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[54] **PORTABLE MOLD FOR ERECTING CONCRETE OR PLASTIC SHELTERS**

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[51] **Int. Cl.**.....**B28b 3/00,** B28b 7/32

[58] **Field of Search**.....249/65, 112, 97, 249/108, 96; 25/127 R, 128 D, 131 SC, 131 SD, 131 Z, 124; 264/31–34, 69, 94; 18/5 P, DIG. 14; 52/2; 425/405 H

[56] **References Cited**

UNITED STATES PATENTS

3,592,436	7/1971	Chandler	249/97 X
1,576,291	3/1926	Acker	249/108
2,579,801	12/1951	Crom et al.	25/127 R
3,206,155	9/1965	Nottingham et al.	25/124 X
1,964,386	6/1934	Nose	249/65 X
3,128,503	4/1964	Hahn et al.	25/127 X
2,311,358	2/1943	Baily	24/128 D UX
3,223,759	12/1965	Williamson	18/DIG. 14
2,892,239	6/1959	Neff	25/DIG. 12
3,530,208	9/1970	Rausing	18/5 P X
1,600,353	9/1926	Nose	249/65 X
3,057,368	10/1962	Seaman	249/65 UX
2,052,818	9/1936	Freyssinet et al.	25/128 K UX
2,823,442	2/1958	Nulle et al.	25/128 R X

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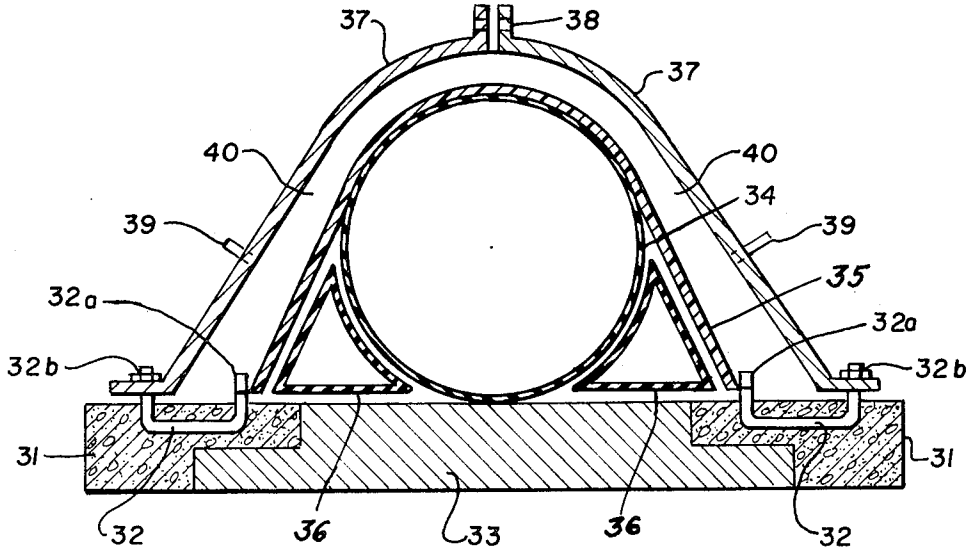
[57] **ABSTRACT**

The invention relates to a portable mold for erecting a poured concrete or plastic structure for use as a shelter or storage building. An inside inflatable form is used to develop an internal countour and supply a compressive force against a poured cement mix sandwiched between the inflatable form and an outside rigid form of determined contour, such as a quonset hut. The inflatable inner form can be removed after exhausting the compressed air from its confined area and may be reused.

5 Claims, 4 Drawing Figures



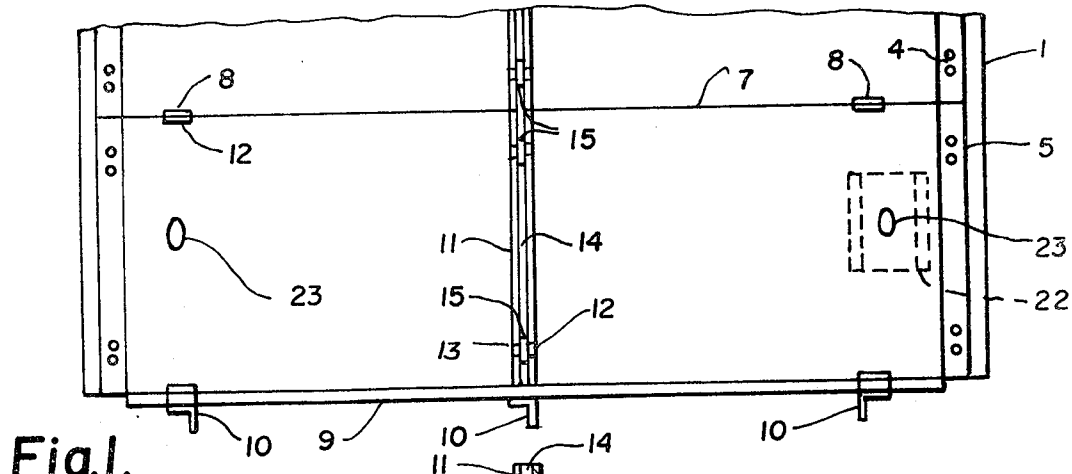


Fig.1.

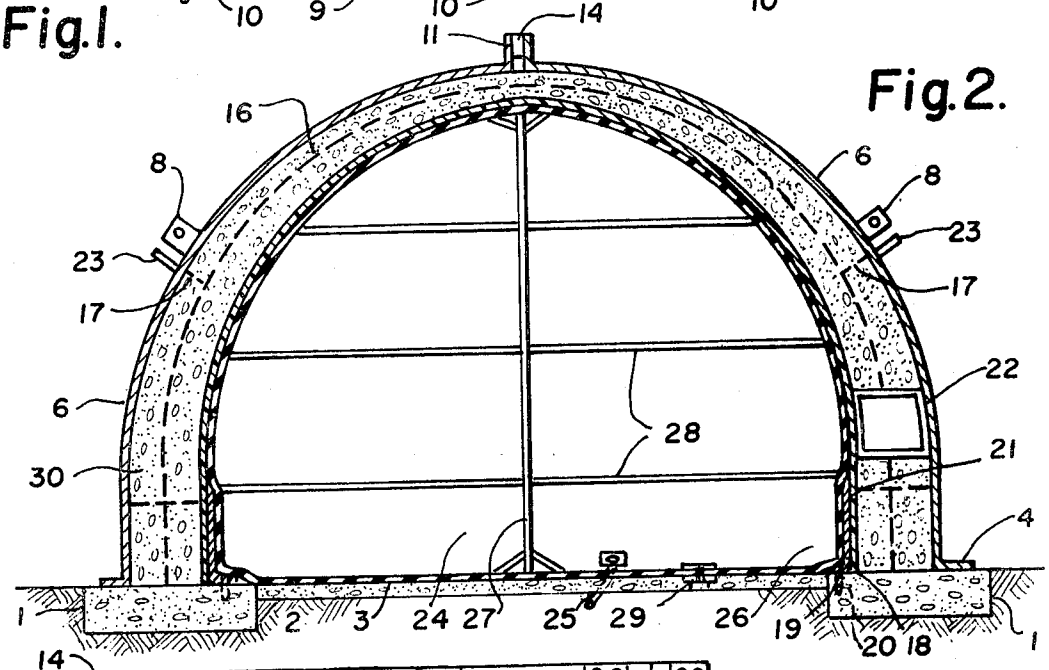


Fig.2.

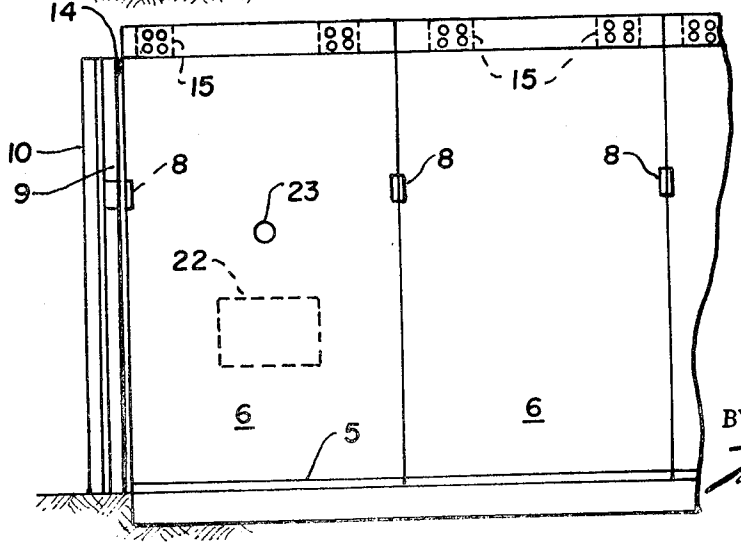


Fig.3.

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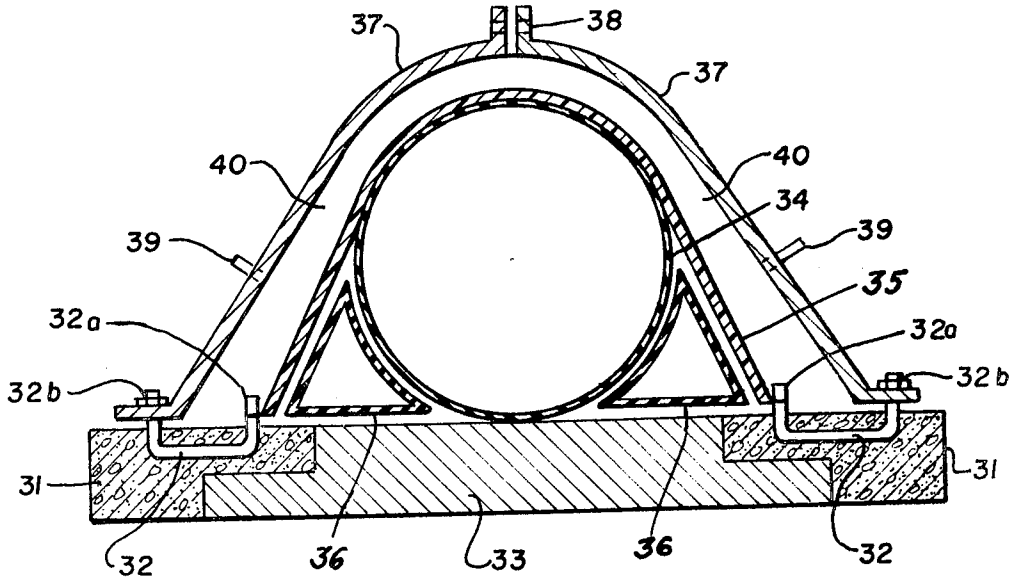

Fig. 4

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PORTABLE MOLD FOR ERECTING CONCRETE OR PLASTIC SHELTERS

This invention relates to a novel form for erecting a poured concrete or plastic structure for habitation, storage, or shelter.

An outstanding disadvantage of commonly used forms for erecting shelters or huts has been that they are relatively complicated in design and generally comprised of parts that are not readily portable. Moreover, they are not flexible to permit easy variations in sizes and contours, as well as ease for inserting windows and door openings. Most important, they are not susceptible to quick assembly and very rapid erection of the concrete structure at the site.

An object of the present invention is to provide a novel form for erection of dwellings or large enclosures, which form is devoid of the abovenamed disadvantages.

A more specific object of the invention is to provide a novel portable form embodying essentially an inflatable inner form member surrounded by a rigid outer form in spaced relationship therewith which defines the outside contour of the enclosure, and wherein a cement or plastic mix is introduced between said forms and thereafter the inner form is inflated so as to compress said mix and force it to assume the shape of the outer and inner surfaces of said forms.

Other objects and advantages will become more apparent from a study of the following description taken with the accompanying drawing wherein:

FIG. 1 is a top view of the form embodying the present invention;

FIG. 2 is a vertical, cross-sectional view thereof;

FIG. 3 is a partial end view thereof;

FIG. 4 shows a modification.

Referring more particularly to FIGS. 1, 2 and 3 of the drawing, a form is shown for erecting a poured concrete or plastic structure for habitation, storage or shelter. The form illustrated, and by way of example, is somewhat the shape of a quonset hut.

The invention provides for easily erected and disassembled forms to receive and compress semi-fluid structural material into calculated shapes of predetermined dimension. The outside form may be of any simple geometric shape composed of rigid panels 6 erected and clamped at 4 to foundation footers 1, also clamped at 12, 13 at the top flanges 11 of the panels with spacers 15 barely separating the respective joined panels at the ridge line.

An inside wall rigid retaining form 18 provides for a pre-determined vertical height. The flange 19 of the rigid inside form is clamped at 20 to the foundation footer 1 with rigidity and extends for the full length of structure on two sides. The distance between outer form panels 6 and the inside wall retaining form 18 is architecturally calculated from structural requirements related to height and width of the completed structure. Outside panels 6 may be flanged or formed at their joining edge 7.

Reinforcement mesh 16 with spacers 17 common to the concrete process is spaced next to the outside form if structural design so requires it for strength. A protective water retaining polyethylene sheeting 21 may be placed between the reinforcement mesh 16 and the inflatable compressive form 24 that is moved into the rigid erected form. The inflatable form 24 is constructed of rubber or other elastic material so designed that when filled with a pre-determined quantity of air at a required pressure a definite contour will be attained. Shape may be designed by inside horizontal 28 and vertical 27 restrictors of webbing or other materials, and/or by vulcanized restrictive areas 26 in the body of the inflatable form in similar fashion to a bladder inflated in a football cover. A restrictive envelope may be employed to insure contour. The form would be rolled or folded into a manageable non-inflated mass for moving and storage. The inflatable form would be equipped with inflating nozzle connectors 25 and with an opening 29 to remove that condensed water which may form and accumulate inside the form.

The purpose of the inflatable form 24 is to have it assume a structural contour somewhat less in dimension than the outside rigid form 6. The distance from the fully inflated inside form 24 to the rigid form 6 would be greater near the foot and gradually decrease in thickness to the ridge 11 or top of the combination of confining forms as predesigned. Window and door shaping frames 22 may be placed as desired between the two forms. The floor area 3 need but be level on earth 2 or it may be constructed prior to placement of the inside forms.

The inflatable form 24 is partially filled with compressed dry air so that the shape and alignment is in correct relation to the rigid form 6. Once in alignment the form may be further inflated so that it has assumed nearly full contour and begins to stretch out the adjacent polyethylene sheeting 21. If sheeting is not used, a pre-shaped covering of fabric, plastic, or other protective and confining envelope may be employed to surround the inflatable form. An example is a leather covered football which has a preformed inflatable bladder and a leather cover.

Insofar as the exterior form 6 encloses a cubic volume of known amount and the inside inflatable form occupies, when fully inflated, a known cubic volume, then the difference would be that volume of space 30 to be filled with a selected material, such as cement and sand, concrete, plastic, or other structural material appropriate for architectural purposes.

End closures 9 may be pre-designed so that the panels may be clamped at 8 to the perimeters of erected outside longitudinal forms. The inflatable interior form 24 may then contour tightly against both end panels. If elected, one end closure 9 may be prepared by design to receive space allotment for cast-in-place concrete or other material. One or both ends 9 may be completed with pre-cast or pre-assembled end panels for erection upon removal of the inflatable form. Retaining end panels 9 may be reinforced with angles or other stiffening members 10 to resist the expanded inside form 24.

Semi-fluid cement, concrete, plastic or other structural material having the physical and/or chemical characteristics to solidify in reasonable time may be pumped into the void space 30 through valve openings 23 provided for the purpose. A sufficient volume is pumped into the confined space at each panel to conform to calculated requirement. The inflatable form 24 is then completely expanded to predetermined dimension by compressed dry air inflation. The expansion of the inside form will cause pressure to "squeeze" and mold the semi-fluid material to exact dimension of the confining forms. The semi-fluid material would "squeeze" upward pushing air, which is displaced,

through the opening **14** provided by the flange **15** separation at the ridge line **11** of the joined outside forms. Semi-fluid material appearing at the ridge line **11** would indicate proper air displacement. In some mixes having less fluid flow characteristics, the use of a vibrator against the outside form may improve the density of the material by reducing air entrapment.

All rigid outside forms **6,9** may be removed when the semi-fluid injected material has hardened to structural strength. The outside form clamps **8, 12, 4** are removed first and the rigid forms **6** removed. At this time any imperfect solidified area may be patch-filled with appropriate materials and the outside contour "brushed" for texture of the appearance or painted as desired.

The inside form **24** may now be partially deflated to relieve compression against the structure sides and top and pulled from the inside area. To assist in this removal and to reduce frictional resistance, polyethylene sheeting placed on the floor **3** at the time of form assembly will simplify removable of the inflatable form. The outside components of the forms an the inflatable form may be moved to next erection site.

The inside wall rigid form **18** may now be removed and any necessary patch filling of the inside structure may be completed. The polyethylene film will have served its purpose and been removed. The end walls **9** may be erected and joined to the roof and side structure by clamps **8.** End walls **9** may be of material, prefabricated or preformed, as the locale may require and complete with doors, windows, ventilators, etc. Electrical, plumbing, or other service requirements may be pre-designed into the components of the rigid forms.

Rigid forms may be coated on the inside with silicone, plastic, or such other material to reduce adhesive tendencies of the cured cement or other structural material. Rigid panels may be of any suitable material, preferably light in weight. Clamps may be of any design preferably to function without the need of bolts requiring tools. Flange holes should be slotted at **5** to make matching of pins and clamps **20, 4** simple in alignment. Spacers **15** in the ridge flange **11** of the outside form **6** may be permanently mounted to insure air venting during the injection of the structural material.

Injection material may be of sand and cement, with or without additives of stone or chemical and/or plastic compositions; or any other formulas or compositions which may be injected or placed in the forms and stabilized by chemical or physical means.

Not to be excluded is the use of this mold system to place treated or untreated particles of sand or other solids which may then be injected with chemicals, stabilizers, plasticizers or hardening compounds of any kind.

FIG. **4** shows a modification of the invention. The most simple inflatable forms are the sphere and the cylinder for fabrication and handling with resultant lowest cost of manufacture.

Advantage of this possibility is taken by using an elongated cylinder. A footer **31** encircles the area upon which the structure is to be erected. The shape of the footer may be of dual-depth, as shown, to resist horizontal movement, such as from sea pressures, or may be flat for housing units. Anchoring pins **32** are cast in the footer **31** in "U" shape for anchoring the forms **35** and **37.**

An inflatable cylindrical form **34** of neoprene, rubber or other flexible material is placed on the mid-centerline of the parallel footers **31.** A shaping form **36** of light-weight material (possibly an inflatable member) is then placed along the length of form **34** and adjacent the row of pins **32***a*.

A shaping blanket or form **35** is placed over the inflatable form **34** and shaping form **36** and firmly fastened at the tie pins **32***a*.

Air pressure applied to the inflatable form **34** will cause the form to expand into the shape of a cylinder and exert pressure against shaping form **36** and against shaping blanket **35** to cause a desired geometrical shape to be formed. This will be the basis of the desired inside forming which will compress fluid cement mix (or other materials) in space **40** against outer form **37.**

The outer restricting form **37** may be erected lengthwise in convenient handling panels tied at the base to footer **31** and fastened temporarily at tie-pin **32***b*. Opposite panels are fastened by temporary clamps **38** at the top flange of each paired panel as shown. Air and excess fluid cement may escape at the top formed flange by design of the flange. Each panel may be provided with a valve or opening **39** to permit flow of fluid cement (or other material) to be injected in measured quantity between the inner inflatable form comprising **34, 35, 36** and the outer restrictive form **37.**

In operation, the inside inflatable form **34, 35, 36** would be air inflated almost to full pressure and not quite to full pre-determined dimension. At each end of the assembled forms, a pressure resistant closing form would be firmly clamped or fastened to the outside restricting form to provide a totally enclosed vessel. A pre-determined quantity of fluid cement is injected through openings **39** into space **40** between inflatable form **34, 35, 36** and the outer restricting form **37.** Windows (not shown) may be formed such as by use of elements **22** shown in FIG. **2.**

Full determined air-pressure is now applied to the inflatable form **34, 35, 36** to compress the fluid cement into the space **40** of fixed geometric size between inner and outer dimensioned forms. Air may escape along the upper flange area of the outer forms and any excess cement will extrude at that escape also. During the compression operation, the cement mix may be vibrated by applying vibratory means against the outer form **37.**

Upon completion of curing time, the outer forming panels and end closures may be removed for re-use at a new site. The inner inflatable form **34, 35, 36** deflated are also removed to a new site. Pre-formed end panels may then be fixed to the structure to provide full enclosure.

Additional provisions may include the following:

The area **33** of floor space between the footers may be hard packed sand or earth. An alternate may include a full cement slab as a floor.

In some areas the structure may be cast as a "groin" for placement without the need of footers. The footers would then be used merely for casting purpose and reused for additional structures and the groins moved and placed as required.

If the footers are to be an integral part of the structure, then reinforcement rods and a lock-in cast should be provided in the footer.

It is not intended to exclude the provision of an integral footer and structure casting including a cast floor.

Metal reinforcement may be set in place, or reinforcing fibers added to the cement mix at the time of mix preparation.

An inner free-floating metal shaping blanket **35** may be used instead of that described as a flexible (nylon or other similar material) shaping member. The inflatable member **34** would then pneumatically lift the metal blanket to form position.

It is possible to provide at least one end with this casting procedure by providing a compression area at the one end. A slip forming operation employing this method may be used for continuous casting of the structure.

A variety of cast-in-place geometrical forms may be utilized to provide for highway culverts and other structures common to the construction industry.

Thus it will be seen that I have provided an efficient and highly portable form for erecting dwellings or large enclosures at the site by expanding an inner partition pneumatically against a poured mix which is sandwiched between an inner form and an outer rigid form whereby the mix becomes uniformly distributed and compressed between the forms, and which forms are easily removed and used over and over again.

While I have illustrated and described several embodiments of my invention, it will be understood that these are by way of illustration only and that avarious changes and modifications may be made within the scope of the present invention and the following claims.

I claim:

1. A form for erecting building shells or enclosures, comprising an outer rigid curved form sub-divided into two curved complementary halves terminating in upwardly extending flanges which are in confronting relationship, said halves defining the outer wall, a base, means for detachably fastening said flanges together, means for detachably fastening the bottom end portions of said halves to said base, a flexible inner form spaced inwardly from and surrounded by said outer form, means for anchoring the ends of said flexible inner form to said base, means for allowing introduction of cementious mix between said inner and outer forms, a cylindrical tube of inflatable material substantially surrounded by said inner form and in contact with substantially the top half thereof and means for introducing air under pressure inside said cylindrical tube so that it will inflate and compress said mix between said inner and outer forms.

2. A form as recited in claim **1** wherein there is a space of substantially triangular cross-section between the bottom half of said cylindrical tube and each end portion of said inner form, a shaping form substantially filling each of said spaces, whereby said shaping forms will press outwardly against said inner form upon inflation of said cylindrical tube.

3. A form as recited in claim **1** wherein said flanges are disposed in spaced confronting relationship when fastened together, whereby said cementious mix will overflow therebetween to define a medial rib.

4. A form as recited in claim **1** wherein said cylindrical tube is of elastic rubber material, wherein said base is in the form of a footer, and wherein said means for detachably fastening the bottom end portion of said halves to said base and said means for anchoring the ends of said flexible inner form to said base comprise a plurality of U-shaped elements embedded in said base and having upstanding legs which serve as the respective means.

5. A form as recited in claim **2** wherein said shaping form is inflatable.

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