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Weaver

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[54] **APPARATUS FOR FORMING BOX-LIKE ARTICLE AND LID THEREFOR**

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[51] **Int. Cl.** **B28b 21/14**

[58] **Field of Search** 249/39, 63, 83, 96–97, 249/119, 121, 122, 136, 142, 144–145, 175, 74; 425/432, 456, 443, 424

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Assistant Examiner—John McQuade

[57] **ABSTRACT**

Apparatus for forming in one operation a molded article having box-like sides such as a concrete meter box, and a molded covering lid therefor. A cavity in the shape of connected sides of a box is formed between an inner form and a surrounding outer form. An open top lid form rests on the top of the inner form, its outside surface extending out beyond the top of the inner form to define a shoulder and an upper extension of the cavity. The cavity and the lid form are filled with a settable material and vibrated. A power unit then raises the box-like article by engaging a pallet beneath the article at the bottom of the cavity, the box-like article being capable of carrying the lid form upwardly with it by engagement of the finished article with the shoulder of the lid form.

10 Claims, 6 Drawing Figures

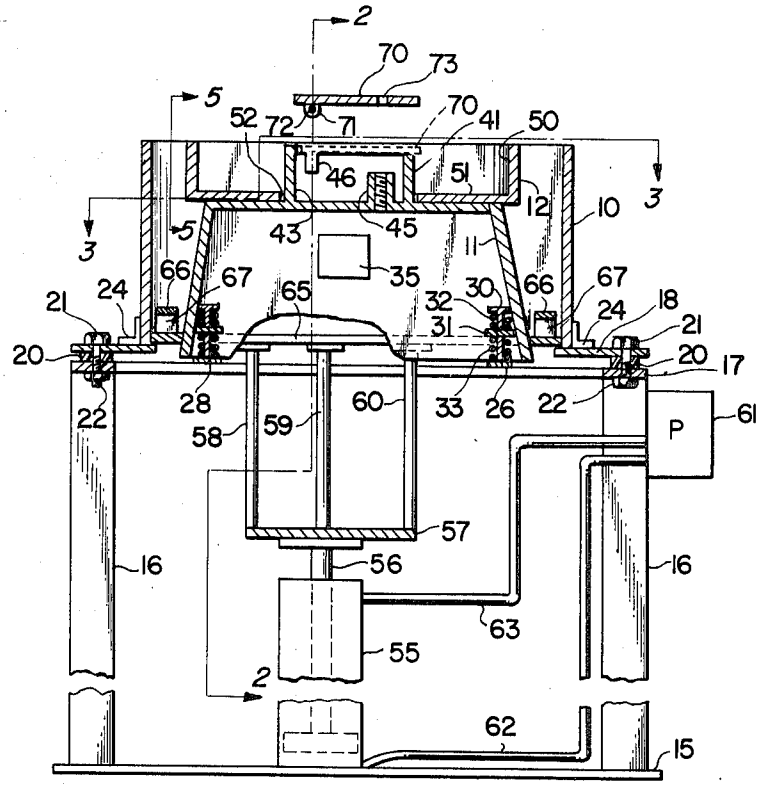


FIG. 1

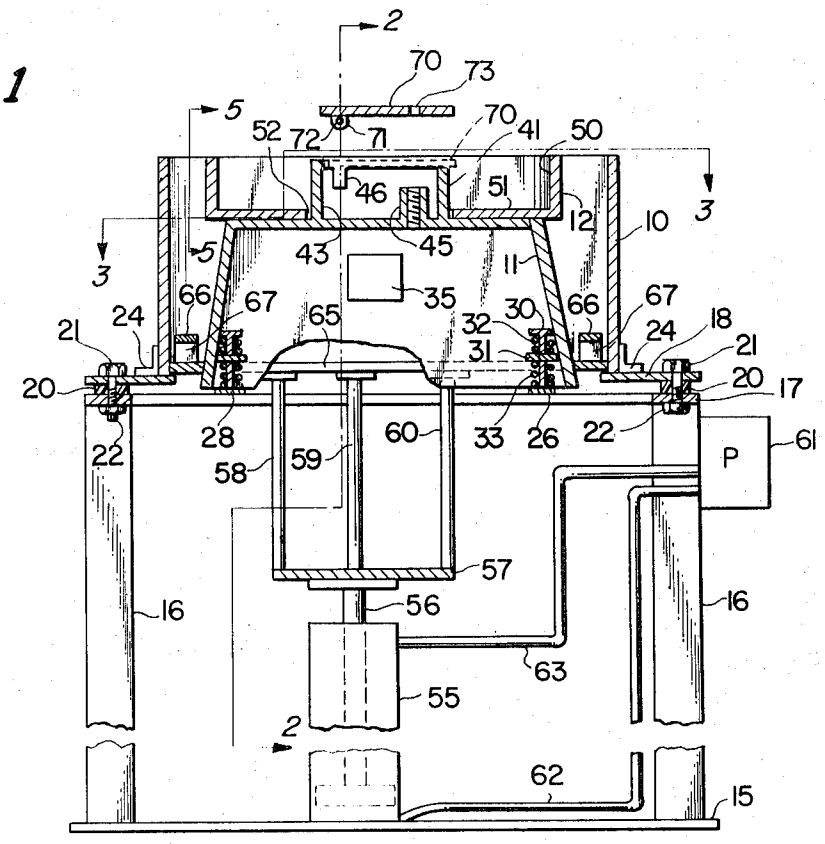
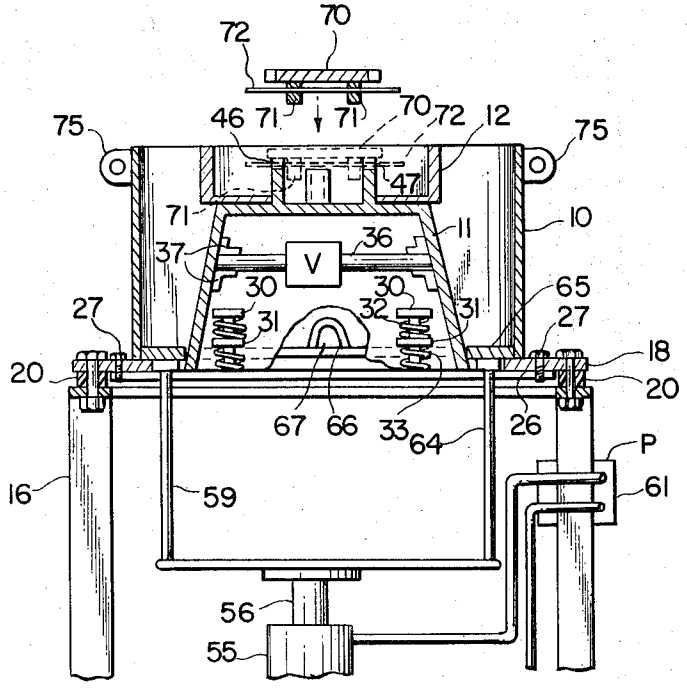

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FIG. 2


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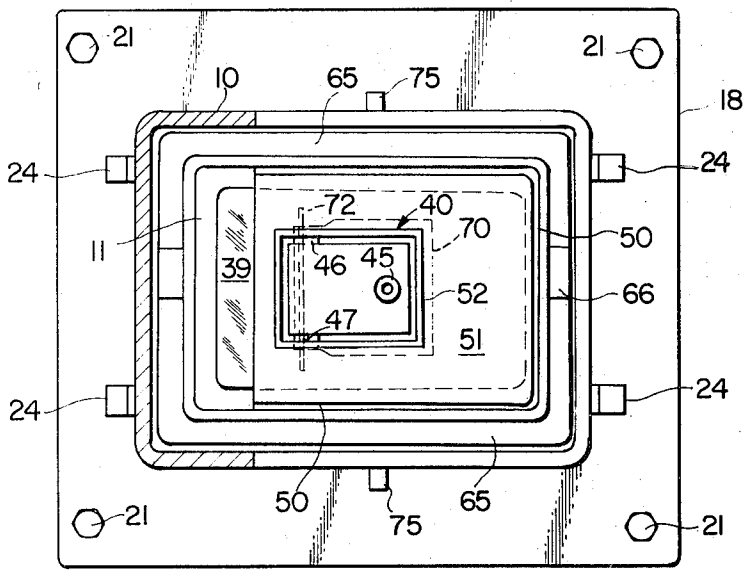


FIG. 3

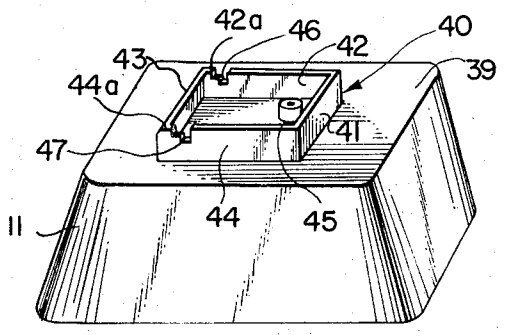


FIG. 4

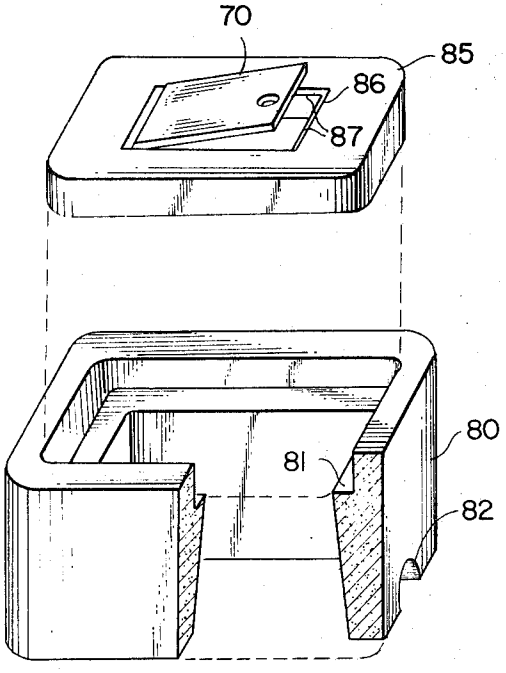


FIG. 6

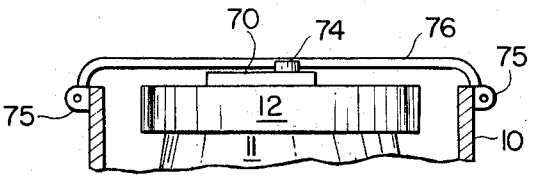


FIG. 5

APPARATUS FOR FORMING BOX-LIKE ARTICLE AND LID THEREFOR

BACKGROUND OF THE INVENTION

This invention relates to the formation of articles by molding, and in particular it relates to a new and improved apparatus for molding an article in the shape of connected sides of a box and a matable lid therefor.

There, of course, exist numerous means and methods for molding articles of settable materials such as concrete or the like in virtually any size or shape.

The article with which the present invention is particularly concerned is a meter box which constitutes a concrete box-like article normally placed in the ground over a meter connected to a section of the pipes, the fluid flow through which is to be metered, together with a heavy lid which covers the top of the meter box and preferably has formed in it a small door which can be easily opened to view the face of the meter.

These meter boxes give the appearance of a box having a lid. However, there is actually no bottom to this "box" since the bottom is opened so that the meter itself can project upwardly thereinto. Consequently, this article will be described below as an article in the shape of connected sides of a box. However, for convenience, the term "box-like article" will also be used, and it is to be understood that this term refers to the article in the shape of a box although the bottom of the article is opened. Further, while the box-like articles with which the present invention is concerned will normally be rectangular, it will be understood that the term refers to an article having any number of sides.

While methods and apparatus do exist for forming the box-like article and the lid, nonetheless there exists a continuing need for new and improved methods and apparatus for producing the same.

SUMMARY OF THE INVENTION

Thus, it is a purpose of this invention to provide a new and improved apparatus for forming a box-like article and a lid therefor.

This object is achieved by providing an arrangement in which the box-like article and the mating lid can be formed in a single operation. A cavity in the shape of connected sides of a box is formed between an inner mold form and a surrounding outer mold form. The lid is formed in an open topped lid form located on top of the inner form such that at least a part of its outer periphery extends out beyond the outer periphery of the top of the inner form, thereby providing an outwardly projecting shoulder and also an upper extension of the cavity. Consequently, the finished box-like article will have an internal shoulder or ledge on which the lid will rest in use.

In accordance with a preferred arrangement, the present invention includes a provision for forming an opening completely through the lid and an arrangement for permanently attaching to the lid an easily openable door covering the opening through the lid.

In accordance with a preferred embodiment of the invention, this means for forming the opening and attaching the door comprises a raised portion on the top of the inner form, which portion extends through an opening in the bottom of the lid form.

In a preferred operation of the present invention, the settable material, preferably a relatively dry concrete mix is placed into the cavity and into the lid form for forming both the box-like article and the lid in one operation. A pallet ring is located at the bottom of the cavity. Means are provided for vibrating the mold, preferably in an inner form and because of this, suitable resilient connections are provided between the inner and outer forms and the base on which these members are mounted. The pallet is lifted by rods which engage the bottom thereof under the force of a piston and cylinder unit, carrying with it the box-like article and the lid. The box-like article and the lid are then placed aside so that the material can set.

Thus, it is an object of this invention to provide a new and improved apparatus for forming a box-like article and a lid therefor.

It is another object of this invention to provide a new and improved apparatus for forming in a single operation a box-like article and a heavy lid therefor, together with an opening through the heavy lid, this opening being covered by an easily opened door.

It is another object of this invention to provide an improved apparatus for producing a concrete meter box and a concrete lid therefor in a single operation, the lid including an opening therethrough for viewing the face of a meter, together with a door permanently attached to the lid and easily openable to view the meter.

It is another object of this invention to provide a more efficient and economical apparatus for forming a box-like article such as a meter box and a matable lid therefor.

Other objects and the advantages of the present invention will become apparent from the detailed description to follow, together with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

There follows a detailed description of preferred embodiments of the invention which are to be read together with the accompanying drawings.

FIG. 1 is a longitudinal cross-section view through an apparatus constructed in accordance with the features of the present invention.

FIG. 2 is a transverse sectional view taken along line 2—2 of FIG. 1.

FIG. 3 is a partial plan and partial horizontal sectional view, taken along line 3—3 of FIG. 1.

FIG. 4 is a perspective view of the inner form of FIGS. 1-3.

FIG. 5 is a partial cross-sectional view taken along line 5—5 of FIG. 1, but with certain parts moved to a different position than in FIG. 1.

FIG. 6 is an exploded perspective view showing the box-like article and the matable lid formed by the method and apparatus of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS:

Referring now to the drawings, like elements are represented by like numerals throughout the several views.

It is of course known to use concrete to form meter boxes or the like and the lids therefor. The present invention contemplates the use of known settable materials to form the box-like article and the lid. Preferably it will be concrete although the articles may also be formed of known settable plastics or other materials. A given material such as concrete can be varied in com-

position. For example one may use a relatively dry concrete for fast setting or a relatively wet concrete for slower setting, although the former is preferred. However, these variations of known materials are also known per se. Thus, since the invention contemplates the use of known materials and known variations thereof, the materials per se do not form a part of the present invention and will not be described in any greater detail.

Referring now to the drawings, the main mold parts include an outer mold **10** which is essentially a hollow, vertical rectangular tube, an inner form **11** (see also FIG. **4**) and an open top lid form **12.** The box-like article is formed in the rectangular ring-like cavity bounded on the outside by outer form **10** and bounded on the inside by the essentially vertical parts of forms **11** and **12.**

Mounted on a base **15** which may be the ground or any other firm surface are a set of legs **16,** preferably four legs, one at each corner. Legs **16** have attached to the upper ends thereof a table **17** which is almost completely open except for a rim portion extending about the periphery thereof (see the cross-sectional lines in FIGS. **1** and **2**). Mounted above the table **17** is a platform **18** which is also almost completely cut out in the center thereof. Platform **18** is spaced above table **17** by a shock absorber pad **20** of a suitable material such as rubber, and is connected to the table **17** by a bolt **21** which passes through platform **18,** pad **20** and table top **17** and which is held in place by a nut **22.** There are four such assemblies **20–22,** the tops of these being visible in FIG. **3.**

The outer mold **10** is rigidly mounted on the platform **18** by suitable means such as angle connecting pieces **24.** A pair of support members or rods **26** and **28** are connected to the bottom of platform **18** and extend across the cut-out thereof. These elements are visible in cross-section in FIG. **1** and one of the elements, namely element **26** is visible in side elevation in FIG. **2,** together with bolts **27** which rigidly connect this rod **26** to the bottom of platform **18.** Projecting upwardly from each of the rods **26** and **28** are a pair of bolts **30** having enlarged heads. These bolts **30** pass through angle pieces **31** which are rigidly connected to the inside of inner form **11.** A pair of springs **32** and **33** are provided on each bolt **30** above and below the element **31,** respectively. This assembly thereby constitutes a resilient shock absorbing connection between the frame via elements **18, 26** and **28** and the inner form **11.** Mounted within the inner form **11** is a vibrator **35** connected to the inside of inner form **11** by suitable rods **36** which are in turn connected via suitable means such as angle pieces **37.** The vibrator may be of any conventional form.

The top **39** of form **11** is essentially flat and it has extending upwardly therefrom a raised hollow portion **40** which is defined by walls **41, 42, 43** and **44.** Within the hollow space of portion **40** is a hollow threaded tube **45** integral with the form **11.** Slots **46** and **47,** the purposes of which will be explained below, are formed in side walls **42** and **44,** respectively.

The lid form **12** is essentially in the shape of an open top pan having a bottom **51,** side walls **50** and a cut-out bottom **52** which permits the lid form **12** to fit over the raised portion **40** to rest against the flat surface **39.**

Mounted on the base is a double acting piston and cylinder unit including a cylinder **55** and a piston rod **56.** This unit is operated in a conventional manner by means of a pump **61** via fluid lines **62** and **63.** Mounted on piston rod **56** is a platform **57** to which six rods are mounted. Three of these rods **58, 59** and **60** are visible in FIG. **1.** The rod **59** is also visible in FIG. **2.** Three similar rods are connected to the platform **57** transversely across from the rods **58, 59** and **60.** The central rod **64** of this other set of rods is visible in FIG. **2.**

The bottom of the cavity itself is formed by a pallet ring **65** which is visible in plan view in its entirety in FIG. **3.** The rods **58, 59** and **60** engage the bottom of one long side of this ring and the other three rods engage the bottom of the other long side of this ring. On the center of each short side of this pallet ring **65** is a raised portion **66** having an opening **67** passing therethrough. The purpose of this opening will be explained in greater detail below.

In each of FIGS. **1–3** a door element **70** is shown in solid lines spaced above the remaining mold structure so that its structure will be more clearly shown. Each door **70** includes a pair of eyelets **71** extending downwardly therefrom and a pivot pin **72** extending through these eyelets and projecting outwardly beyond the sides of the door **70.** Note FIG. **2.** During the molding operation, door **70** is lowered so that the pin **72** extends through the aligned slots **46** and **47** as shown in dotted lines in FIGS. **1–3.**

FIG. **5** illustrates the top of the appratus with the element **70** in place. It is held there by a hold-down bolt **74** which passes through an opening **73** in the door **70** (see FIG. **1**) and is threadedly engaged with the hollow threaded tube **45.** In addition, a hold-down strap or bar is placed across the top of door **70** and the ends of this strap or bar **76** are connected to suitable hold-down eyelets **75** located on the exterior of outer form **10.**

Before describing the operation of the invention in detail, it will be helpful to view the finished articles in FIG. **6** including the final box-like article **80** which has an internal ledge **81** and a small circular opening **82** at each end, one of these being visible in FIG. **5.** The top is an essentially rectangular block **85** having an opening **86** extending therethrough, and the door **70** is firmly connected to the block **85** and turnable about pivot pin **72,** the ends of which are embedded in block **85.** The top of door **70** is flush with the top surface of block **85** and the bottom of door **70** rests on ledge **87,** the purpose and formation of which will become more apparent in the following description of the operation of the invention.

The method and operation of the invention are as follows.

The elements are positioned as shown in FIGS. **1–3** except that the door **70** is lowered to the dotted line position with the pivot pin **72** located in the slots **46** and **47.** It will be noted that the top of raised portion **40** is at the level of the top of form **12** only at the rear thereof, i.e., at the wall **43** and the rear parts **42***a* and **44***a* of walls **42** and **44.** The top of the remainder of raised portion **40** is recessed downwardly by an amount equal to the thickness of the door **70.** The rear edge of top **70** adjacent and parallel to the pin **72** does not extend completely to the outer surface of wall **43,** but only to the ends of raised parts **42***a* and **44***a*. This is to provide a clearance for the portion of gate **70** behind the pivot axis to move downwardly as the main portion of door **70** swings upwardly. To permit such upward swinging movement of the door, it is also necessary that

the sides of door **70** to the rear of pin **72** (i.e., to the left as viewed in FIGS. **1** and **3**) be inward or at most flush with the outer surfaces of walls **42** and **44** so that no concrete is formed beneath this rear portion to the rear of pins **72.** To provide ledge **87** (FIG. **6**) on which the finished door can rest, the part of the door formed forward of pin **72** (i.e., to the right thereof in FIGS. **1** and **3**) extends out over the edges of the recessed parts of raised portion **40,** i.e., over the end wall **41** and the recessed parts of walls **42** and **44.** With the door **70** in position as described above, a bolt is introduced through opening **73** and threaded into tube **45** to hold the door **70** firmly in place. In addition, all of the elements are supported by a hold-down strap or bar **76** (see FIG. **5**) which extends across the entire width of the apparatus and is engaged at its ends with hold-down eyelets **75.**

With the structural elements thus in place, material such as a semi-dry concrete is poured into the cavity between the outer form **10** on the one hand and the inner form **11** and the outside of form **12** on the other hand, preferably to the very top of outer form **10.** At the same time, the settable material is poured into the form **12** up to the top of side walls **50** which is also flush with the raised part of portion **40** (i.e., **42***a*, **44***a*, and **43**) and with the upper surface of door **70.** At this time, the piston and cylinder unit is down with the rods thereof engaging and supporting the bottom of pallet ring **65.** Vibrator **35** is actuated to vibrate and hence expedite settling of the material. After vibrating, preferably from 30–45 seconds, the material has reached a state whereat it is sufficiently dry to be self-supporting, at which time the article and the lid are removed. Preferably, piston rod **56** and its associated rods are raised, carrying upwardly with them the pallet ring with the box-like article thereon, the latter carrying with it the lid form **12** and the lid itself. Once the elements reach this upper position, a strong pole is inserted across through the two openings **67** to support the weight of the finished products. While the products are steadied on this pole, the pole supports the weight thereof as the products are carried to a suitable location where the products can be removed. Here, the lid form is removed by simply opening the door **70** and reaching therethrough against the bottom of lid form **12** and moving it upwardly off of the box-like article **80.** The lid form is then turned over and tapped and pulled off of the lid which is then left to dry and set. Alternatively, if so desired, one could of course initiate the removal process by lifting the lid form **12** and the lid to remove the same before raising the pallet ring **65.**

In order to optimize the operation of the invention, either by the preferred or the alternative procedure, one would employ two lid forms **12** with a single molding apparatus so that as soon as the box-like article has been removed, the alternative lid form can be placed therein, and a new procedure commenced without necessarily waiting for the lid to be removed from the lid form.

The cement in lid form **12** was located at a level above pin **72** and hence these pins are now firmly embedded within the lid. Thus, as shown at the top of FIG. **6,** the lid **85** has the door **70** easily openable about its embedded pivot pin **72** to open and close the through opening **86.** When closed, door **70** is flush with the top of **85** and rests on ledge **87.** Further, the shoulder formed by the intersection of walls **50** and bottom **51** of lid form **12** has formed an internal ledge **81** in the box-like article **80.** The lid **85** has been constructed such that its outer periphery is greater than the inside dimensions of this ledge so that the lid **85** will be supported by this ledge. Further, the upper surface of lid **85** will be approximately flush with the top of article **80** although it may just as well be slightly raised or slightly recessed relative thereto.

Although the invention has been described in considerable detail with respect to a preferred embodiment thereof, it will be apparent that the invention is capable of numerous modifications and variations apparent to those skilled in the art without departing from the spirit and scope of the invention.

I claim:

1. An apparatus for making a molded article having box-like sides and a molded lid which is matable therewith comprising:

an inner form having outwardly facing side walls,

an outer form surrounding the inner form and forming with the outwardly facing side walls of the inner form a cavity in the shape of connected sides of a bos, the upper edges of the outer form extending up to a height greater than the height of the inner form,

and an open top lid form having a bottom located on top of the inner form, at least a part of said bottom extending outwardly beyond the outer periphery of the top of the inner form, and said lid form including side walls extending upwardly from the outer periphery of said bottom,

at least a portion of the outside surface of the lid form being spaced inwardly from the inside of the outer form to define therewith an upper extension of the said cavity which is formed between the inner and outer forms,

whereby while filling both the said cavity and the lid form the article with the box-like sides and the mating lid therefor can be formed in a single molding operation, said inner form including means for forming an opening through the lid to be formed, said forming means including means for mounting a door in said lid, said door being positioned such that it forms an openable door over the opening through the lid to be formed, and is permanently attached to the lid.

2. An apparatus for making a molded article having boxlike sides and a molded lid which is matable therewith comprising:

an inner form having outwardly facing side walls,

an outer form surrounding the inner form and forming with the outwardly facing side walls of the inner form a cavity in the shape of connected sides of a box, the upper edges of the outer form extending up to a height greater than the height of the inner form, and an open top lid form having a bottom located on top of the inner form, at least a part of said bottom extending outwardly beyond the outer periphery of the top of the inner form, and said lid form including side walls extending upwardly from the outer periphery of said bottom, at least a portion of the outside surface of the lid form being spaced inwardly from the inside of the outer form to define therewith an upper extension of the said cavity which is formed between the inner and outer forms, whereby, while filing both the said cavity and the lid form the article with the box-like sides

and the mating lid therefor can be formed in a single molding operation, said inner form including means for forming an opening through the lid to be formed, said inner form including a raised portion which is raised upwardly from the top of the inner form, said lid form having an opening in its bottom shaped to fit over the said raised portion when the lid form is placed onto the top of the inner form, said raised portion being positioned to form the said opening through the lid which is to be formed, said raised portion including means for mounting a door therein such that in the finished lid the door is permanently connected to the lid and openably covers the opening therethrough.

3. An apparatus according to claim **2,** wherein said means for mounting the door includes a set of aligned upwardly opened slots formed in the raised portion, said door having a pivot pin locatable in said aligned slots and having outer portions extending horizontally out beyond the outer periphery of the raised portion whereby when the finished lid is removed from the lid form, the outer portions of the pivot pin remain embedded in the lid.

4. An apparatus according to claim **3,** including a holding means for holding the door against the top of the raised portion, said holding means comprising a bolt engageable against the top of the door and threadedly engageable through the raised portion with the top of the inner form, and a hold down bar attached to the outer form and held tightly against the top of the door.

5. An apparatus according to claim **1,** said outer form being a tubular member of polygonal cross-section, said inner form being of frustro-pyramidal cross-section, the bottoms of the inner and outer forms being spaced apart and including a pallet in the cavity between the bottoms of the inner and outer forms.

6. An apparatus according to claim **5,** said lid form bottom extending out beyond the top of the inner form all about the periphery of the latter, whereby the finished article having box-like sides will have a horizontal ledge formed therein by the outwradly projecting part of the lid form, on which ledge the finished lid can rest.

7. An apparatus according to claim **1** including:
a base,
said inner and outer forms mounted on said base,
a pallet ring locatable at the bottom of said cavity such that the article is formed thereon, and a lifting means for lifting the pallet ring up into and through the cavity,
whereby when the finished article is self-supporting, said lifting means lifts the article upwardly through and out of the mold, the article being capable of carrying upwardly with it the lid form with the lid therein.

8. An apparatus according to claim **7,** said lifting means including a power piston and cylinder unit on the base, a set of vertical rods operatively connected to the piston and cylinder unit for vertical movement therewith, the upper ends of said rods being located against the bottom of the pallet ring.

9. An apparatus according to claim **7,** including connecting means for connecting said inner and outer forms to the base, said connecting means including shock absorbing means.

10. An apparatus according to claim **7,** including means for vibrating the inner form, said base including a cut-out table top, a cut-out platform connected to the table top and spaced thereabove by shock absorbing members, said outer form being fixed to said platform, support rods connected to the platform and extending across the cut-out opening therein, and a shock absorbing connecting means for connecting the inner form to the support rods.

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