream can be passed by the dam site by leaving out a section of the dam at one end until the remainder is finished, or in other ways commonly used in the construction of dams. It will be understood by those skilled in the construction of dams that by using my sack method of construction for the bottom portion of the dam that the solid concrete top portion can be constructed in forms without requiring a coffer dam as ordinarily would be used for constructing a dam on a foundation under water. It will be understood that the top portion of the dam shown in Figures 4 and 5 can be constructed in the same way as the bottom portion if desired.

In Figures 6 and 7 is shown a concrete pier, the bottom portion of which may be constructed under water by means of large circular sacks filled with concrete and stacked on top of each other. Several tie rods 11 may be used as described above, for tying each of the circular sacks to the one above and below it. Where large sacks are to be filled with green concrete and used in the construction of dams and piers in the way explained above they will preferably be relatively thin and strongly made. Suitable means will preferably be provided for supporting the bottom side of a large circular sack while it is being lowered into place. Unless the sacks are made extra strong to resist internal pressure, the number of sacks that can be safely put in place in one day is limited, if ordinary slow setting cement is used.

In the description and claims of this specification, the term "green concrete" will be understood as meaning freshly mixed concrete which has not appreciably set.

I do not limit my invention to the use of only such devices as are specifically shown in the accompanying drawing, since widely different designs of such devices can be used without departing from the scope of my invention. For example, in practicing my invention, other containers which have walls easily pierced by a pointed rod may be used in place of sacks for holding the concrete.

Variations may be resorted to within the scope of the invention, and portions of the improvement may be used without others.

Having thus described my invention, I claim:

1. A structure composed of a plurality of sacks of cementitious material, certain of said sacks having embedded in them parts of short

metal rods pointed on each end, the remaining portions of said rods piercing and being embedded in adjoining sacks of cementitious material subsequently placed in said structure.

2. In a structure, in combination, a plurality of sacks of green plastic concrete, and short rod-like instrumentalities, each of which is embedded partly in one of said sacks and partly in an adjoining sack, said instrumentalities having deformed or roughened places to be more firmly gripped and held by the concrete in said sacks when it sets.

3. In a structure, in combination, a plurality of sacks of green plastic concrete, and means for fastening said sacks together including short rods having flange elements arranged intermediate their ends, an end portion of each of said rods being embedded up to its flange element in one of said sacks, and the other end portion of the same rod being embedded up to the same flange element in an adjoining sack.

4. A masonry structure composed of sacks filled with concrete and fastened together by short metal rods, each of said rods being partly embedded in one of said sacks and arranged to extend through the wall of said sack and the wall of an adjoining sack to be partly embedded in said adjoining sack, the portions of the rod in the walls of said sacks and between the walls, while portions are not encased or covered by concrete, being protected from corrosion by a coating of non-oxidizable material.

5. In a masonry structure, in combination, a sack filled with soft freshly mixed cementitious material, a rod piercing the wall of said sack to be partially embedded in the soft material in said sack so as to leave a portion of the rod projecting from the sack, and means engaging said rod and the wall of said sack to prevent further movement of said rod into said sack.

6. A masonry structure including sacks of soft freshly mixed concrete placed so as to form a wall, plaster-holding means fastened to said sacks while the concrete in them is still soft, and a coating of plaster-like material fastened to and supported by said holding means, said sacks being fastened together by having short rods embedded in them, each of the rods being embedded partly in one sack and partly in an adjoining sack.

7. A masonry structure including sacks of soft freshly mixed concrete fastened together by short metal rods, each of which has both ends pointed, a coating of protective material which is substantially free from corrosion arranged intermediate the ends of each rod, and a flange element positioned approximately at the middle of said coating, an end portion of said rod being embedded up to said flange in one of said sacks and the opposite end portion being embedded up to said flange element in an adjoining sack.

8. In a masonry structure, in combination, a sack of soft freshly mixed concrete, and a short metal rod pointed on each end and arranged with a flange member intermediate its ends, said rod being embedded up to its flange member in said sack and held in substantially vertical position by said flange member engaging said sack.

9. In a masonry structure, in combination, a sack of soft freshly mixed concrete, and a short metal rod provided with a flange member intermediate its ends, said rod being embedded up to its flange member in said sack, said flange being effective to prevent said rod from being pushed entirely into said sack.

10. A rod for fastening sacks of concrete together including a short metal rod having both ends sharpened for piercing the walls of the sacks and being embedded therein while the concrete is soft and plastic, a protective coating arranged intermediate the ends of said rod and made of a material substantially free from corrosion or oxidation, and a flange element positioned approximately at the middle of said coating and arranged to be held on said rod by said coating.

11. The method of masonry construction consisting in placing a sack of soft, freshly mixed concrete in a structure, embedding a short rod in said sack so that a portion of said rod will project from a side of said sack and subsequently placing another sack of soft, freshly mixed concrete in said structure on substantially the same level as said first named sack so that the projecting portion of said rod will be embedded in the subsequently placed sack.

12. The method of masonry construction consisting in placing sacks of soft, freshly mixed cementitious material in a structure, embedding short metal rods, each having a flange element intermediate its ends in said sacks up to said flange elements, and placing an additional sack of soft freshly mixed cementitious material in said structure so that the outer portion of said rods are embedded in said additional sack.

13. The method of masonry construction consisting in placing sacks of soft freshly mixed concrete in a structure, embedding short rods in said sacks so as to leave portions of the rod projecting from the sacks, subsequently placing additional sacks in said structure so that the projecting portions of said rods will be embedded in said subsequently placed sacks, fastening plaster-holding means to the sacks in said structure while the concrete is still soft, and putting a coat of plaster-like material on said holding means.

14. The method of masonry construction consisting in placing sacks of freshly mixed

concrete in a structure, embedding short metal rods in said sacks so as to leave portions of said rods projecting outwardly from said sacks, holding said rods stationary against further embedding movement into said sacks, placing additional sacks of freshly mixed concrete in said structure so that the projecting portions of said rods will be embedded in said additional sacks.

15. A device for fastening together two adjoining sacks of soft freshly mixed concrete in a structure, said device including a rod-like instrumentality having both ends pointed for readily piercing the walls of said sacks, to be embedded therein, and a flange-like member fast on said instrumentality intermediate its ends for determining the amount of said instrumentality to be embedded in each sack, said instrumentality having roughened or deformed elements to permit concrete around said instrumentality to grip and hold it more securely.

16. A masonry structure including sacks of green plastic concrete and short rod-like instrumentalities, each of said instrumentalities embedded partly in one sack and partly in an adjoining sack in engagement with the concrete in said sacks.

17. In a masonry structure, in combination, a plurality of sacks of soft concrete stacked one above another, and a plurality of uprightly disposed tie rods embedded in said sacks, the lower portion of a tie rod piercing the upper wall of one sack to be embedded therein, and the upper portion of the same tire rod piercing and being embedded in a superjacent sack, the tie rod portions embedded in each sack being disposed closely adjacent each other, and having such lengths that they overlap.

18. A device for fastening together two sacks of soft concrete in a structure, including a rod-like instrumentality having both ends pointed, and a flange member fastened on said instrumentality nearer one end than the other.

19. A masonry structure including sacks of green plastic concrete, said sacks having walls readily pierced by pointed instruments, plaster-holding instrumentalities including deformed or roughened nail-like members partly embedded in said sacks, and plaster-carrying lath fastened on said nail-like members, and a coating of plaster-like material applied to said lath.

20. A masonry structure including sacks of green plastic concrete, said sacks having walls readily pierced by pointed instruments, plaster-holding instrumentalities piercing the walls of said sacks to be embedded in the green concrete, and a coating of plaster-like material applied to said instrumentalities.

21. In a masonry structure, in combination, containers filled with green plastic concrete, said containers having walls readily pierced by pointed instruments, and short rod-like instrumentalities, each of said instrumentalities being embedded partly in one of said containers and partly in an adjoining container.

In testimony whereof I affix my signature.

WILLIAM W. LILLARD.