July 31, 1951 — L. R. CROUCH — 2,562,299

CONCRETE WALL FORM AND METHOD
OF MOLDING CONCRETE WALLS

Filed June 7, 1946 — 4 Sheets-Sheet 1

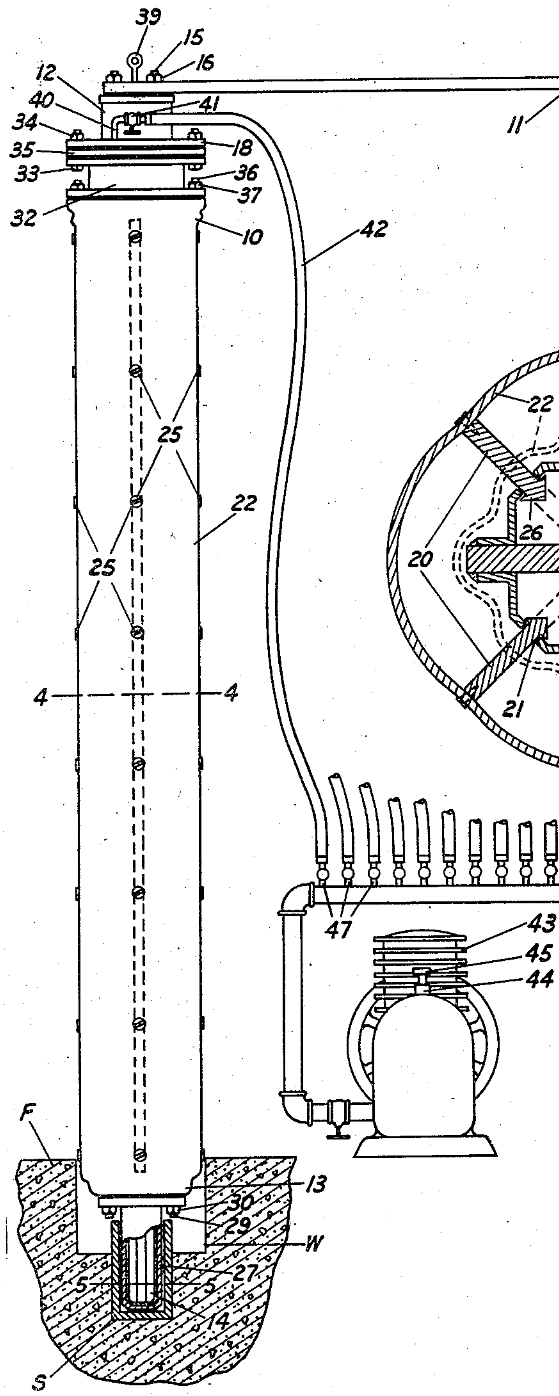

FIG. 1

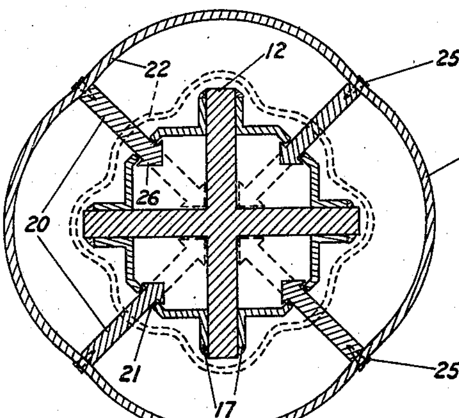

FIG. 4

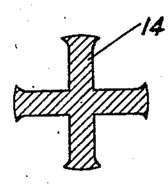

FIG. 5

Inventor
Logan R. Crouch
By A. F. Flournoy
Attorney

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CONCRETE WALL FORM AND METHOD OF MOLDING CONCRETE WALLS

Filed June 7, 1946 4 Sheets-Sheet 2

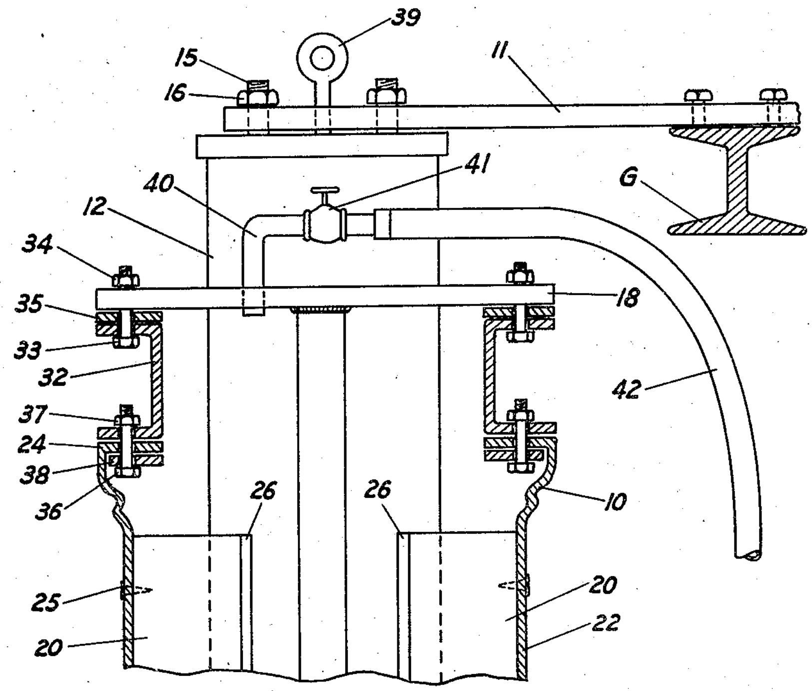

FIG. 2

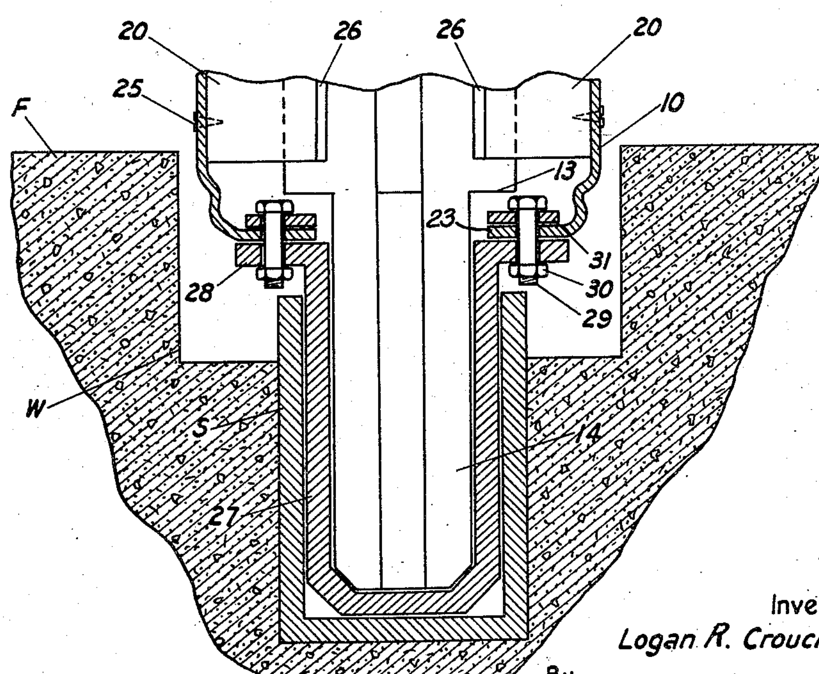

FIG. 3

Inventor
Logan R. Crouch
By A. F. Flournoy
Attorney

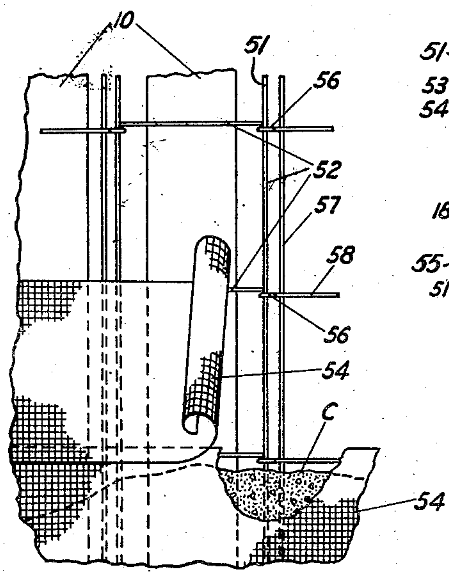

FIG. 6

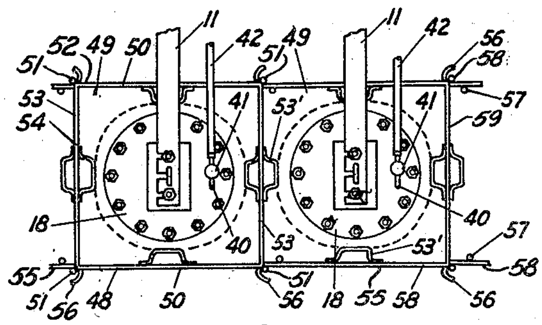

FIG. 7

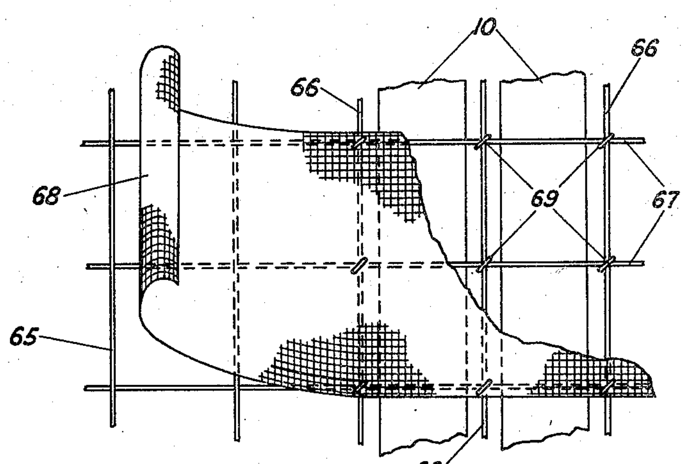

FIG. 8

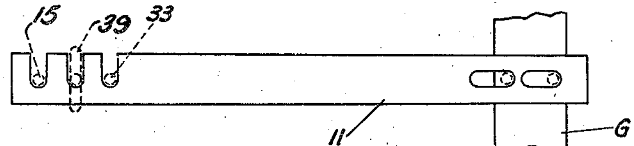

FIG. 9

Inventor
Logan R. Crouch
By A. F. Flournoy
Attorney

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CONCRETE WALL FORM AND METHOD OF MOLDING CONCRETE WALLS

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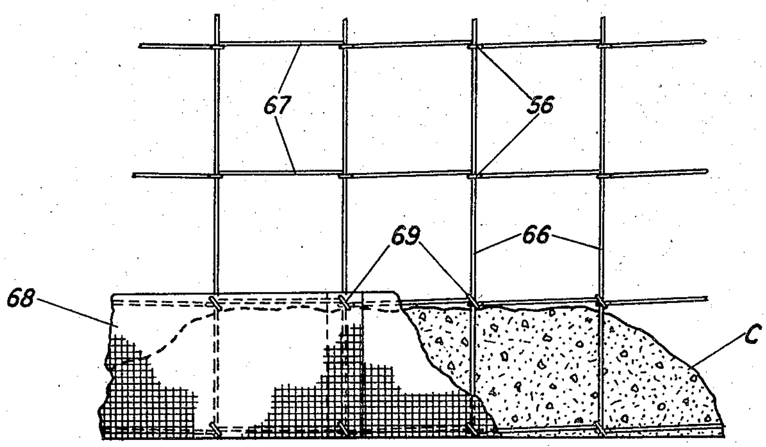

FIG. 10

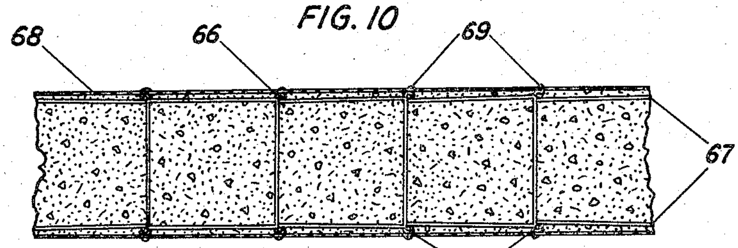

FIG. 11

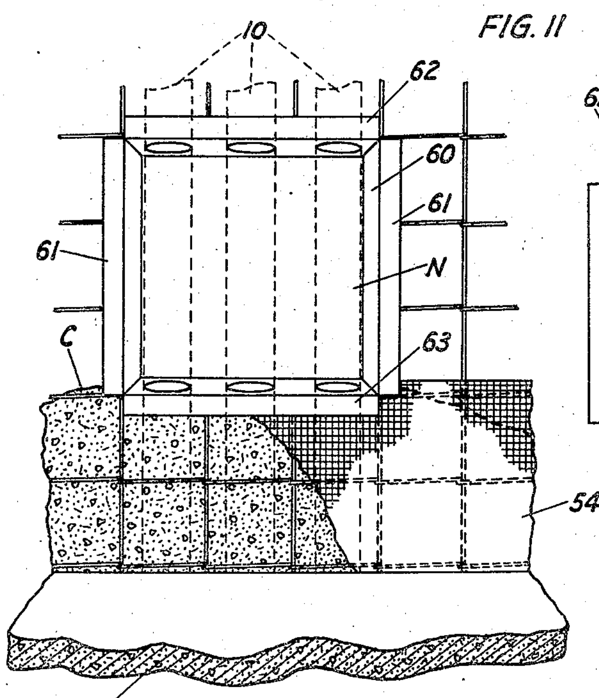

FIG. 12

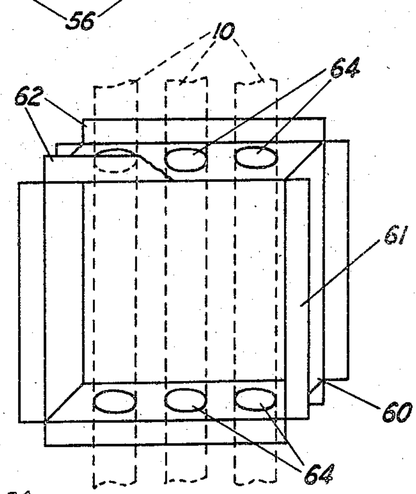

FIG. 13

Inventor
Logan R. Crouch
By A. F. Flournoy
Attorney

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CONCRETE WALL FORM AND METHOD OF MOLDING CONCRETE WALLS

Logan R. Crouch, Jackson, Miss.

Application June 7, 1946, Serial No. 675,211

5 Claims. (Cl. 25—131)

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My invention relates, generally, to methods of constructing concrete walls and forms for use in the construction of same, but more particularly to wall forms including inflatable core members and methods that utilize the inflatable core members not only as internally positioned concrete backing walls but as means for tamping concrete after it is poured into the form.

While hollow collapsible forms for use in concrete work are known to the prior art, all of the prior art collapsible forms for use in the pouring of concrete walls, as far as I am aware, have been constructed out of sheet metal. These metal types of collapsible forms are provided with overlapping sheet metal shell members which may be moved from expanded positions into collapsed positions and vice versa. Due to the stiffness of the sheet metal out of which this type of prior art form must be made only a slight movement of its wall members from a collapsed position to a fully expanded position is permissible. Concrete adhering to the outer surface of these slidable form members interferes with the operation of them. Fluid concrete works in between the overlapped layers of the wall members, hardens and sticks the slidable members together.

Inflatable core members, broadly speaking, are known to the prior art but such devices as are known to the prior art are not applicable to the work of making poured concrete walls.

As far as I am aware, I am the first inventor to have devised an inflatable type of collapsible core member for use in the construction of concrete walls.

An object of my invention is to provide a wall form for use in the erecting of poured concrete walls that is comprised of a hollow cage type reinforcing system which includes side wall elements positioned to become embedded in the finished concrete walls without the aid of any wood forms or their equivalent. Within this cage type reinforcing system will be placed inflatable core members, the core members serving as internal backing walls for the soft concrete before it sets. The core should be removably mounted so that they may be deflated, and withdrawn after the concrete has partially set to be used again.

Another object of my invention is to provide in wall forms collapsible removable core members which are designed to be expanded into contacting positions with portions of surrounding cage reinforcing type members used with the cores in order to hold the reinforcing members in correct assembled position until concrete poured into the form has had time to set partially in the embedded reinforcing members.

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Other objects and advantages of my invention will appear in my detailed description to follow of an inflatable core member and reinforcing elements that embody my invention which I have shown in my accompanying drawings in connection with other apparatus which I embody in the carrying out of my invention in a method of making a concrete wall.

In the drawings,

Figure 1 is an elevational view of an inflatable core member forming a part of a wall form embodying my invention in equipment usable in the carrying out of my invention in a method of making a concrete wall or the like.

Figure 2 is an enlarged broken elevational view of the top portion of the inflatable core member illustrated in Figure 1.

Figure 3 is an enlarged broken elevational view of the lower end of the core member illustrated in Figure 1.

Figure 4 is an enlarged cross-sectional view of the inflatable core member illustrated in Figure 1 taken on line **4—4** of Figure 1.

Figure 5 is an enlarged cross-sectional view of an anchoring foot portion of the inflatable core illustrated in Figure 1 taken on line **5—5** of Figure 1.

Figure 6 is a fractional side elevational view of a preferred assemblage of a prefabricated wall reinforcing cage in which there is shown installed a series of the inflatable core members illustrated by Figure 1.

Figure 7 is a fractional top plan view of the preferred assemblage illustrated by Figure 6.

Figure 8 is an elevational view illustrating the assembling of a modified form of wall reinforcing construction to be used with the inflatable core illustrated in Figure 1 in the building of a concrete wall.

Figure 9 is a plan view of a tying element shown in Figure 1.

Figure 10 is an elevational view of a modified form of wall reinforcing structure.

Figure 11 is a plan view of the structure illustrated by Figure 10.

Figure 12 is an elevational view of a wall reinforcing structure provided with a window receiving box, and

Figure 13 is a broken elevational view of the window box illustrated in Figure 12.

Before beginning the description of my invention in the inflatable core member mentioned in my general description above I will describe the foundation F on which my novel core members and reinforcing members are erected. The foundation F may be a floor foundation or a wall foundation. The foundation F must be provided with a series of wells W, the spacing of which will determine the spacing of the inflatable core members to be described later.

In order to assure more nearly perfect alignment of the core members tubular sockets S (sections of iron pipes) are cemented in straight alignment and spaced at proper intervals to receive the cores. The upper ends of the sockets S should extend above the bottom surface of the wells W in order to keep concrete from flowing into the inside of the tubular sockets S. It must be remembered that after the cores have been used at one position in making a wall they are to be pulled out of the sockets S to be used again in another section of the wall.

The reinforcing elements which become embedded in the finished concrete wall may be placed in position on the foundation F either before or after the inflatable cores are positioned in the sockets S. The pre-formed type reinforcing cages mentioned in my description may be stacked one upon another, after which, the inflatable cores may be lowered into position.

The modified form of wall reinforcing construction as illustrated in Figure 8 is constructed after the inflatable cores 10 have been set in position.

When the inflatable cores 10 are set in the sockets S their upper ends are tied into correct aligned position by means of slotted fastening straps 11 which may be bolted to some convenient frame member such as the roof girder G shown in Figure 1 of the drawing, said girder G being preferably rigidly mounted with the base H.

The inflatable core 10 is provided with a centrally positioned rigid spine 12 preferably made out of metal. The lower end of the rigid spine 12 is formed in the shape of a base flange 13 out of the center of which an anchoring foot 14 is extended. The upper end of the rigid spine 12 is joined to the fastening strap 11 by means of a pair of studs 15 and nuts 16.

A head plate 18 is welded onto the upper end of the spine 12. The rigid spine 12 is preferably made cross-shaped in cross-section. Four pairs of aligned spaced guide shells 17 are bolted or welded to the spine 12 in the manner shown in Figure 4. The vertically extending slots defined by the adjacent edges of spaced members of the pairs of the guide shells 17 constitute guiding slots 21 through which slidable tying vanes 20 joined to the flexible shell 22 are adapted to move. The flexible shell 22 is joined to other members at the bottom of the spine 12 by its bottom inwardly turned flange portion 23 and joined at its top to head members by its top inwardly turned flange portion 24.

The slidable tying vanes 20 are preferably made out of wood or aluminum to make them light but they may be made out of fabric or out of the same material the flexible shell is made of and made integral with the flexible shell 22. The flexible shell 22 should be made out of rubber or a rubberized fabric. The shell 22 should be both glued to the tying vanes 20 and fastened to the same by flat headed wood screws 25.

The thickened inner edge portions 26 of the slidable tying vanes 20 serve as stops for limiting the outward movements of the tying vanes 20 and consequently the expansion of the flexible shell 22 attached to the tying vanes. The dotted lines in Figure 4 indicate the fully collapsed position of the flexible shell 22.

The bottom end of the flexible shell 22 is attached to a metal anchoring shell 27 provided with a perforated flange 28. The flexible shell 22 is attached to the anchoring shell 27 by means of the bolts 29, nuts 30, and the washers 31, as best seen in Figure 3 of the drawings. The anchoring shell 27 is made in a size to loosely fit in the tubular socket S.

The anchor foot 14 of the rigid spine 12 should fit loosely in the anchoring shell 27. In the assembled position of the inflatable core 10 the flexible shell 22 is rigidly fastened to the head plate 18 through the means of a double flanged metal collar 32. The double flanged metal collar 32 is bolted to the head plate 18 by means of bolts 33 and nuts 34. A gasket 35 is interposed between the collar 32 and the head plate 18 to insure an airtight fit. The collar 32 is bolted to the upper end of the flexible shell 22 by means of bolts 36, nuts 37, and a perforated clamping ring 38 interposed between the heads of the bolts 36 and the inner surface of the inwardly turned flange portion 24 of the flexible shell 22.

A lifting eye 39 is screwed into the head plate 18 for use in lowering the core 10 (deflated) into and removing it from the poured concrete wall reinforcement.

An elbow pipe fitting 40 is threadedly engaged in the head plate 18 in communication with the interior of the flexible shell 22. A two-way valve 41 is mounted on the outer end of the pipe fitting 40 by means of which compressed air may be delivered to the inside of the flexible shell 22 from the air hose 42 connected to the valve 41. This same two-way valve 41 may be operated to shut off the pressure stream of air coming from the compressor 43 and at the same time open up an air discharge passage to exhaust the air inside the flexible shell 22 when it is necessary to remove the core 10 from the finished concrete wall. The air hose 42 is connected with one of the valve controlled discharge pipes 47 mounted in the manifold 46. The single illustrated compressor 43 takes care of as many as ten cores 10 at one time. The compressor 43 is provided with a safety valve 44 which valve includes an air pressure adjusting screw 45.

When the two-way valve 41 is positioned to allow compressed air to be delivered into the flexible shell 22 the internal air pressure of the core 10 must be controlled by the safety valve 44. The pressure adjusting screw 45 is designed to be turned clockwise to increase the air pressure and counterclockwise to decrease the air pressure.

Relatively low air pressure (one pound to ten pounds per square inch) may be used in operating my cores 10 since the only work that they have to perform is the work of pressing the poured concrete into position between the outer surface of the expanded flexible shell 22 and the reinforcing structure to become embedded in the finished wall, and the work of holding the reinforcing frame structure 48 in correct alignment.

My explanation of the operation of the core 10 and the procedures to be followed will be explained in connection with my reinforcing frame structure illustrated in Figures 6 and 7 of the drawings. It is to be understood, however, that the operations I carry out with my core member 10 in connection with the reinforcing frame structure 48 can be carried out also with the modified forms of the reinforcing member illustrated in Figures 8, 10, and 11 of the drawings, and for that matter with other styles of reinforcing members such as pre-fabricated reinforcing wall members made C-shaped in cross-section, which may be slipped around the cores 10 after they have been set.

When the modified forms of reinforcing members illustrated in Figure 10 have been all assembled the concrete must be poured in from the top in the manner known to the prior art.

In my description to follow of my preferred form of wall reinforcing frame structure 48 I will explain my novel procedure of pouring a concrete wall, a procedure that produces a more compact wall. As far as I know, my novel procedure in pouring a concrete wall has not been ever before attempted. The novel procedure is made possible by my preferred form of reinforcing frame structure 48 and by the procedure I follow in fabricating my preferred form of reinforced frame structure 48, illustrated in Figure 6 and Figure 7 of the drawings.

My drawings show the frame structure 48 of my preferred form of reinforced structure provided with vertically extending cells 49. When deflated, the cores 10 are loosely fitted in the cells 49. The frame structure 48 is started with a completed reinforcing frame four-walled cage 50. The cage 50 is comprised of four uprights 51 joined together by lateral rods 52 and spacing rods 53. The spacing rods 53 determine the thickness of the poured wall. I contemplate using strips of mesh wire 54 to complete the reinforcing structure. The size mesh to be used will depend on the method employed in forming the wall. The strips of mesh 54 needed may be all added at one time, or added strip by strip during the pouring of the wall as explained further on in this specification.

To start the wall the four-walled cage 50 is placed over a core 10. The core 10 is anchored in the well W in the foundation F and positioned by a temporary frame at the top and then inflated. The inflated cores 10 bring into proper position the four-walled cage 50 and the three-sided cages 55 joined to the four-sided cage 50 and to one another by means of the hooks 56 and hold them in proper pouring position to permit the application of the strip of mesh wire 54. The three-sided cages 55 are made up of four uprights 57, lateral rods 58, spacing rods 59. These three-sided cages 55 may be placed either before or after additional cores 10 are installed. The additionally added cores 10 mounted in the cells 49 formed by the addition of the three-sided cages 55 bring the added three-sided cages 55 into their proper wall pouring position. The application of the strips of mesh wire 54 to the completed righted frame structure 48 completes the reinforcing system.

In carrying out a step by step method of pouring a wall after the reinforcing frame structure 48 has been completed I add strips of screen mesh 54 in pairs which I fasten on opposite sides

of the reinforcing frame structure 48 commencing at the floor level of the wall. I then fill the space between the pairs of strips of mesh 54 with fluid concrete C. The type of strips of mesh 54 used has openings sufficiently small to prevent the poured fluid concrete C from draining out through it but large enough to permit some of the neat cement content of the concrete mixture to flow through to serve as a bonding agent between the finishing coat of the wall and the main body portion of the wall. The wall will be completed by successive addition of pairs of strips of mesh 54 followed by the addition of batches of the fluid concrete C. This method, while slower than methods wherein the entire quantity of fluid cement C is poured in from the top of the reinforcing system, eliminates tamping operations. This step by step method also produces a more compact wall than can be produced by the prior art method (the single pouring followed by a tamping operation).

It is to be understood that the step method of making concrete wall explained above may be carried out in the making of these walls where the cores 10 are not used as illustrated by Figure 10 of the drawings.

Window openings N (Fig. 12) are formed in the wall as the wall is constructed. Sheet metal boxes 60 of the kind illustrated in Fig. 13 are placed into the reinforcing structure 48 to comprise part of the completed reinforcing system. The box 60 has a width equal to or slightly larger than the width of the wall into which it is placed; and is provided with side flanges 61 folded backwardly over each side edge of the opening in the reinforcing framework 48; top flange 62 and bottom flange 63, both of which are also folded upon themselves over the outer side edges of the opening in the framework. Since these boxes 60 are to remain in the wall they may be tied with wires, welded or bolted to the framework in the proper position and alignment to receive the subsequently attached window frames.

These boxes 60 must be of such a measurement in width as to take the same space as would be taken by a cell 10 or an even number of cells 10. For example if the cells 10 were spread six inches from center of one to center of the next we could use window boxes 60 that were 18 inches, in width, 24 inches and other multiples of six inches. These boxes 60 should preferably be made out of very light sheet metal (20 gage).

The box 60 is provided with holes 64 in both its top and bottom walls to allow some cores 10 to be placed in wells W in the foundation F in the manner other cores used in the making of the wall are mounted. The holes 64 should be made the same size as the cell openings in the cage members (four-walled cage 50 and three-walled cage 55). The cells 49 located at the window space will have medial portions removed to accommodate the window box 60.

In the method of making a wall utilizing the core 10, the air from the compressor 43 is controlled by the two-way valve 41. When the cores 10 have been inflated their flexible shells 22 will be expanded into contacting position with the internally extending cage spacers 53′ of the reinforcing structure 48. That is to say, the core 10 itself serves as a means for aligning the reinforcing structure 48 in the horizontal direction. The pressure maintained on the cage spacers 53′ by the flexible shells 22 will be sufficient to prevent them from moving while the strips of mesh 54 are being added and while the fluid concrete C is being poured. Since the outside of the wall is carried a predetermined distance outside of the frame 48, the coaction of the spacing rods 53 and 59 holding the spacer 53' against the expanded shells 22 which are spaced away from the aligned centers also aligns the wall.

If desired, all of the strips of mesh 54 needed to make the wall may be fastened in place before any concrete is poured, after which the liquid concrete may be poured from the top of the frame structure 48 to fill the space between the side walls of the same and the expanded core members 10 and the spaces between the cores 10, which is to say, the whole volume of the finished wall. After the concrete C has been poured the cores 10 are maintained in an inflated condition until the concrete has taken on its initial setting, a condition in which it is stiff enough to permit the removal of the cores 10.

Before the poured concrete C is allowed to set completely the smooth finishing courses are added to the wall. This is one of the most important features of my invention in that it permits the formation of a concrete wall wherein the finished course is bonded to the main body of the wall before the main body of the wall is permitted to dry. That is to say, the entire wall is finished before any part of the wall is allowed to set completely, resulting in a wall wherein the finished coat will never flake off.

The procedure described above may be varied in a very novel manner to produce an even better wall than the one resulting from the simple wall pouring operation I have just described. The two-way valve 41 may be operated manually in a manner to introduce air and expel air from the core 10 to bring about slow pulsations of the side walls of the flexible shell 22 to produce slow flowing movements in the mass of the poured concrete—that is to say, a tamping operation.

It must be borne in mind that it is one of the purposes in pouring a wall under my method to compel part of the liquid concrete C to pass through the screen mesh 54 to be used singly or in combination with other added cement in the surface finishing operation in the making of the walls.

Another tamping operation that may be carried out when my cores 10 are used is accomplished through the means of the air compressor 43 itself. If the two-way valve 41 is positioned to deliver compressed air into the core 10 from the compressor 43 the safety valve 44 on the compressor may be set by means of the safety valve adjusting screw 45 to deliver low pressure air into the core 10. The air pressure will be varied by the running of the compressor 43. A vibration will be set up in the side walls of the flexible shell 22, vibrations that will be transmitted to the mass of poured concrete C. The mass of concrete C will be vibrated into a settled position in the wall and neat cement portions of the concrete C will be caused to flow through the screen mesh 54. The type of tamping operation to be used will depend upon the nature of the job to be handled.

When the wall type reinforcing structure 65, illustrated in Figure 8, is used the vertical reinforcing rod 66 and the lateral rods 67 are temporarily held in crossing positions by being fastened at their ends until the screen layer 68 is applied. In applying the screen layer 68 tying wires 69 are used to bind the vertical reinforcing rod 66 to the lateral reinforcing rod 67 at their points of contacts. The ends of the tying wire 69 are extended through the screen layer 68 before being twisted together in order to bind the screen layer 68 to the reinforcing rods. No useful purpose would be served in further descriptions of reinforcing constructions that could be used in connection with cores 10.

Having thus described my invention I claim:

1. In a wall forming construction, an inflatable core member comprising a tubular flexible shell, said flexible shell joined at its lower end to an anchoring shell adapted to fit releasably in a socket made in a foundation to accommodate the same, an elongated rigid spine element removably mounted in said flexible shell terminating at its lower end in an anchoring foot adapted to fit releasably in said anchoring shell, said spine provided with a head plate to which the upper end of said flexible shell is releasably fastened in an airtight fit, an air conduit extended through said head plate in communication with the space between said spine and said flexible shell, whereby said flexible shell may be expanded and tying members attached to the inner wall of said flexible shell and said spine adapted to limit the expansion of said shell.

2. In a wall forming construction, an inflatable core member comprising a flexible tubular shell closed at its lower end, a rigid spine element centrally positioned within said flexible shell, said flexible shell being joined in an airtight manner to said spine at its upper end, an air conduit communicating with the space between said flexible shell and said spine member, a two-way valve located in said air conduit adapted to control a flow of compressed air into said core and adapted to discharge air from said core directly into the atmosphere, said spine provided with a plurality of radially extending tying vane guides in which are slidably mounted tying vanes adapted to move, each of said vanes being attached along its outer edge to said flexible shell, said vanes provided with stops on their inner edges adapted to limit the expanding movement of said flexible shell when the same is being expanded by compressed air or other fluid introduced into it through said air conduit.

3. A member for use in plastic construction adapted to act as a core for forming an opening and also serve as a brace, said member comprising an outer inflatable shell of non-rigid material and a rigid spine extending into said inflatable shell, an opening for inflating and deflating said outer shell, yieldable connecting elements joining said spine and said outer shell, said yieldable connecting elements adapted to permit said outer shell to expand a predetermined distance when inflated.

4. A member for use in plastic construction adapted to serve as a core and also act as a brace, said member comprising an elongated inflatable outer shell of non-rigid material and an inner rigid spine extending lengthwise inside of said outer shell, an opening for inflating said outer shell, connecting elements between said spine and said outer shell, adapted to limit the outward movement of said shell and rendering it rigid with said spine when inflated; said member being provided with extending projections at its end for maintaining said member in a fixed position.

5. The method of constructing a cement wall containing spaced vertical openings, which consists of providing a base upon which the wall may rest, providing said base with a plurality of spaced socket openings in lineal alignment, providing a plurality of expanding core members having an outer flexible shell-wall element and a vertically disposed elongated fixed element within the core

member, mounting the lower ends of the fixed core elements within the lineal aligned socket openings and bringing the core members into vertical alignment, maintaining the core members in vertical alignment by connecting the upper ends of the fixed elements with a horizontal bracket which is fixed to a beam member rigidly supported by the base, incorporating box-like skeleton frame members around the respective cores, fastening courses of wire mesh fabric to the skeleton frames, inflating the cores to hold the skeleton framework in rigid vertical position and then depositing plastic cement around the core members and allowing portions of the cement to filter through the mesh fabric, working this portion of the concrete to form a smooth wall surface and then removing the flexible cores prior to complete setting of the concrete.

LOGAN R. CROUCH.

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