Aug. 5, 1941. J. C. PELTON 2,251,499

BUILDING STRUCTURE

Filed Nov. 2, 1938 3 Sheets-Sheet 1

Fig. 1.

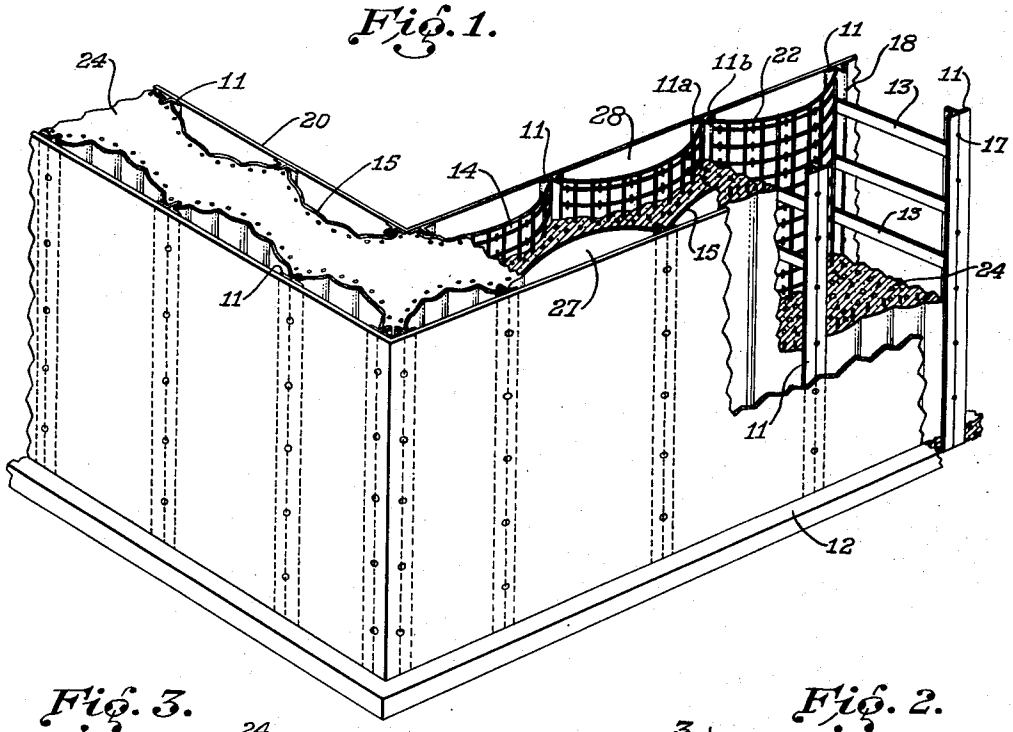



Fig. 3.

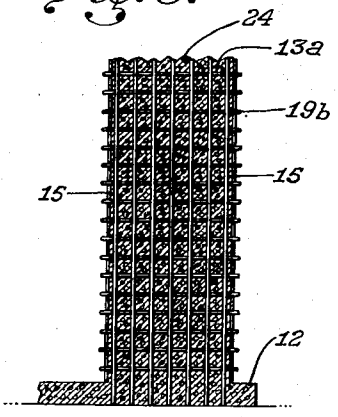



Fig. 2.

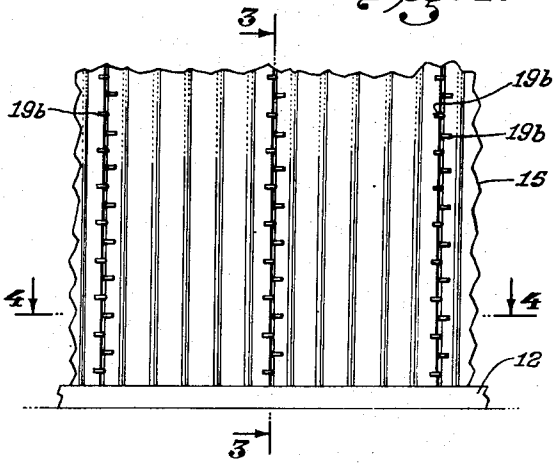
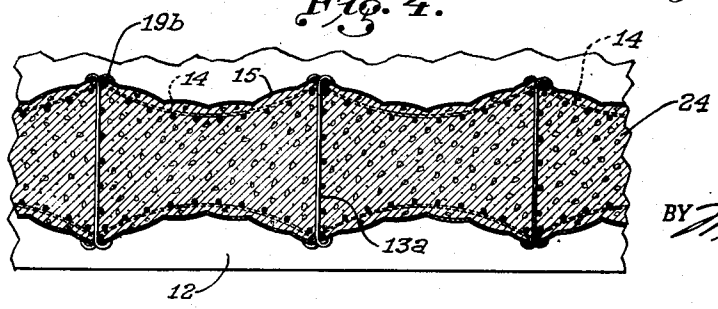



Fig. 4.




INVENTOR.
John C. Pelton
BY Miner L. Hartmann
ATTORNEY.

Aug. 5, 1941. J. C. PELTON 2,251,499

BUILDING STRUCTURE

Filed Nov. 2, 1938 3 Sheets-Sheet 2

Fig. 5.

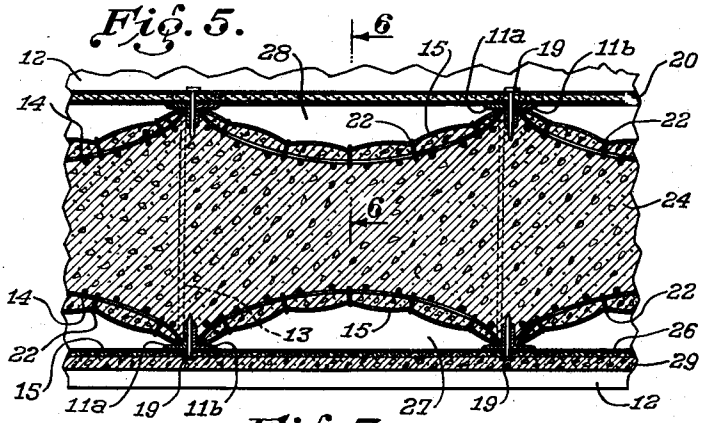



Fig. 6.

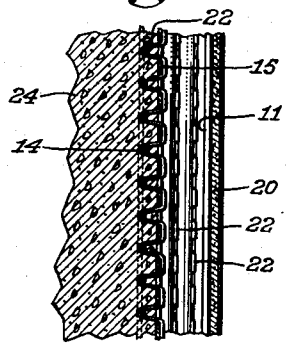



Fig. 7.

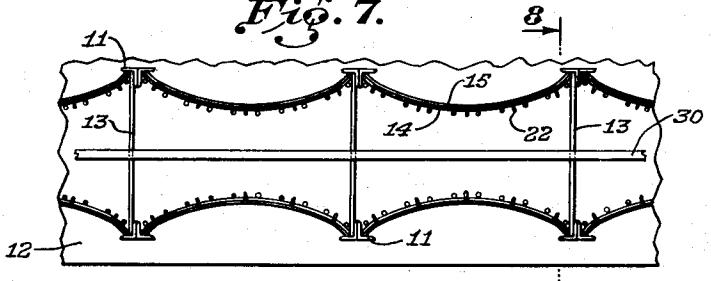



Fig. 8.

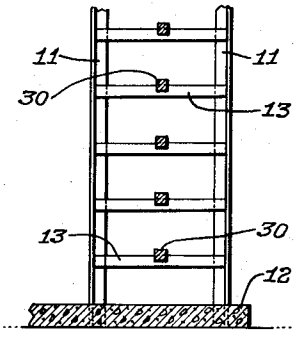



Fig. 9.

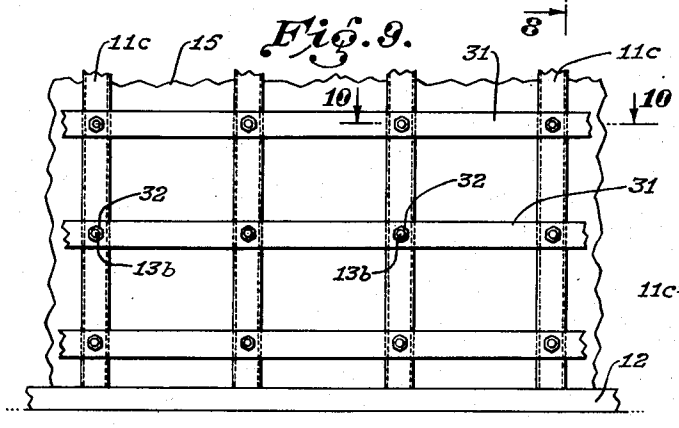



Fig. 10.

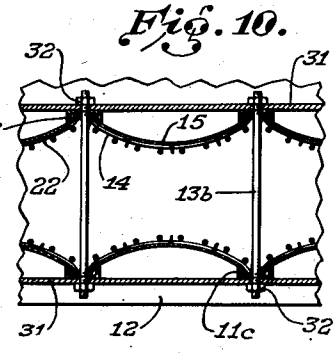
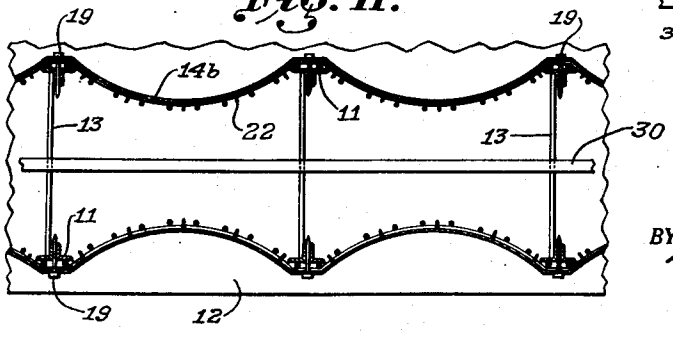



Fig. 11.




INVENTOR.
John C. Pelton
BY Marion A. Hartmann
ATTORNEY.

Aug. 5, 1941. J. C. PELTON 2,251,499

BUILDING STRUCTURE

Filed Nov. 2, 1938 3 Sheets-Sheet 3

Fig. 12.

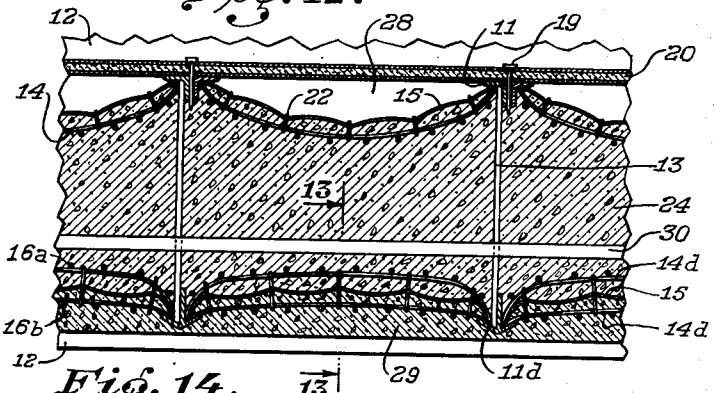



Fig. 13.

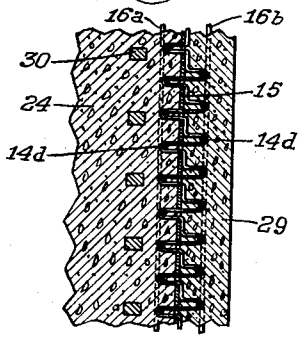



Fig. 14.

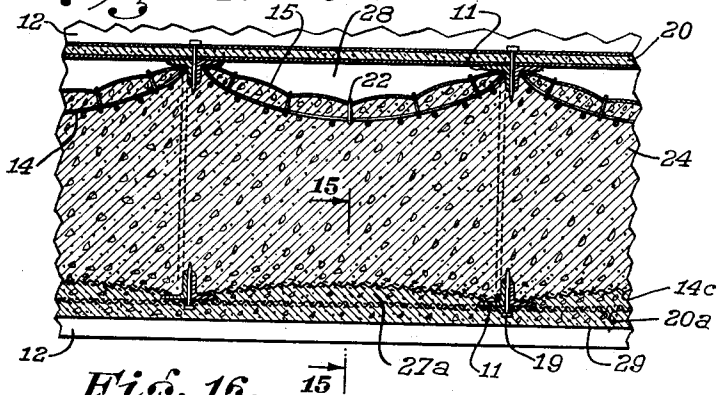



Fig. 15.

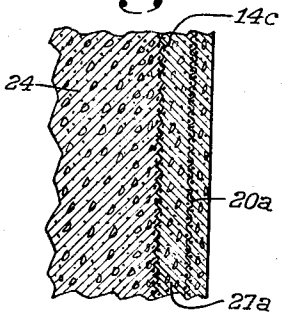



Fig. 16.

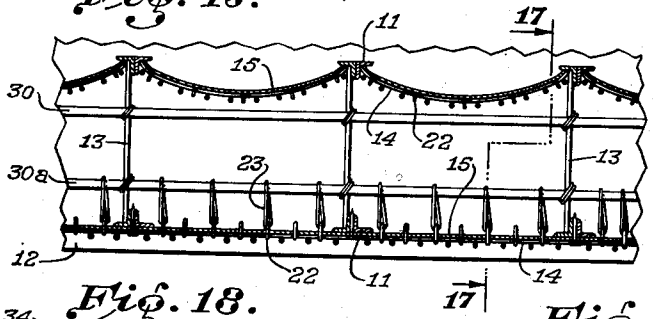



Fig. 17.

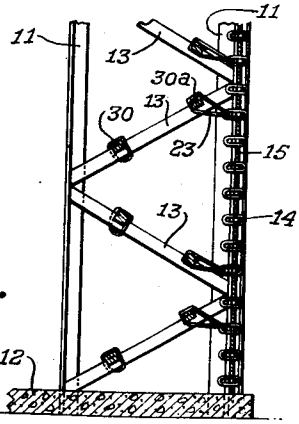



Fig. 18.

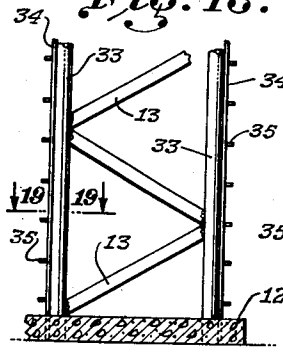



Fig. 19.

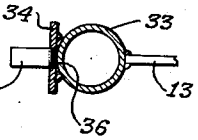
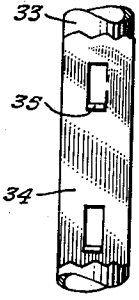



Fig. 20.




INVENTOR.
John C. Pelton
BY Miner & Hartman
ATTORNEY.

Patented Aug. 5, 1941

2,251,499

# UNITED STATES PATENT OFFICE

2,251,499

## BUILDING STRUCTURE

John C. Pelton, Los Angeles, Calif., assignor to Viber Company, a corporation of California

Application November 2, 1938, Serial No. 238,399

14 Claims. (Cl. 72—48)

This invention relates to building structures, and in particular to reenforced cementitious wall structures.

In the building of concrete walls, in particular those for small buildings such as houses, a large item of cost is that of the forms necessary to hold the concrete or similar material in place until it hardens. These forms, whether of the permanent or temporary type, must be assembled, and later removed when the concrete has set. It is customary in all concrete construction to use metal reenforcing rods distributed through the mass for greater strength and stability. My invention utilizes the reenforcing metal structure for the mold for forming of the concrete.

An object of my invention is to provide a concrete building structure in which the reenforcing metal elements are part of the forming means for the concrete. Another object is to provide a metal framing structure which serves as a mold for cementitious materials and a reenforcing means within the structure which is formed within and around it. Still another object is to provide a structural core of concrete and metal about which ventilating or dead air spaces may be formed between the core walls and surface finish layers attached thereto. Another object is to provide a concrete wall upon which ornamental surface finishing layers may be attached. Another object is to provide a low cost permanent building structure. These and other objects are attained by my invention, which will be best understood by reference to the accompanying drawings, in which:

Fig. 1 is a perspective view showing a preferred embodiment of my invention with parts broken away to show details;

Fig. 2 shows in elevation a portion of a concrete wall comprising another embodiment of my invention;

Fig. 3 is a sectional view taken on the line 3—3 of Fig. 2;

Fig. 4 is a sectional view taken on the line 4—4 of Fig. 2;

Fig. 5 is a horizontal sectional view of Fig. 1;

Fig. 6 is a vertical section taken on the 6—6 of Fig. 5;

Fig. 7 is a plan view of an alternative self-reenforcing forming structure of my invention;

Fig. 8 is a vertical sectional view taken on the line 8—8 of Fig. 7;

Fig. 9 shows in elevation the detail of another self-reenforcing forming structure;

Fig. 10 is a sectional view taken on the line 10—10 of Fig. 9;

Fig. 11 is a sectional plan view of another alternative forming structure;

Fig. 12 is a horizontal sectional view of another form of my invention;

Fig. 13 is a vertical section taken on the line 13—13 of Fig. 12;

Fig. 14 is a horizontal sectional view of another form of my invention;

Fig. 15 is a vertical section taken on the line 15—15 of Fig. 14;

Fig. 16 is a plan view of another self-enforcing forming structure of my invention;

Fig. 17 is a vertical sectional view taken on the line 17—17 of Fig. 16;

Fig. 18 is an elevation showing another type of uprights forming a structural frame for my forming structure;

Fig. 19 is a sectional view taken on the line 19—19 of Fig. 18;

Fig. 20 is an end elevation of the upright of Fig. 18.

In general, my invention involves a structure or frame which serves as a wall forming mold or as an outlining frame to which sheeted members may be attached to retain cementitious mixtures, which structure becomes the reenforcing metal for the concrete core formed within the mold and for the plaster which may be placed on the outside of the core. In its preferred embodiment, the reenforcing structure consists of angle-iron framing elements arranged in parallel formation, sheeted mesh-like concrete-retaining material sprung as inwardly bowed arches between adjacent angle-iron framing elements on either side of the wall to be formed, longitudinally tying members to hold the framing elements in position against the pressure of the arched sheets, and cross-tying members to hold the opposite wall-forming structures in position. A fluted monolithic concrete core or wall is then molded between the two forming walls of arched sheeted meshed material, the meshed material becoming embedded as reenforcing in the concrete. The meshed sheets may be fine enough to retain damp concrete mix, but preferably the wire mesh has a concrete-retaining membrane loosely attached on the side of the sheets away from the concrete, which permits better retention of the concrete and allows it to deeper embed the wire or rods of the mesh. The longitudinal tying means may be chord elements which are attached to the framing elements across the arches which produce the flutes in the concrete core; and when these chord elements are structural sheets, they serve as finished outer wall surfaces

They may be of a "plaster base" material upon which cementitious finishes such as plaster or stucco may be applied, in which case air spaces are formed in the flutes of the concrete core, or the flutes may be completely filled up and a plain plaster surface formed on the wall.

Referring to the drawings, particularly to Fig. 1, T-shaped framing elements 11 of light weight metal are set upright to outline the two sides of the wall to be formed, for example, by fixing their lower ends in a previously formed concrete foundation or base 12. Cross-tying members 13 hold the upright T-shaped members 11 together to define the wall thickness. Between adjacent T-shaped uprights 11, is sprung, in arched formation bowed inwardly, a sheeted material 14 preferably formed of wire mesh, to which is attached on the outer wall surface (on the concave side of the bowed sheet) a concrete-retaining membrane 15. The T-shaped uprights 11 are preferably constructed of two angle-irons 11*a* and 11*b*, welded at separated points along the face (top of the T) and at the adjoining edges as shown at 17 and 18. This structure permits the use of barbed nails 19, which may be driven or forced between the two angle-irons (shown in detail in Fig. 5) for attaching outside finishing material as described below. The cross-tying members 13, holding the T-shaped members at the proper distance apart for the walls of the structure, are steel bars or reenforcing rods of the usual type, attached to the T-shaped members 11 by suitable means, for example by welding.

The sheeted material 14, in the preferred construction shown in Fig. 1, is wire mesh with the wires or rods welded at each crossing. Attached to this wire mesh by links or stitching 22, is a membrane 15, for example water-proof paper, which serves to retain the unset concrete, and also by its bulging allows the wires to be deeper embedded in the concrete. Figs. 5 and 6 show this in detail.

In order to hold the arched sheets and the uprights in a sufficiently rigid wall mold into which concrete may be formed, chord members across the arches are employed. The chord members which hold the T-shaped members 11 in place against the thrust of the sprung arched mesh 14, may be removable strips, but in a preferred form as shown in Fig. 1, sheeted structural material 20 of the type commonly known as "wall board" or "plaster board" is attached to the uprights 11 by nails 19. Alternatively, "plaster base" or "stucco base" such as wire mesh or expanded metal sheets adapted to receive inside finishing plaster or outside stucco layers, may be used to provide finished plane wall surfaces outside the fluted concrete core.

In Fig. 2 is shown in elevation a portion of a concrete core built in accordance with my invention; Figs. 3 and 4 show sectional views of this core or wall. The surface of this core consists of concave panels or flutes, with smaller scallops or bulges in the concave panels resulting from forcing of the concrete against the membrane attached to the wire reenforcing elements. In this particular arrangement shown in Figs. 2, 3, and 4, the uprights and the cross-tie members are combined to form sheets of wire mesh 13*a* with hooking means 19*b* at the outside edges by which the embedded arched wire-mesh sheets 14 are attached. The fluted concrete core 24 thus formed may be plane surface finished as elsewhere described.

Fig. 5 shows in greater detail my hollow structural wall. Prior to the placing of the conrete for the core, the wire-mesh sheets 14 are sprung in arched formation between the spaced uprights 11, a water-proof membrane being attached to the concave side of the arch by stitching 22. The concrete mix, when placed against the arched wire-mesh surfaces 14, forces the loosely stitched paper 15 away from the wire mesh, allowing the wires to be almost wholly embedded in concrete. Cross-tie rods 13 attached to the T elements 11, serving during the placing of the concrete to hold the two forming surfaces of the wall at desired distances apart, also become embedded, and together with the wires constitutes effective metal reenforcing for the concrete. In the complete structural wall of Fig. 5, one surface of the concrete core 24 is faced with "plaster board" 20 by attaching to the upright elements by means of nails 19 driven between the vertical angle-irons 11*a* and 11*b* which make up the T shaped uprights. The surfacing for the other side of the concrete core 24 consists of wire-mesh sheets 26, with attached paper membrane 15, fastened to the uprights as described above. On this wire mesh base 26 are applied layers of stucco or plaster material 29. Air spaces 27 and 28 are thus formed between the stucco or wall board and the flutes of the concrete core 24.

Figs. 7 and 8 show an alternative forming structure in which chord members across the concave arches are not used, but the sheets are held in arched formation by longitudinal reenforcing bars 30 placed on the convex side of the arch. As shown, these longitudinal bars 30 are attached to the cross-tie members 13 by notching, but they may be wired or welded at the crossings. Any suitable outside finishing sheets may be attached on the outside of the concrete core after it is formed in this forming structure.

Figs. 9 and 10 show another arrangement in which the chord members are bars attached by nuts 32 to the ends of the end-threaded rods 13*b*, which serve as cross-tie members, the bars 31 being removable after the concrete core has set. The forming elements 11*c* in this alternative structure are represented as channel-shaped, and the bolts 13*b* hold the channels 11*c* at proper distances apart to form the wall structure, the arched sheeted members 14 being sprung between and held by the channels 11*c* and the threaded rods 13*b*.

Fig. 11 shows still another alternative arrangement in which the sheeted meshed material forms a continuous sheet providing forming surface for several adjacent flutes in the concrete core. This continuous sheet 14*b* is held in place against the upright framing elements 11 by barbed nails 19 or other suitable means, the two sides of the wall being held apart by the cross-tie bars 13. The flute-forming arches are held in position lengthwise before and during the pouring and setting of the concrete by longitudinal bars 30 suitably attached to the cross-tie members 13.

Figs. 14 and 15 show another arrangement for forming and constructing the composite concrete and plaster wall of my invention. One side of the wall structure may be formed as previously described above for Figs. 5 and 6, with T-shaped uprights 11, arched wire-mesh panels 14, concrete-retaining membrane 15 and chord means 20 of structural sheets such as "wall board" attached on the concave side of the arches to the

uprights 11; while the opposite side of the wall structure is formed by springing panels 14c of "expanded" metal or fine wire mesh in relatively flat arches between the uprights 11, using as chord members open wire mesh 20a stretched in a flat sheet on the outer wall and supported by nails 19 or other fastening means to the uprights 11. While other types of sheeted material which are concrete-retaining, may be used for the panels 14c, I prefer to use what is known as "expanded" metal sheets. By using sufficiently dry concrete mix for forming the core 24, this material will retain and form it, and the small amount of finer concrete extruding through the openings in the mesh or expanded metal, when hardened, provides keys for attachment of the later applied plaster coatings. The open wire mesh 20a serves not only as a structural chord, but also as a reenforcing base for stucco or plaster, which is trowelled through the mesh and upon it, filling the space 27a, and forming the desired flat surface finish 29 to the structural wall. The paper membrane 15 on the exterior of the flutes of the core 24, may be removed, if desired, after the concrete has set and before the stucco or plaster 29 is applied.

Figs. 12 and 13 show a similar arrangement, but in this structure a special wire mesh, with wires forming embeddable strands 16 on either side of an intermediate concrete-retaining membrane 15, is used for the flat arched panels 14d, which are sprung between acute angled T-shaped uprights 11d, with cross-ties 13 to the opposite wall uprights 11. No chord member is used on the concave side of the arched panel sheets 14d, but the longitudinal bar 30, fastened by tying or welding to the cross-ties 13, holds the flat arches in sprung formation while the concrete mix is being placed for the core 24, and become embedded within it. The wire strands 16b exterior to the concrete afford anchoring means for the surface finishing stucco or plaster 29, which may be plastered on in a sufficiently thick layer to fill the shallow flutes in the concrete core to a flat wall surface.

Figs. 16 and 17 show another self-reenforcing form for a concrete wall or core, to which surface finishing materials may be attached to provide structural walls such as for houses. This forming structure consists of T-shaped upright members 11, joined across the wall-forming space by cross members 13. On one wall side, between the upright members 11 are sprung arched panels 14 of concrete-retaining sheet material of the type above described as welded wire mesh with a concrete-retaining membrane such as paper 15 attached to the exterior side by links or stitches 22. Serving to hold the uprights 11 from displacement by the sprung arch panels 14, are longitudinal bars on the convex side of the arches, and preferably adjacent to them, which are tied or otherwise attached to the cross-tie members 13. On the opposite wall side, a concrete retaining sheeted material such as "expanded" metal, small meshed wire, or open wire mesh with attached paper backing, is attached to the flat face of the T-shaped uprights. In the drawing the concrete-retaining sheeted material is represented as open wire mesh 14 having paper 15 with wire stitches 22 on its inner (concrete) ide. Parallel to this sheeted material are longitudinal bars 30a attached to the cross-ties 13, and at intervals wire links or ties 23 are attached between the longitudinal bars 30a and the wire stitches 22 of the wire mesh 14. The purpose of these wire links is to prevent outward bowing of the flat side of the form when the concrete mix is placed within it. When the concrete is placed, the wires of the sheeted material in the arches and on the flat surface, as well as the cross-ties 13, the uprights 11, the longitudinal bars 30 and 30a, and the ties 23 become embedded and constitute the reenforcing metal structure for the concrete wall. Suitable exterior finishes may be applied to either or both sides of the concrete wall thus formed, by attaching to the uprights 11, or by coating over the surfaces, with or without additional plaster "base" sheets.

Figs. 18, 19 and 20 show another form of uprights and cross-ties which may be used in carrying out my invention. The uprights consist of metal pipe 33, which are joined, for opposite walls, by cross-tying members 13 welded or otherwise attached to the pipes 33 to form a suitably braced structure. To the opposite side of the pipe surface is attached a metal strip 34 from which has been punched protruding metal tabs 35. These tabs form the means for attaching sheeted material to the uprights, and the angles, marked 36, between the pipe and the metal strips 34 provide an abutment seat for the arched sheets which form the flutes in the concrete core of my structure.

My invention provides means of producing concrete walls for low cost construction particularly for small houses in which the height of the wall is not great and in which light steel framing elements may be used as described. The framing elements may be of the usual angle-iron construction of suitable strength, but for ordinary small construction, I prefer to use angles made from heavy galvanized sheet metal. The flute-forming arches may be of sheet metal, plain or "expanded," but preferably I use wire mesh; the wire being of a size to withstand the load of the concrete mix, and to provide the required reenforcing effects when the concrete has set. The wires or rods may be straight or crimped and the sheets may be plane or corrugated or otherwise warped. The concrete-retaining membrane which is attached to the open mesh wire is preferably water-proof paper, but may be any material such as burlap or fabrics to retain the concrete. Fine meshed wire netting or "expanded" metal sheets may be used instead of wire mesh with attached paper, and very dry concrete, which is retained by such structure, may be compacted against these sheets by vibration.

If desired, additional reenforcing bars may be used in parts of the structure. The outside surfaces of the ventilated structural wall may be of any suitable material and may be attached as chord members by suitable means. For low cost construction, I prefer to employ a wire-mesh having a paper backing, (commonly called "stucco-base" or "plaster-base") fastened to angle-irons in T-formation by nails driven between as above described, using plaster finish on the interior and cement stucco on the exterior. The paper membrane remains within the dead air space formed between the fluted concrete walls and the outer wall elements, and if it is water-proofed paper, adds additional "damp proofness" to the finished structure.

While I have described various forms of my invention, I do not wish to be limited thereby, and restrict my invention only insofar as is required by the prior art and the spirit of the appended claims.

I claim:

1. A form for a monolithic concrete wall structure comprising vertical framing elements, inwardly arched self-supporting sheeted members sprung and held by compression between adjacent framing elements defining at least two sides of a space to be filled with concrete, and tie means attached to said framing elements and wholly within the space for concrete, adapted for holding said arched members in place during the pouring and setting of the concrete.

2. A form for a monolithic concrete wall structure comprising vertical framing elements, inwardly arched sheeted members sprung and held by compression between adjacent framing elements defining at least two sides of a space to be filled with concrete, and reenforcing bar members attached to said framing elements within the space to be filled with concrete, and adapted to hold said arched sheet members in arched formation.

3. A form for a monolithic concrete wall structure comprising vertical angle-iron elements disposed in parallel formation, inwardly arched sheeted members sprung and held by compression between adjacent angle-iron elements defining at least two sides of a space to be filled with concrete, and bar members attached to said angle-iron elements and wholly within the said space for concrete, and adapted to hold said arched sheeted members in position.

4. A form for a monolithic concrete wall comprising upright framing elements disposed in double rows, inwardly arched sheeted members sprung between adjacent framing elements in each row defining a space to be filled by concrete, cross-tie means for holding said framing elements in parallel formation and chord membere attached to said framing elements across said arched members.

5. A form for a monolithic concrete wall comprising upright framing elements disposed in double row formation, inwardly arched sheeted members sprung and held by compression between adjacent framing elements in each row defining a space to be filled with concrete, cross-tie means adapted to serve as reenforcing bars in the monolithic concrete structure for holding said framing elements in parallel formation, and tension members for said arched sheeted members attached to said cross-tie means.

6. A form for a monolithic concrete wall structure comprising framing elements disposed in parallel formation, inwardly arched wire-mesh sheets sprung between adjacent framing elements defining at least two sides of the space to be filled with concrete, a concrete-retaining membrane attached to the exterior surface of said wire-mesh sheets, and chord members attached to said framing elements across said arched sheets.

7. A form for a monolithic concrete wall structure comprising upright angle members disposed in parallel formation, inwardly arched paper-backed wire-mesh sheets sprung between adjacent angle members defining at least two sides of a space to be filled with concrete, and chord members attached to said angle members across said arched sheets.

8. A form for a monolithic concrete wall comprising upright elements disposed in double row formation, inwardly arched sheets sprung between adjacent framing elements in each row defining the space to be filled with concrete, cross-tie bars between opposite upright elements in the two rows adapted to serve as reenforcing bars in the monolithic concrete structure, and longitudinal reenforcing bars within the space for concrete attached to adjacent cross-tie bars to hold said uprights in vertical position against said sprung arched sheets.

9. A form for a monolithic concrete wall comprising upright angle members disposed in parallel formation, inwardly arched paper-backed wire-mesh sheets sprung between adjacent angle members defining at least two sides of a space to be filled with concrete, and tie means attached to said angle members to hold said members in vertical position.

10. A framing structure for a form for concrete comprising two T-shaped structural members disposed with the top of the Ts parallel, and cross-tie bars attached to the stem of said T members for holding said members apart, each of said T-shaped members consisting of two adjoining angle strips welded at the adjoining angles and at the adjoining edges at spaced intervals.

11. A monolithic concrete structure comprising a concrete wall having a series of vertical flutes of arched section on either longitudinal side, the bottoms of the flutes on the two wall sides being oppositely disposed, and meshed metal reenforcing bars embedded within the concrete at the arched surfaces of said flutes the arched bars of said mesh being under compression and bending stress.

12. A hollow structural wall comprising a monolithic concrete core having a series of vertical flutes of arched section on either side and having arched metal reenforcing bars under compression and bending stress embedded within the curved surfaces of each flute and held between reenforcing metal angles at the fillets between flutes, and a structural layer attached to said reenforcing angles as chords to form hollow spaces defined by the flutes of said core and the structural layer.

13. A hollow structural wall comprising a monolithic concrete core of double fluted cross-section having metal reenforcing bars under compression and bending stress embedded within the arched surfaces of each flute and having reenforcing metal angles at the outer flute edges, a sheeted plaster base attached to said reenforcing angles, and a plaster layer on said base to form hollow spaces between the flutes and said layer.

14. A hollow structural wall comprising a monolithic concrete core of double fluted cross-section having metal reenforcing bars under compression and bending stress embedded within the arched surfaces of each flute and having attaching means at the outer flute edges, and structural sheets attached by said attaching means to form hollow spaces defined by the flutes and the structural sheet.

JOHN C. PELTON.