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Moore

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[54] **INSULATED, TUBULAR-WALL CONSTRUCTION AND METHOD**

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[22] Filed: **Apr. 23, 1973**

[21] Appl. No.: **353,765**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 131,003, April 5, 1971, abandoned.

[52] **U.S. Cl.** **52/382,** 52/127, 52/371, 52/404, 52/443, 52/741

[51] **Int. Cl.** **E04b 1/74,** E04f 13/04

[58] **Field of Search** 52/380–383, 52/404, 405, 408, 411, 238, 241, 254, 127, 741

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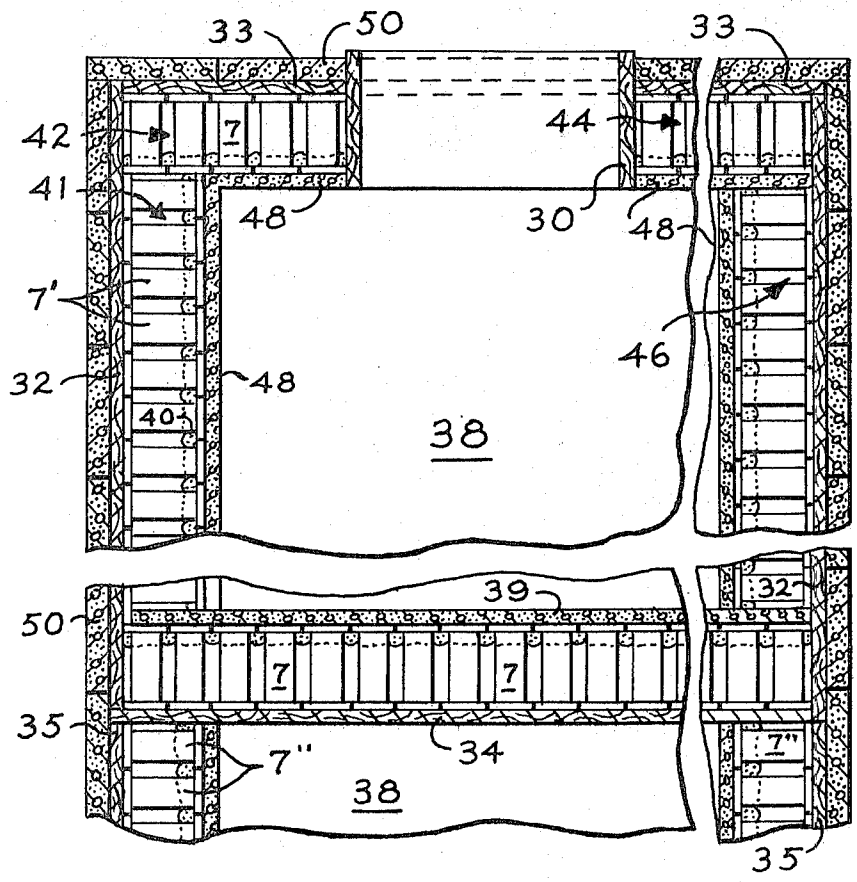
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[57] **ABSTRACT**

Upright or horizontal walls of stationary buildings or vehicles, comprising stucco, plaster, epoxy putty or other plastic material on and between end elements of used, opened, non-rectangular cans (or optionally on new cans), each of which comprises a tube and end elements bonded to the tube. The cans are placed on a can-backing wall element and between upright wall elements that may comprise for example plywood sheets or vertical building-corner elements. The cans contain gaseous material which may comprise: air or other gas, alone; such gas mixed with fibrous insulation, foamed plastic, insulating pellets or hollow globules, bark modules, short lengths of air-containing reed or bamboo or other hollow or pithy stems; or gas mixed with any other kind of insulation. Stucco (comprising portland or epoxy cement or lime, mixed with fine aggregate or the like) is troweled or sprayed on end elements of the previously assembled cans. Tongues of the stucco, holding it in place, go into cavities between contiguous portions of the can sides and when the cans are of the used, opened type also into the openings of the can-end elements. Optionally, the cans may be of glass (bottles or jars). The invention comprises a method of making the composite wall.

16 Claims, 12 Drawing Figures



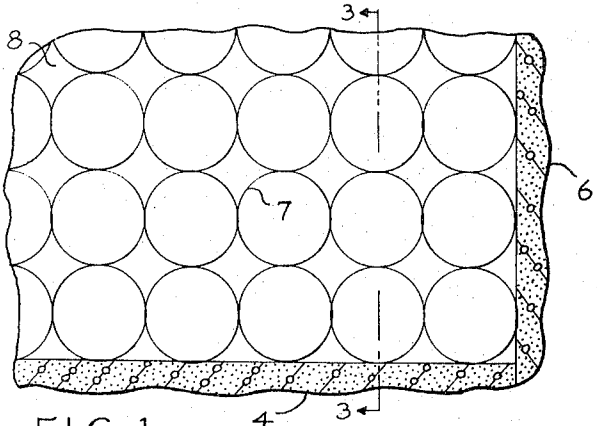


FIG. 1

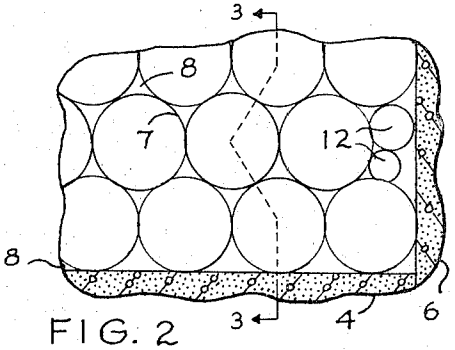


FIG. 2

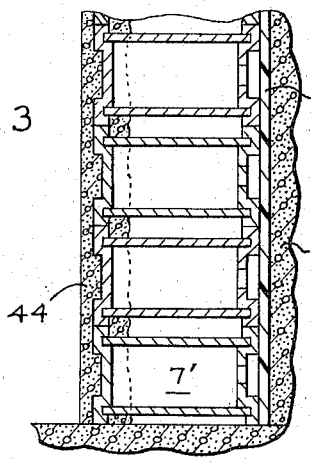


FIG. 3

FIG. 4

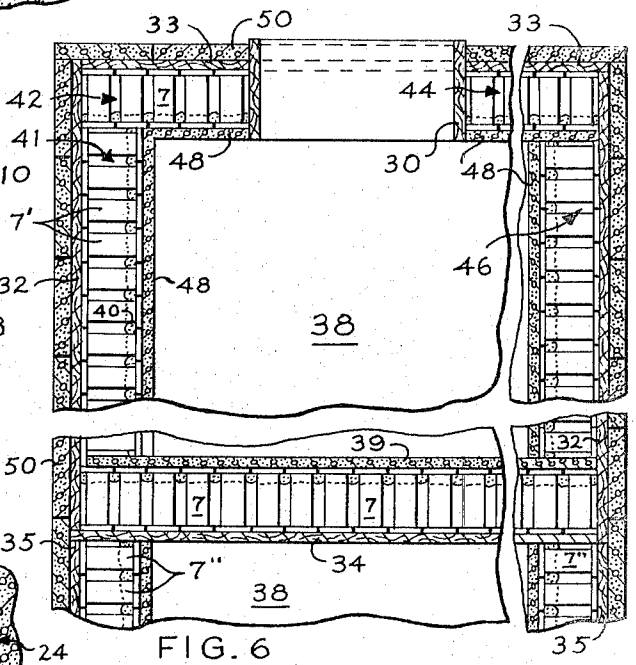


FIG. 6

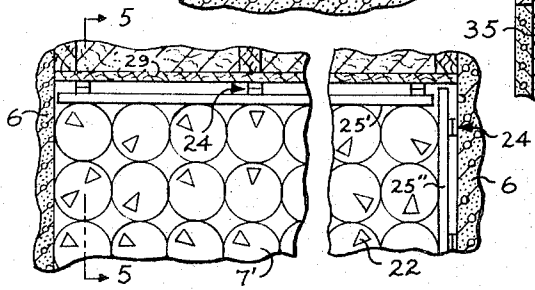


FIG. 5

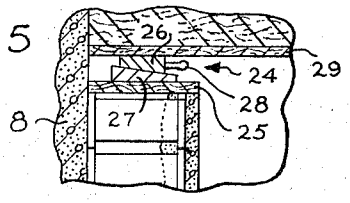


FIG. 11

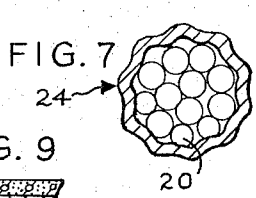


FIG. 7

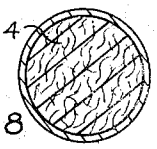
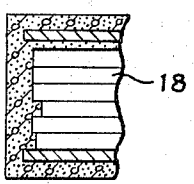


FIG. 8

FIG. 9



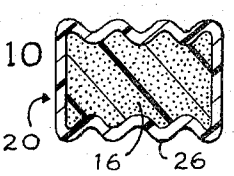
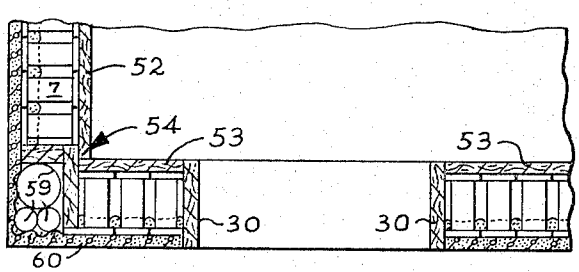


FIG. 10



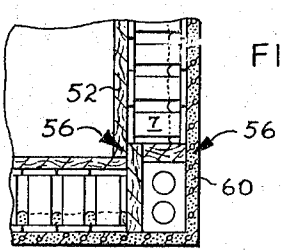
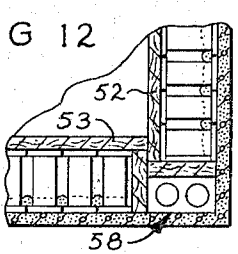


FIG 12



INSULATED, TUBULAR-WALL CONSTRUCTION AND METHOD

This application is a continuation-in-part of application Ser. No. 131,003, filed on Apr. 5, 1971 and now abandoned.

In view of the long-existent need for an economical, easily built, insulated wall and building, some of the objects of this invention are to provide: (1) a stuccoed wall (upright wall, roof or deck) comprising non-rectangular cans that contain gaseous insulating material, have end caps or closure elements that are backed by a rigid wall element, have contiguous side portions, and are supported on a lower wall and between and against at least two upright wall elements, providing cavities between can sides, into which stucco is troweled or sprayed; (2) a wall of this type in which the insulating material in the cans comprises air or other gas mixed with fibers or other porous insulating material; (3) such a wall in which the insulating material comprises foam plastic; (4) such a wall in which the insulating material comprises bark modules, preferably treated with preservative; (5) a wall of the type of (1) above, in which the cans are of the used type, having holes in minor portions of the can-end caps that before stuccoing are exposed to ambient air and are adapted to receive and hold tongues of stucco, similar to the stucco tongues in cavities between can sides; (6) a wall as in objective (1) or (5), above, comprising hardened stucco; and (7) a wall as in (6) above, in which two of the upright, can-stack-supporting wall elements are wall-corner or house corner structures. Other objects of the invention will be apparent in the following specification and accompanying drawings.

In these drawings:

FIG. 1 is an elevational view (or optionally a plan view), partly broken away, of contiguous cans of one form of the invention, in place on a lower wall and between and bearing against two rigid upright wall elements, before stucco, concrete or the like is applied on and between can ends;

FIG. 2 is a similar view, showing a different arrangement of the cans;

FIG. 3 is a sectional view from a plane comparable to that indicated at 3—3 in FIG. 1, but showing stucco as having been placed against and between can ends;

FIG. 4 is an elevational, sectional view, partly broken away, illustrating a ceiling, two upright wall elements and a stack of used, opened cans (shown in elevation), with the opened can-end covers ready to receive stucco;

FIG. 5 is a sectional detail view from the plane 5—5 of FIG. 4;

FIG. 6 is a horizontal sectional view of a portion of a building, comprising at least two rooms, each of which has four walls and includes stacks of cans and stucco (or plaster) in can-provided cavities;

FIG. 7 is a detail sectional view of a corrugated can, containing gaseous material that comprises gas and insulating can-filler elements that may be considered as globules, small-diameter stems or bark modules;

FIG. 8 is a detail sectional view of a cylindrical can, containing fibers as an exampled gaseous insulating material;

FIG. 9 is a fragmentary sectional view of a used, opened can, exampled as containing stems of reed or the like and supporting stucco or concrete;

FIG. 10 is a detail sectional view of a different type of corrugated can, having annular corrugation ridges, and gaseous insulating material that is exampled as foamed plastic;

FIG. 11 is a horizontal sectional view of a portion of a room, illustrating stuccoed stacks of cans that are flanked and supported by wall-corner elements; and

FIG. 12 is a fragmentary sectional view, similar to part of FIG. 11, illustrating a variation of the can-supporting wall-corner elements.

FIGS. 1 and 2 illustrate optional arrangements of the tubular members 7, placed within three (or four) preferably rigid wall elements 4 and 6. Each of these figures may be considered as a view from either a horizontal or a vertical plane. When, as is preferred, each is in vertical section the illustrated, quadrilateral room may be similar to that of elevationally sectional FIG. 4, or of horizontally sectional FIGS. 6 and 11. But when, as is optional, the cans 7 of FIG. 1 or 2 are in a horizontal wall (a floor, ceiling or roof), the elements 4 and 6 are vertical and the element 8, which backs or supports the cans, is then a concrete foundation slab, or leveled ground, or a strength-providing ceiling of a lower-story room. In this optional form of the invention there are two parallel upright wall elements 4 and two parallel upright wall elements 6; and the cans 7 have end-caps that are contiguous to and bear on the substantially planar upper surface of the horizontal wall element 8. In each instance this element 8 is optionally coated with asphalt, plaster or other adhesive material, 10.

When, as is preferred, the cans 7 form insulating, strength-providing framework of vertical or otherwise upright walls, the wall element 4 is a foundation slab or floor; and on this element 4 the lower tier of the cans is placed. Then on this tier the cans are stacked between the two substantially parallel upright wall elements 6 (one of which is not shown in FIGS. 1 and 2). These wall elements 6 prevent the cans from rolling and tumbling out of place, holding them in position for stuccoing or plastering. Substantially coplanar end elements or caps of the cans 7 are contiguous with a lateral surface of the wall element 8, and optionally may be pressed slightly into waterproofing adhesive material 10.

In FIG. 2 the cans 7 are staggered, and at ends of the alternate, staggered can rows, smaller cans, 12, preferably fill parts of the row-end spaces where larger cans will not fit.

The gaseous insulating material within the hollow interiors of the cans, in each of the figures, optionally may be air, helium or other gas, alone, or gas mixed with insulating filler elements. Such filler insulation may be: cinders; ashes; slag; shredded bark (preferably treated with preservative; shells; pumice; vermiculite; expanded clay or shale; glass or other fibers (illustrated at 14, FIG. 8 — for example, rockwool, glass fibers, preservative-treated excelsior, cotton, cotton linters, bagasse, Spanish moss or the like); cellular foam plastic (exampled at 16, FIG. 10); shredded foam plastic; air-containing stems (illustrated at 18, FIG. 9 — for instance, lengths of reed, bamboo, other hollow or pithy plant stems, or small-diameter plastic or glass tubing); or plastic or glass hollow globules, pine-bark modules or pellets (20, FIG. 7).

The cans 7 optionally may be of plastic or of glass (for example, used or new glass jars or bottles), but preferably they are of metal; and preferably they are

used cans (illustrated at 7' in FIGS. 3, 4 and 6), having held beer, soft drinks or juice, and having opened end caps — for example, the triangular holes 22 of FIG. 4, which are in only a minor portion of each opened end cap. In stuccoing, the plastic stucco goes into these holes 22, as well as into spaces between the can sidewalls. As indicated in FIG. 4, the maximum distance between the openings 22 and the cavities between cans, for bridging over of the stucco on solid portions of the opened can-end covers, is short, due to the arrangement of the used cans with the holes 22 positioned to receive stucco, thus facilitating holding of the plastic stucco on the cans and strengthening the hardened stucco.

The tubular parts of the cans preferably are cylindrical, but optionally they may have corrugated ridges that are parallel to their axes (as at 24, FIG. 7) or annularly corrugated, as illustrated at 26 in FIG. 10).

In preparation for stuccoing on the cans, they preferably are held in stable position not only by the upright wall elements but optionally also by auxiliary means for this purpose. This means may be shims or wedging elements (for example, pieces of wooden, asphalt or asbestos-cement shingles) inserted in spaces between sides of the cans and one or more of the upright wall elements. Another example of such shimming or wedging means is shown at 24 in FIGS. 4 and 5. Here the can-tightening means comprises a board or bar (25, 25', 25'') of rigid or stiff material (wood, metal or fabric-reinforced plastic) which flanks all of the cans in a vertical wall, transmits can-stabilizing pressure to sides of the cans and also serves as a ground, providing a line to which the stucco may be troweled. For forcing this bar toward the sides of the cans the wedges 26 and 27 are provided. When the wedge 26 is forced toward the can-backing wall element 8 (as by hammering or pushing), its inclined surface is moved over the inclined surface of element 27 (this element optionally being nailed, screwed and/or glued to the bar 25), and thus this bar applies pressure against the adjacent can sides, stably tightening the cans in place.

Although the wedge elements optionally may be stuccoed over and left in the stuccoed wall, preferably they are withdrawn for further wedging use after the stucco is set or nearly set. The knob or other handle 28, held by pliers or fingers, facilitates this withdrawal. Also this knob or projection (preferably of solid metal) facilitates assembly and forcing together of the wedging elements since it may be manually held in moving the element 26 into position and then may be tapped with a hammer in tightening the cans. Preferably, the elements 26 and 27 are elongated bars of the same length, extending over a major portion of the length of the bar 25, which bridges all the cans on one side of the wall group of cans. Preferably, two spaced knobs or handles 28 are fixed to 26.

As an alternative means for stabilizing the cans before stuccoing, the wedging elements 24 and the bar 25'' of FIG. 4 may be eliminated, and the bar 25' of steel (or optionally lead-coated wood) may be sufficiently heavy to place enough gravity-caused pressure on the stack of cans to force them into tightly contiguous relation with each other and against the two upright wall elements 6. Then after the stuccoing is completed the bar 25' (preferably having a pull of the screen-door type, or a knob) is withdrawn and stucco is troweled into the space between the top cans and the element 29.

FIG. 6 illustrates a nearly completed room and part of another room of a house or other building. A door (or window) frame is shown at 30, and other door or window elements are present in the broken-away parts of the figure. Interior edges of these frames serve as aligning grounds to which the interior stucco is troweled. This building is preferably built in accordance with the following method: (1) a substantially rigid wall, preferably comprising angularly-joined upright wall elements that are sheets of plywood, 32, 33, 34 and 35, is formed by nailing and/or gluing the sheets at corners (this plywood is preferably three-fourths of an inch in thickness and is waterproofed at least on its exterior surface). (2) On the horizontal wall element 38 (a concrete foundation slab or a strength-providing rigid floor over a ceiling of a lower story) a lower tier of the cans 7 is placed, these cans being backed by and contiguous with the inner surfaces of the plywood 34; (3) on this lower tier the cans 7 are stacked up to or nearly to the ceiling level; (4) optionally with or without the can-bracing wedging elements of FIG. 4 between the ceiling and the stack of cans (and/or between the stack and one of the side elements 32), the stucco 39 is applied (preferably by troweling) to the can-end caps, into the cavities between them (and when the cans are of the used, opened type short distances thru the can-end openings (as exampled at 40). (5) The stacks of cans indicated at 41, 42, 44 and 46 are formed. (6) Optionally with can-stabilizing means, 24–28, in place, the stucco 48 is troweled (or optionally sprayed) on the end caps and cavities of the cans. (7) On the lower wall 38 and against can-backing wall elements 35 the cans 7'' are placed in parallel stacks. (8) Optionally with or without can-stabilizing means, the stucco 48 is applied on ends of the cans 7'' (preferably troweled, or optionally sprayed). (9) Veneering bricks of baked-clay or concrete (or concrete blocks) 50 are laid in mortar on the outside of the sheets 32 to 36 (any other type of exterior building material may be substituted for these bricks or blocks — for example, aluminum, plastic, steel or wood siding, nailed to the upright sheets, asbestos-cement or wood shingles, or stucco on mesh); (10) doors and windows are placed in the frames.

FIGS. 11 and 12 illustrate upright can-containing walls made in accordance with the above method. Here the cans are exteriorly stacked against can-backing plywood or other planar wall elements 52 and 53 and between can-bracing, wall elements 54, 56 and 58 which in this instance are exterior-of-the-room building-corner elements. The corner element 54 comprises a pair of angularly-joined boards (or an elongated, metallic or reinforced-plastic angle, to which the wall elements 52 and 53 are fastened. Within the angle of these boards (or of the optional metallic or plastic angle) the elongated cans or tubes 59 are uprightly stood and preferably bonded together by bits of epoxy putty or the like. Metallic mesh is fastened to edges of the boards and angularly around the tubular members 59. Each of the corner elements 56 and 58 comprises vertically stacked concrete or baked-clay blocks, preferably mortared together. In element 56 the longer dimension of these blocks extends in one horizontal direction; and in element 58 it extends in another direction, with ap-

propriate change in shape of the angled boards (or angle).

With the cans in place, and optionally tightened in position by can-stabilizing means, the stucco **60** is troweled (or optionally sprayed) on the can ends. Thus the stucco in this instance is the exterior surface of a very economical and yet very strong building, which utilizes inexpensive, wall-strengthening-and-insulating cans — which are preferably used cans, the disposition of which is now a hard problem in the western world.

In the claims, unless otherwise qualified, the word "can" means a tubular element having end closures, of any cross sectional shape and material; the word "stucco" signifies material that is pasty when applied but sets with passage of time, for example, portland or plastic cement mixed with fine aggregate; the term "applying stucco" means: troweling or spraying; and the term "applied in situ against can ends" means: troweled or sprayed on ends of cans previously assembled between wall elements.

I claim:

1. Wall structure, comprising at least four angularly joined wall elements, including:

a lower wall element of firm material having a substantially planar upper surface;

an upright can-backing wall element having a can-positioning surface of considerable area;

two other upright wall elements, angularly joined to spaced, upright portions of said can-backing element;

adhesive material on said can-positioning surface;

a plurality of used, non-rectangular cans of liquid-canning type, containing gaseous material, each of said cans comprising a tube, an imperforate can-end cover, and a second, opened can-end cover having a hole thru a minor portion of it, the said cans having: substantially parallel axes that are transverse to said can-positioning surface; portions of the sides of each adjacent pair of cans that are in contact and other side portions of each said pair that are spaced from each other, having cavities between them; and outermost side portions of the cans that are in closely adjacent relation with surfaces of said two other upright wall elements; and

hardened stucco on said opened can-end covers, having: a substantially planar outer surface; inner portions contiguous with can material of said opened covers; other inner portions in the form of tongues projecting into said cavities between side portions of the cans; and other inner portions projecting in the form of tongues into said can-end cover holes, aiding in holding the stucco on the cans and strengthening the combination of said stucco and cans.

2. Structure as set forth in claim **1**, in which said gaseous material in the cans comprises gas and thermally insulating material.

3. Structure as set forth in claim **1**, further including means lying on uppermost portions of said cans for forcing said cans into stable condition between said two other upright wall elements, providing firm stucco bases.

4. Structure as set forth in claim **3**, in which said means includes an elongated piece of firm material, lying on said cans, having a width which exceeds the length of the cans by a distance approximately equal to the thickness of said stucco, and having a straight-edge portion, serving as a ground for the stucco.

5. Structure as set forth in claim **4**, in which said elongated piece, lying on said cans, has sufficient weight to jam the cans together and to jam their laterally outermost portions against said two other upright wall elements; the said elongated, weighted piece being removable from the stuccoed wall.

6. Structure as set forth in claim **4**, further including an upper, substantially horizontal wall element, angularly joined to said three upright wall elements, having a space between it and said elongated piece, in which the said means further includes upper wedging elements in said space, having cooperating wedging surfaces, the lower one of said wedging elements being fixed to an upper portion of said elongated piece, and the upper one of said wedging elements being movable relatively to said lower wedging element, for forcing said lower element and elongated piece into jamming contact with uppermost portions of said cans.

7. Structure as set forth in claim **6**, in which: a vertical plane containing a straight line of said straight-edge portion is clear of all portions of said wedging elements; the said wedging elements are adapted to remain in said space; and said wedging elements and space are adapted to be sheathed over in a completed wall.

8. Structure as set forth in claim **6**, in which: a vertical plane containing a straight line of said straight-edge portion is clear of all portions of said wedging elements; and the said upper wedging element further includes projecting means adapted to be forcibly moved in jamming said wedging surfaces together, and adapted to be manually held for withdrawing said upper wedging element from said stuccoed wall structure, and freeing said lower wedging element for its withdrawal from the wall structure.

9. Structure as set forth in claim **8**, in which said projecting means includes at least one knob.

10. Structure as set forth in claim **8**, in which said projecting means includes spaced knobs, fixed to edge portions of said upper wedging element.

11. Can-containing wall structure, comprising at least four angularly joined can-supporting elements, including:

a lower, substantially horizontal can-supporting element;

two spaced, upright wall-corner, can-supporting elements, each of which includes vertically stacked masonry units and mortar between each pair of said units;

an upright, can-backing wall element, having a can-positioning surface of considerable area, fastened to each of said corner elements;

adhesive material on said can-positioning surface;

a plurality of used, non-rectangular cans of liquid-containing type, containing gaseous material, each of said cans comprising a tube, an imperforate can-end cover, and a second, opened can-end cover having a hole thru a minor portion of it, the said cans having: substantially parallel axes that are transverse to said can-positioning surface; portions of the sides of each adjacent pair of cans that are in contact, and other side portions of each said pair that are spaced from each other, having cavities between them; and outermost side portions of the cans that are in closely adjacent relation to said corner elements; and

hardened stucco on said opened can-end covers, having: a substantially planar outer surface; inner portions contiguous with can material of said opened covers; other inner portions in the form of tongues projecting into said cavities between side portions of the cans; and other inner portions in the form of tongues projecting into said can-end cover holes, aiding in holding the stucco on the cans and strengthening the combination of said stucco and cans.

12. Structure as set forth in claim **11,** in which: the said upright corner elements further include boards; and the said can-backing wall element is fastened to said boards.

13. A method of constructing a composite wall of used cans of liquid-containing type on a can-backing wall element, having a lateral surface of an area substantially equal to that of the desired wall and flanked by a lower, substantially horizontally positioned can-supporting element and two upright can-bracing wall elements that are angularly joined to said can-backing element and adapted to stabilize and hold the cans against sidewise rolling, including the following steps:

a. forming a pair of spaced, can-bracing pillars by stacking and mortaring together wall-corner masonry units on the said lower can-supporting element;

b. stacking on said lower element and between said pillars numerous used cans of liquid-containing type, with their axes substantially parallel, portions of the sides of each adjacent pair of cans in contact and other side portions of each adjacent pair of cans having cavities between them; each of said cans containing gaseous material and comprising a tube, an imperforate can-end cover, and a second, opened can-end cover having a hole thru a minor portion of it; the imperforate can-end covers being placed in closely adjacent relation to said can-backing wall element; and the opened can-end covers being substantially aligned in an upright plane, with their unperforated solid portions and their said holes exposed to ambient air, ready to receive stucco;

c. applying stucco in pasty condition against said solid portions, into said cavities in tongues of stucco, and into said holes with other tongues strengthening the combination of can-end covers and stucco; and

d. allowing the stucco to set into strength-providing material.

14. A method as set forth in claim **13,** further including, before said step (b), coating said lateral surface with adhesive material; in which said step b includes jamming said imperforate can-end covers against said adhesive material.

15. A method as set forth in claim **13,** further including, before said step (b), placing thermally-insulating material, mixed with air, into a plurality of used cans; in which the said step (b) comprises stacking the said plurality of insulation-containing cans with the holes in end-covers of said used cans facing toward the workman.

16. A method as set forth in claim **15,** further including: before said step (b), providing an upper, substantially horizontally positioned element above the space for placing said cans; before said step (c), temporarily placing on uppermost portions of the cans of said step (b) can-depressing means, comprising a bar-like element, for forcing said cans into stable position between said pillars, providing firm stucco bases and a ground for the stuccoing; and, after said step (d), the following two steps:

e. withdrawing said can-depressing means from above the cans and stucco, leaving a small unstuccoed space between said cans and said upper element; and

f. troweling stucco into said small space.

* * * * *