Dec. 12, 1944. L. L. GRENEKER 2,364,710

DESTRUCTIBLE FORM

Filed March 30, 1943 2 Sheets-Sheet 1

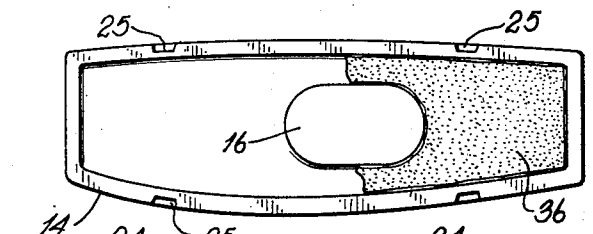


Fig. 1.

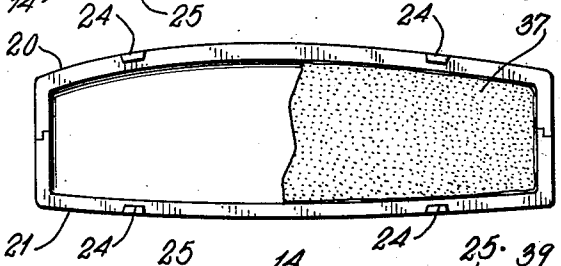


Fig. 4.

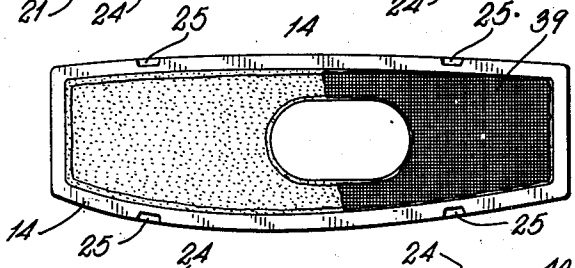


Fig. 2.

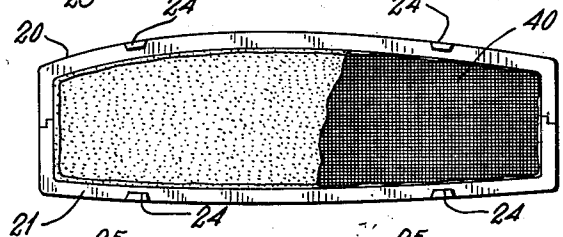


Fig. 5.

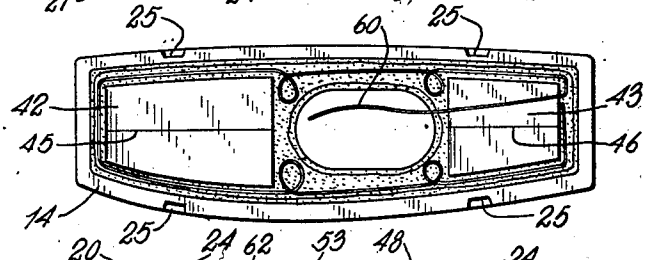


Fig. 3.

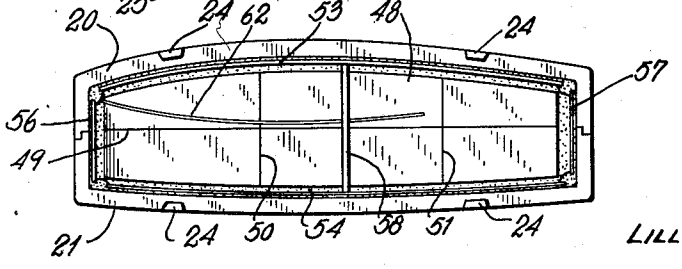


Fig. 6.

INVENTOR
LILLIAN L. GRENEKER

BY
Williams, Rich & Thomas
ATTORNEYS

Dec. 12, 1944. L. L. GRENEKER 2,364,710

DESTRUCTIBLE FORM

Filed March 30, 1943 2 Sheets-Sheet 2

Fig. 7.

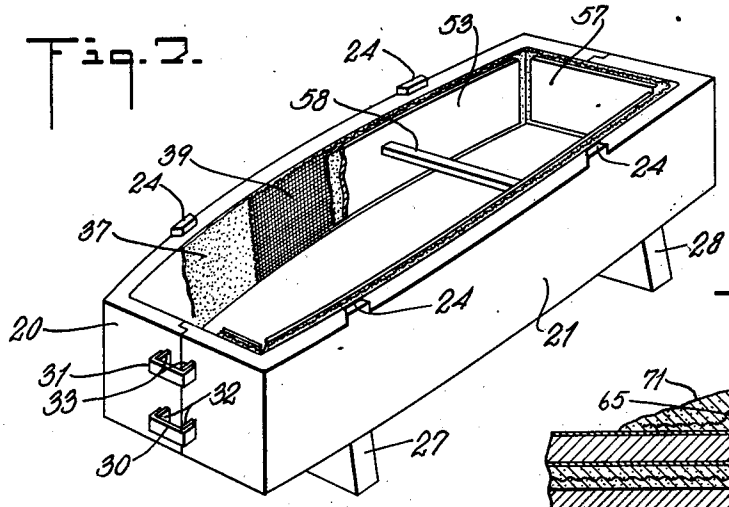
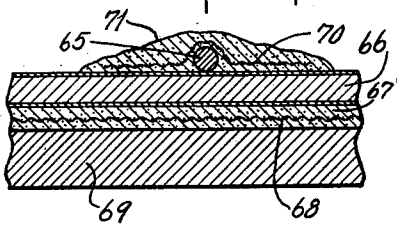


Fig. 11.



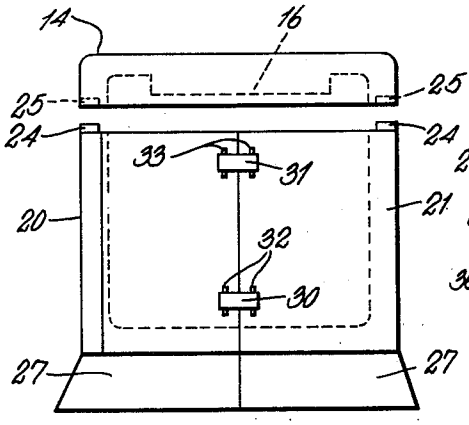


Fig. 8.

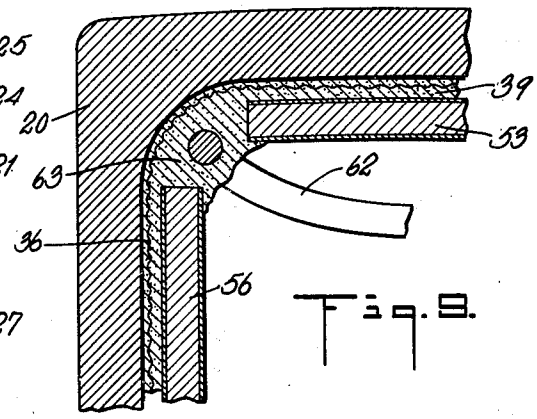


Fig. 9.

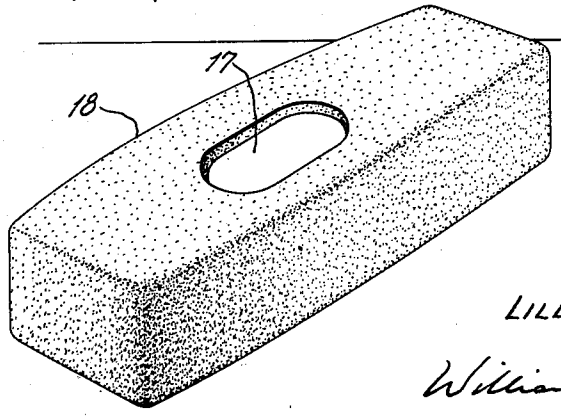


Fig. 10.

INVENTOR

LILLIAN L. GRENEKER

BY

William, Richardson

ATTORNEYS

Patented Dec. 12, 1944

2,364,710

UNITED STATES PATENT OFFICE

2,364,710

DESTRUCTIBLE FORM

Lillian L. Greneker, New York, N. Y.

Application March 30, 1943, Serial No. 481,093

7 Claims. (Cl. 18—45)

This invention relates to a destructible form which is particularly useful in the manufacture of fuel tanks and cells or articles made of rubber or other material. It is not concerned with the particular shape of the form, but merely with its construction, since of course the construction may be used in forms having an infinite variety of shapes and sizes.

The invention may be considered an improvement upon the invention described and claimed in my Patent No. 2,343,292 resulting from my copending application Serial No. 472,559, filed January 16, 1943, in which is described a hollow form made of a frangible material reinforced by a rope and also (if desired) by a fabric embedded therein, the wall of said form being so thin that pulling out of said rope will reduce the form to pieces which may be withdrawn from the hollow article after it has been made on said form.

The general object of the invention is to provide a form which will be even easier and cheaper to make and lighter than the form described in my aforesaid application, and which will still be strong and rigid and not subject to change of shape under conditions to which it may be subjected in use. Like the form described in the aforesaid application, the form hereinafter described can be easily destroyed and completely removed from the fuel tank or cell or article which is made on it, even though the opening in the fuel tank or cell or article through which the pieces of the form must be removed is comparatively small.

The present invention achieves the above mentioned object by reinforcing the frangible material of the flat or gradually curved walls of the form with a suitable board-like material having considerable thickness and stiffness but some flexibility such as "Celotex," "Sheet Rock," "Plasterboard," etc., in combination with a loosely-woven fabric and a rope embedded in said frangible material; the wall of the form being so thin where the rope is embedded that pulling the rope out of said form will reduce the form to pieces which may be withdrawn from the hollow article after it has been made on the form. The pieces of board-like material used in making the form are either made small enough to be withdrawn through the opening in the article or, if too large to pass through said opening, are broken into pieces small enough to pass through said opening when the form is broken up. Thus, those walls of the form which are flat or slightly curved, are principally reinforced by the board-like material and fabric embedded therein, and the reinforcing rope is for the most part only embedded in the frangible material around the board-like material and in places where it is more convenient to reinforce the frangible material with the rope than with the board-like material. After the form has served its purpose, that is, after a fuel tank or cell or other article has been made thereon, the pulling out of the rope embedded in the form will destroy the form; whereupon the pieces and parts thereof, consisting of the rope, the frangible material, the board-like material and the fabric, can be removed through the opening in the article.

The invention will be understood from the following description, taken in connection with the accompanying drawings, in which are described and shown a fuel-cell form embodying the invention, and the method of making it. In the drawings, Figs. 1, 2 and 3 are plan views looking at the inside of the cover portion of a mold, and Figs. 4, 5 and 6 are plan views looking down into the body portion of said mold, showing therein a form embodying the invention undergoing the various steps of its manufacture; Fig. 7 is a perspective view of the body portion of said mold with part of the form fabricated therein, the wall of the form being broken away to show its construction; Fig. 8 is an end elevation of the body and cover portions of the mold; Fig. 9 is a fragmentary sectional plan view through a corner of the body portion of the mold and a corner of the form fabricated therein; Fig. 10 is a perspective view of the form after it has been fabricated within the mold and removed therefrom; and Fig. 11 is a sectional view of a wall of the form showing a way in which the rope may be applied to the surface of the board-like material for the purpose of reinforcing it. The same reference characters refer to the same parts throughout the drawings.

As will be apparent form Figs. 1, 2, 3 and 8 the cover portion 14 of the mold is provided with a boss 16 which defines the opening 17 which is to the left in the completed form 18 which is shown in Fig. 10. From Figs. 4, 5, 6, 7 and 8, it will be apparent that the body portion of the mold consists of sections 20 and 21. To facilitate proper engagement of the mold sections 20 and 21 with one another, their engaging surfaces are formed with cooperating shoulders, as shown in the various views; and in order to insure proper placing of the cover section 14 on the body sections 20 and 21, upstanding lugs 24 are provided on the upper surfaces of the body sections 20 and 21, and correspondingly located notches 25 are provided in the cover section 14. The body sections 20 and 21 of the mold may be provided with base members 27 and 28 or may be otherwise constructed, so as to facilitate the standing upright of the body sections of the mold in the position shown in Figs. 7 and 8. For holding the body sections of the mold 20 and 21 together, any suitable means may be provided, such as removable metal clamps 30 and 31 cooperating with metal lugs 32 and 33 cast in and projecting

from the ends of the mold sections 20 and 21, as shown in Figs. 7 and 8. For holding the cover section 14 tightly in engagement with the mold sections 20 and 21, any suitable means may be used, or merely the weight of the cover section may be relied upon as sufficient. The mold sections may be made of any suitable material such as plaster, cement, metal etc.; and the mold can be constructed either according to the dimensions of the form or from a model of the form.

The structure of the form and the methods by which it is made in the mold will now be described. The frangible material used in the form may be plaster of Paris or any other suitable material, and in the description which follows the term "plaster" is intended to cover all suitable materials capable of being molded. The board-like material used in the form for reinforcing purposes, in the manner hereinafter described, may be such materials as "Celotex" or "Sheetrock" or "Plasterboard" or other similar materials which have the property of uniting well with plaster. The fabric, hereinafter referred to, may be of any loosely woven kind such as cheesecloth or what is commonly known as "paper burlap" which I have found to be particularly satisfactory. The rope (hereinafter referred to) which is used for the double purpose of reinforcing the form and providing means for its ready destruction after the form has served its purpose in the making thereon of a fuel tank or cell or other article, may be of any cheap kind, provided it has sufficient strength to stand the strains imposed upon it when it is pulled out of the plaster during the destruction of the form.

Before fabricating the form within the mold sections 14, 20 and 21, the inside surfaces of the latter are greased in order to prevent sticking of the plaster thereto, as is customary in the molding of plaster articles. These greased surfaces of the mold sections are then covered with a thin layer of wet plaster, as indicated at 36 in Figs. 1 and 2, and at 37 in Figs. 4 and 5. Pieces of loosely-woven fabric, such as paper burlap, are then applied to the wet plaster and more or less embedded in it, as represented at 39 and 40 in Figs. 2 and 5. In practice, it is desirable to cut the fabric 39 and 40 into pieces approximating in size and shape the walls of the mold to which the fabric is to be applied, so that the fabric will extend substantially completely throughout the area of the plaster. Then a thin layer of wet plaster may be applied to the fabric in order to more completely embed it in the plaster. The fabric, so embedded in the plaster, serves to reinforce the walls of the form and to prevent the formation of cracks therein upon drying, as will be hereinafter mentioned. Pieces of board-like material, such as "Celotex," are then pressed against the fabric-reinforced wet plaster which has been applied to the inside surfaces of the mold sections. Preferably, these pieces of board-like material, before insertion in the mold, are smeared with wet plaster on the side which is to be applied to the wet plaster in the mold, so as to improve the bonding of the board-like material to the plaster in the mold. The pieces of board-like material so used for reinforcing the walls of the form are cut to such a size that the board-like material will cover the major portions of the walls of the form to which they are applied. Such material may be cut into pieces small enough to pass through the opening in the fuel cell corresponding to the opening 17 in the form 18, when the form is broken up after it has served its purpose. However, it has been found convenient, satisfactory and time-saving to make some of the pieces of board-like material so large that they would not easily pass through the opening in the completed article corresponding to the opening 17 in the form, and then to break up these pieces of board-like material into small enough pieces to pass through said opening when the form is destroyed. To facilitate the breaking up of such larger pieces of board-like material, it has been found useful to cut partially through such larger pieces of board-like material, so that it will readily break up into pieces small enough to pass through the opening in the fuel cell after it has been fabricated on the form. The pieces of board-like material used in reinforcing the portion of the form which is made in the cover section 14 are shown in Fig. 3 at 42 and 43, it being understood that these sections are partially cut through and thereby weakened along the lines 45 and 46. The piece of reinforcing board-like material used in the bottom of the body portion of the mold is indicated in Fig. 6 at 48, it being understood that this piece of board-like material has been partially cut through and thus weakened along the lines 49, 50 and 51. The pieces of board-like material used in reinforcing the side walls of the mold are indicated in Fig. 6 at 53 and 54, and those used in reinforcing the end sections of the form are shown at 56 and 57, it being understood that these sections may also be partially cut through as above described in order to facilitate their breaking up and removal when the form is destroyed after it has served its purpose. In order to hold the pieces of board-like material 53 and 54 in their bent condition and firmly in engagement with the wet plaster on the curved side walls of the mold while the plaster is becoming bonded to the pieces of board-like material, a wooden stick 58 (shown in Fig. 7) or a plurality of such sticks may be wedged in between the pieces of board-like material 53 and 54. After the form is completed these sticks may be removed if desired, since the curved side walls of the form will then be rigid and self-supporting.

After the reinforcing board-like material has thus been applied to the fabric-reinforced wet plaster within the mold sections, a rope is laid into the wet plaster wholly or partially around the pieces of board-like material, for the double purpose of reinforcing the plaster at those places and providing means for readily destroying the form after it has served its purpose in the making of a fuel cell. Fig. 3 shows one way in which the rope 60 may be laid in the wet plaster in the cover section 14 of the mold, but it will be understood that the rope may be laid in other ways at the discretion of the maker of the form. After the rope 60 has been laid in the plaster, more wet plaster is applied to it so as to bury it and cover the edges of the pieces of board-like material. Complete burying of the pieces of board-like material in the plaster has been found not to be necessary; that is, the main portion of the inside surface of the board-like material may be left bare. In laying the rope in the body portions 20 and 21 of the form, it will be found convenient and satisfactory to lay it in the wet plaster at the vertical corners of the mold and around the corners at the bottom of the mold, thereby providing both for reinforcing the form at those points and for destruction of the form by the pulling out of the rope after the form has served its purpose. In Fig. 6 the free end of the rope is indicated at 62.

Fig. 9 shows in cross section the construction of the form within the body section of the mold at one vertical corner; and makes clear how the walls of the hollow form are reinforced by the fabric 39 and rope 62 embedded in the plaster 63, and by the pieces of board-like material 53 and 56 which are bonded to and at their edges are more or less buried in the plaster 63.

While the plaster in the cover section 14 and in the body sections 20 and 21 of the mold is still moist, the cover 14 is applied to the top of the body sections 20 and 21; and in a short time the plaster in the cover section unites with the plaster in the body sections of the mold. Thus, within the mold there is made a hollow plaster form the walls of which although thin have very considerable strength owing to the reinforcing action of the fabric, the board-like material and the rope. Moreover, any tendency for the formation of cracks in line with the edges of the board-like material, is prevented by the reinforcing effect of the fabric embodied in the plaster at those places. After the plaster has set within the mold for a short time, the cover section 14 is removed; and after removal of the clamps 30 and 31 at each end of the mold sections 20 and 21 the latter are separated, thereby facilitating removing from the mold the form 18 shown in Fig. 10. After drying, preferably in a drying room or oven, the form 18 is complete and ready for use in the manufacture of a seamless fuel tank or cell. The outside surfaces of the form 18 may, if desired, be covered with paper glued thereto, or treated in any other suitable manner, according to the preferences of the users of such forms. Another way of covering the outside surfaces of the form with sheet material such as paper or cloth, is by laying such paper or cloth over the inside surfaces of the mold at the beginning of the fabricating process; after which the first thin layer of wet plaster is applied to the paper or cloth (instead of directly to the greased inside surface of the mold) and bonding of the paper or cloth to the plaster takes place during the making of the form. When paper or cloth is so used, it will in some cases reinforce the plaster sufficiently to make it unnecessary to embed in the plaster the fabric hereinbefore mentioned.

In some forms, it may be desirable to provide additional reinforcing of a wall of the form. Fig. 11 illustrates a convenient and satisfactory way of providing such reinforcing. As will be obvious from that figure, this reinforcing may be accomplished by laying a rope 65 across the inner surface of one of the pieces of reinforcing board-like material 66 which is bonded to plaster 67 which is reinforced by a loosely-woven fabric 68, all lying within a mold wall 69. A piece of fabric 70, preferably after being dipped in wet plaster, is preferably laid over the rope 65; and then enough wet plaster 71 is applied to bury the rope 65 and the fabric 70. The plaster 71 dries in the form of a ridge on the inside surface of the board-like material 66, and owing to the reinforcing nature of the rope 65 the rigidity of the wall of the form at that location is increased. This way of reinforcing the wall of the form may, of course, be used in connection with curved walls as well as flat walls.

From what has been stated, it will be understood that, after fabrication of the fuel cell on the form 18, it is possible to reach through the opening in the fuel cell corresponding to the opening 17 in the form and to seize the loose end or ends of the ropes which are embedded in the plaster of the form. By pulling the rope or ropes the whole structure of the form may be broken up; and the rope, the pieces of reinforcing board-like material, the reinforcing fabric (when used) and the paper covering (when used) may be readily removed through the opening in the article corresponding to the opening 17 in the form. Any small amount of loose plaster or dust or pieces of sheet material or fabric or paper left within the fuel cell can easily be removed by washing or an air blast.

Of course it is not absolutely necessary to provide any opening, such as 17, in a form made in the manner herein described. That is, the form may be made with no opening at all. In all cases the fuel tank or cell or other article made on the form will have an opening; and in removing the form it is merely necessary to break through the wall of the form at said opening, thereby revealing an end or some part of the rope embedded in the form, whereupon that part of the rope may be grasped and pulled out of the opening, thereby demolishing the form and permitting the removal of all of its parts from the finished article which has been fabricated upon the form.

It will be understood that various modifications may be made in the structure of a form embodying the present invention, without departing from the spirit of the claims hereto appended.

What is claimed is:

1. A hollow form which in outside shape and size conforms to the space within a hollow article having an opening therein which is to be made on said form, the wall of said form being made of frangible material reinforced by a fabric embedded therein and also by board-like material and by a rope embedded in said frangible material, and the walls of said form being so thin where the rope is embedded that pulling out of said rope will reduce the form to pieces which may be withdrawn from the hollow article through said opening.

2. A hollow form according to claim 1, having the rope arranged in the frangible material around the edges of the board-like material.

3. A hollow form according to claim 1, which is further reinforced by sheet material secured to the outside surface of the frangible material.

4. A hollow form according to claim 1, in which the board-like material is in pieces small enough to pass through the opening in said article.

5. A hollow form according to claim 1, in which the board-like material when introduced is in pieces some of which are too large to pass through the opening in said form, but are partially cut into sections small enough to pass through said opening when the form is broken up.

6. A hollow form according to claim 1, in which the rope is laid on and across the inside of said board-like material and is covered with frangible material.

7. A hollow form according to claim 1, in which the rope is laid on the inside of said board-like material and is covered with frangible material having a fabric embedded therein.

LILLIAN L. GRENEKER.

CERTIFICATE OF CORRECTION.

Patent No. 2,364,710. December 12, 1944.

LILLIAN L. GRENEKER.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 1, second column, line 39, for "the left" read --be left--; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 20th day of March, A. D. 1945.

Leslie Frazer

(Seal) Acting Commissioner of Patents.