United States Patent [19]

Varriano

[11] **3,910,547**

[45] **Oct. 7, 1975**

[54] **MOLD FOR THE MANUFACTURE OF AN ARTICLE WITH RELIEF FEATURES**

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[22] Filed: **Oct. 15, 1973**

[21] Appl. No.: **406,181**

[52] **U.S. Cl.** **249/104;** 249/112; 249/127; 425/89; 425/195

[51] **Int. Cl.²** **B28B 1/14;** B28B 7/06

[58] **Field of Search** 249/112, 113, 127, 82, 249/102, 103, 104; 264/316; 425/89, 195

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Assistant Examiner—Carl Rowold
Attorney, Agent, or Firm—Kenneth S. Goldfarb

[57] **ABSTRACT**

A mold and coloring frame for use in manufacturing for forming cast decorated objects, the mold comprises a base having a raised peripheral wall, strips within said wall secured to the base, and a smooth flexible film tautly disposed over the peripheral wall so that when casting material is poured onto the film it will depress the film below the strips so that impressions of the strips are formed in the surface of the panels. A frame including flexible pads being placed on top of the film after coloring is applied thereto, and removed after the casting material has been poured onto the mold.

5 Claims, 19 Drawing Figures

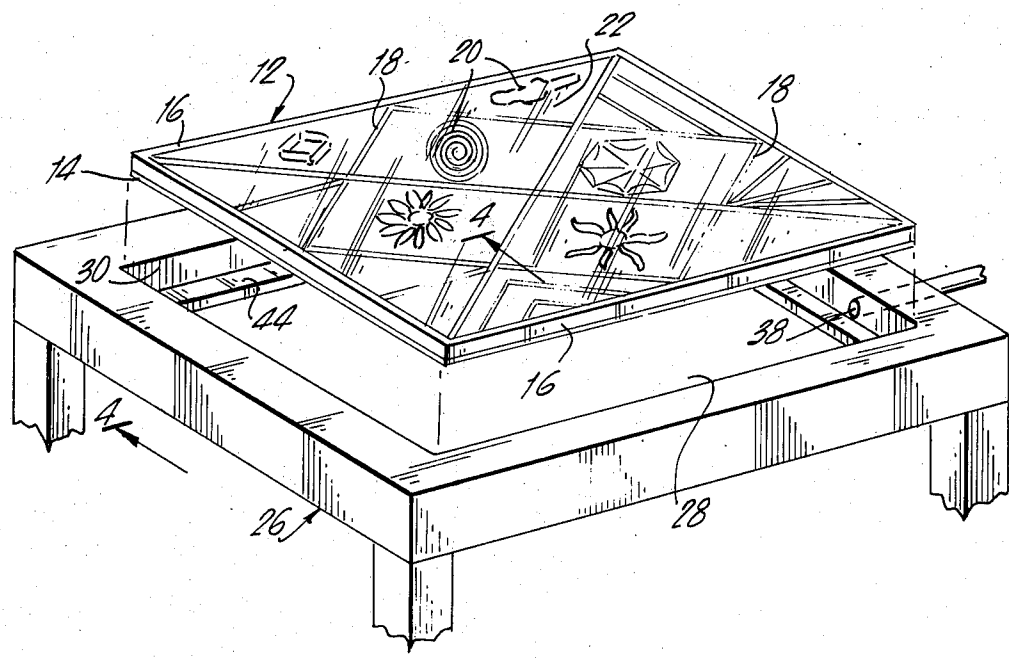
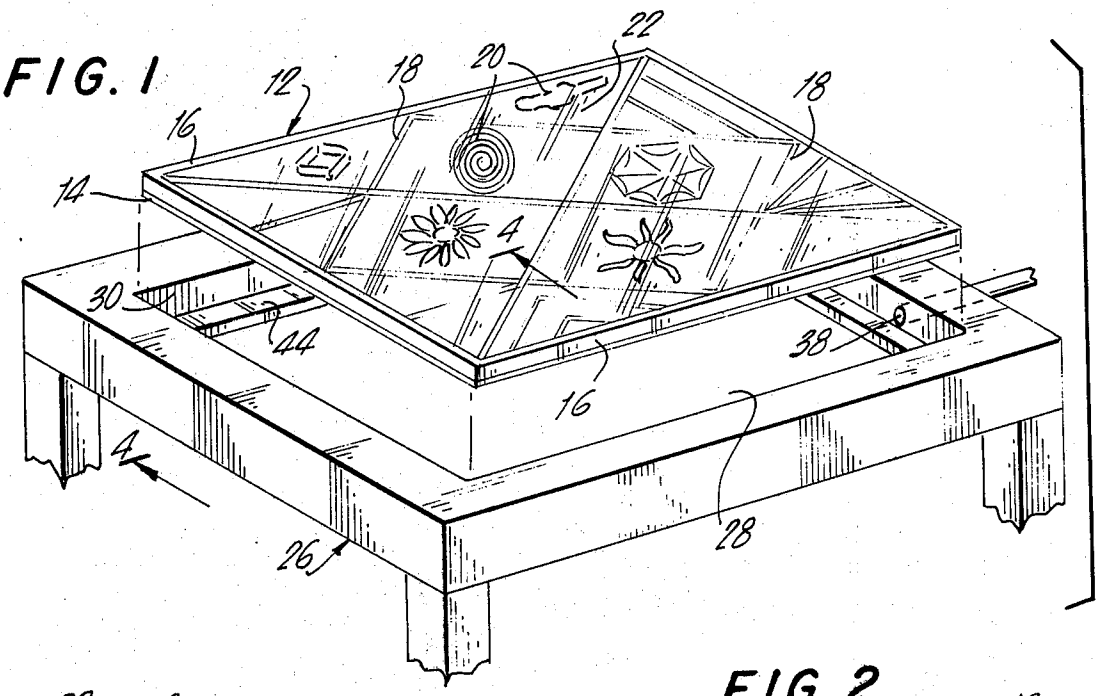


FIG. 1



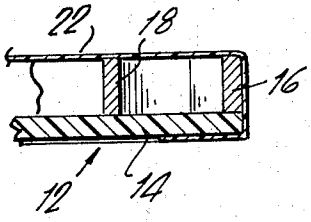
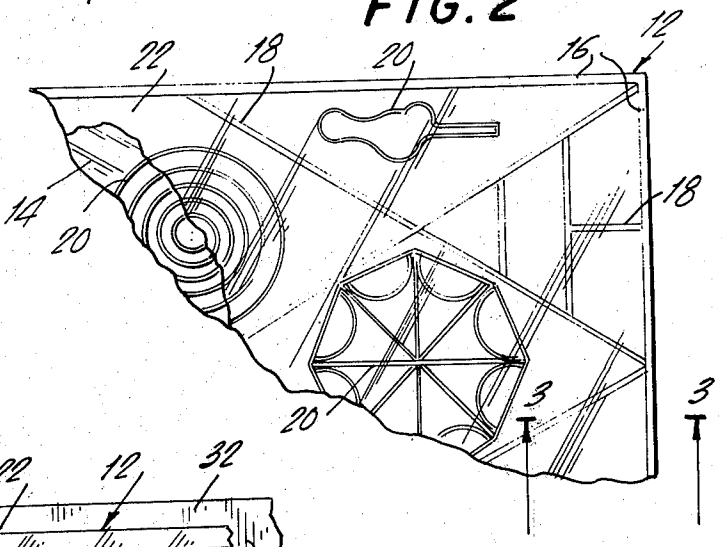


FIG. 3

FIG. 2



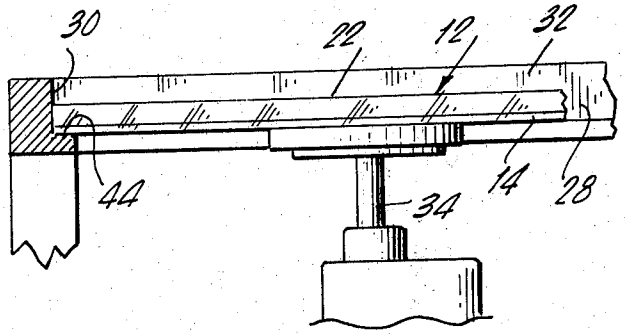


FIG. 4

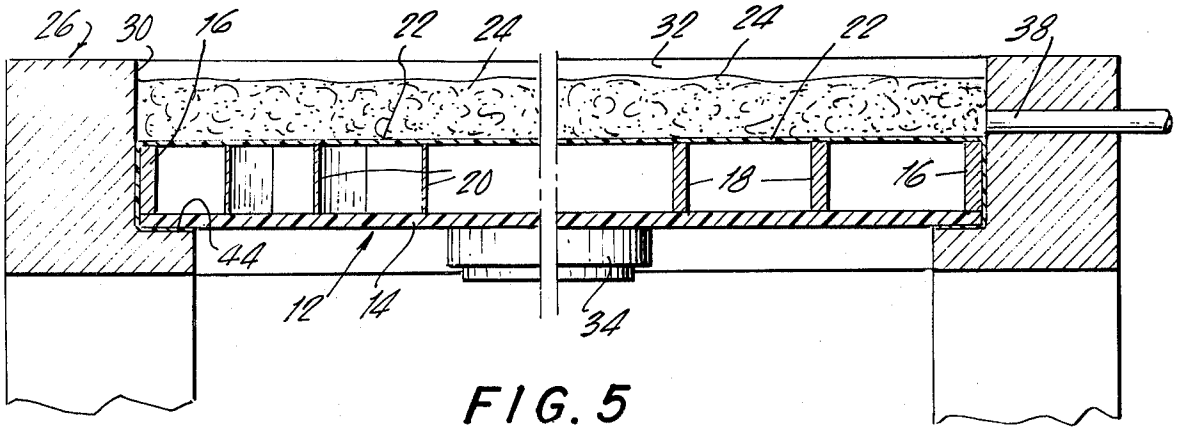


FIG. 5

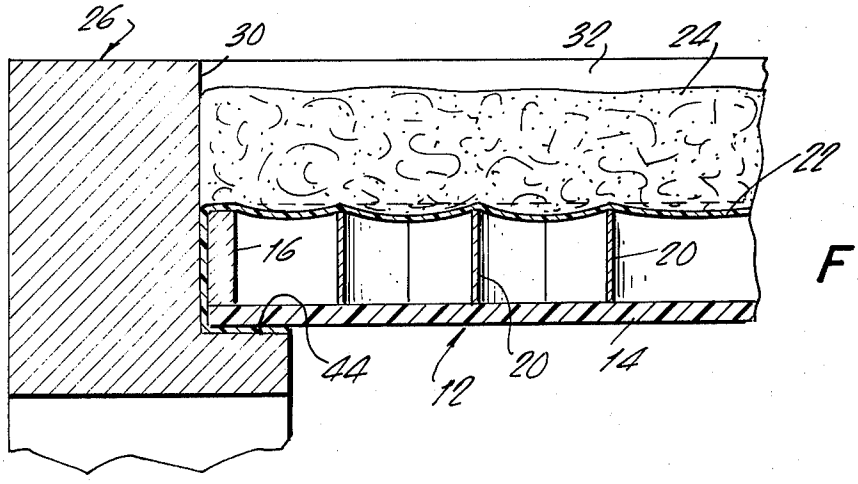


FIG. 6

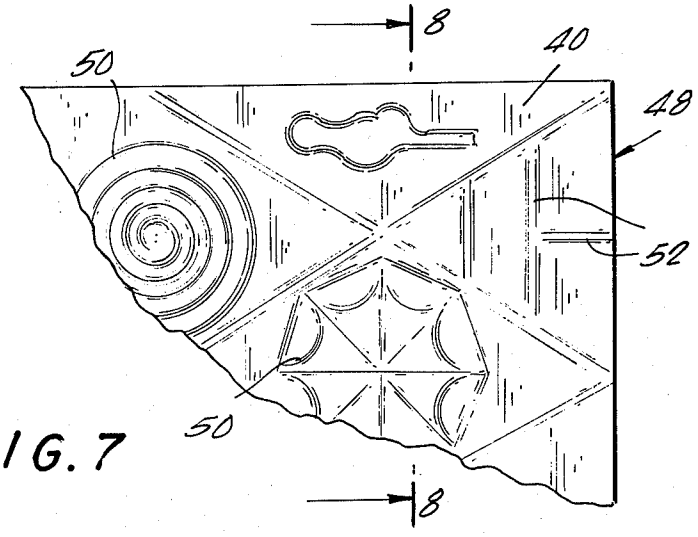


FIG. 7

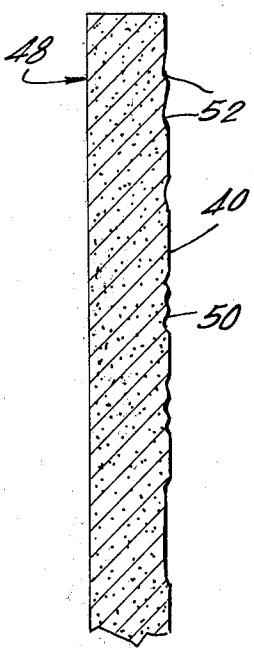


FIG. 8

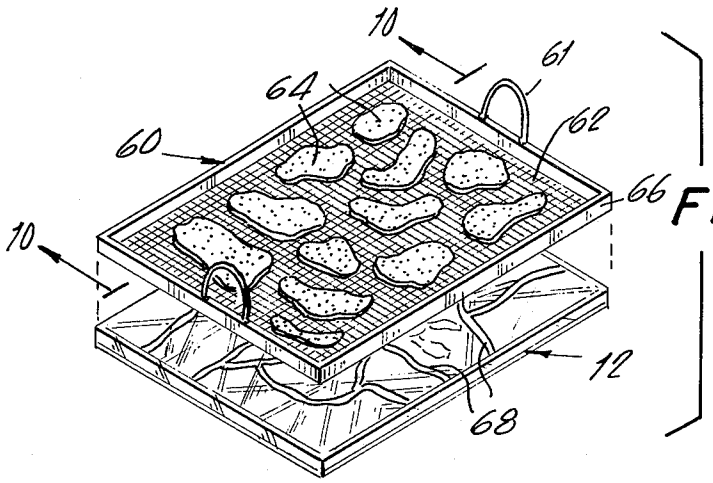


FIG. 9

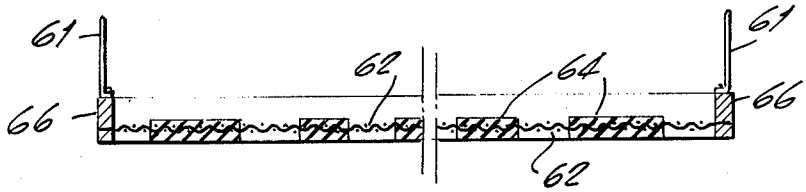


FIG. 10

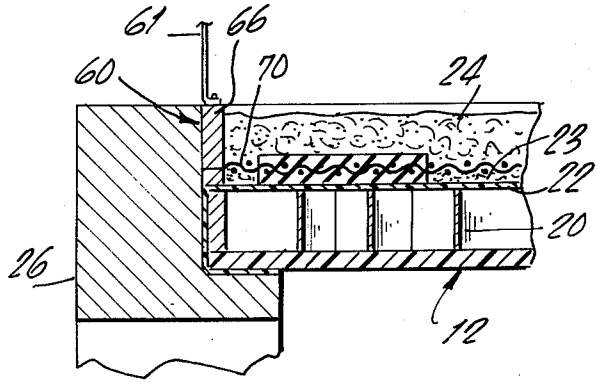


FIG. 11

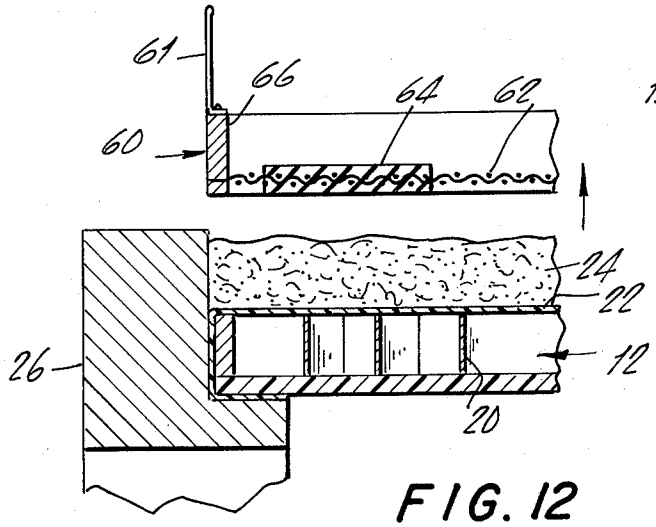


FIG. 12

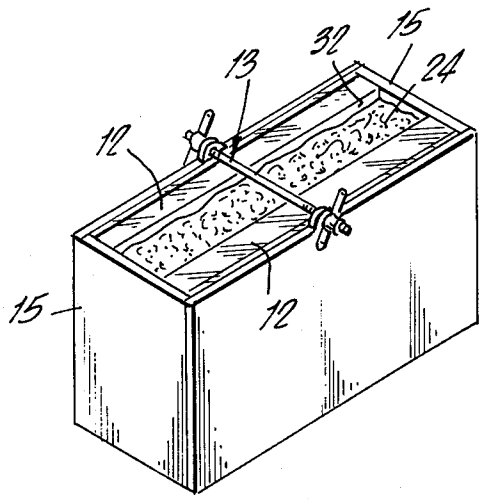


FIG. 13

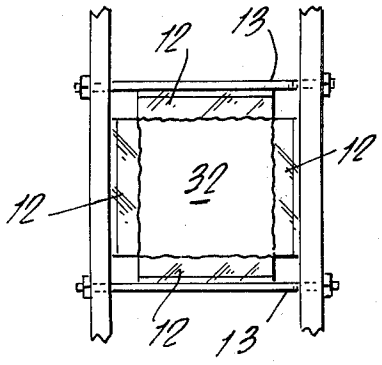
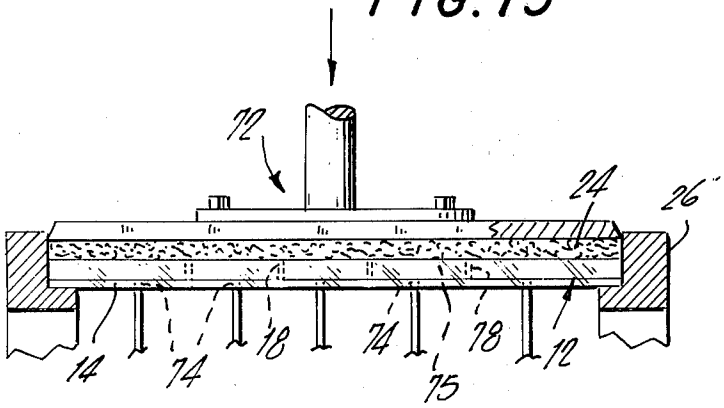


FIG. 14

FIG. 15



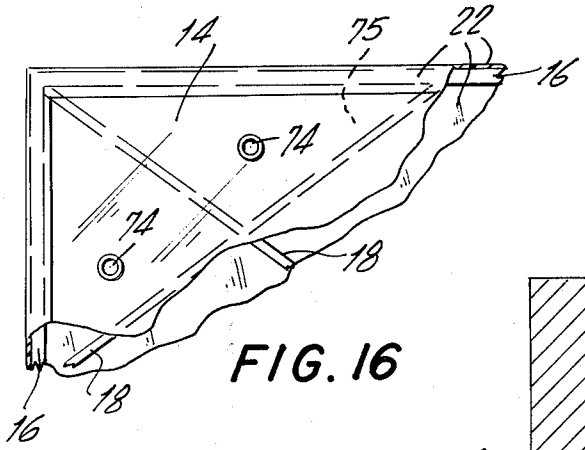


FIG. 16

FIG. 17

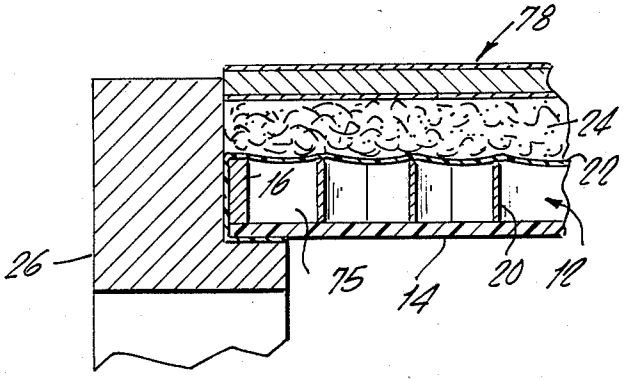
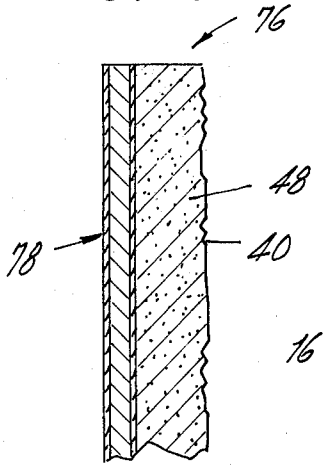


FIG. 18



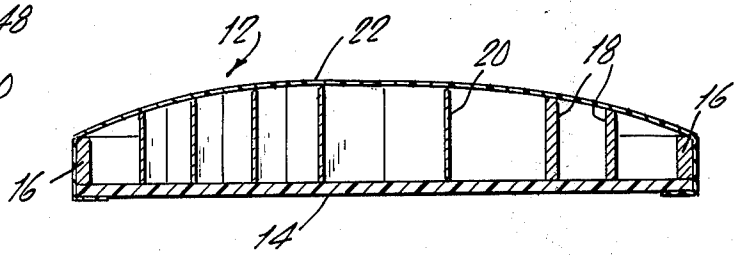


FIG. 19

MOLD FOR THE MANUFACTURE OF AN ARTICLE WITH RELIEF FEATURES

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to a mold for forming cast objects, a method of manufacturing such articles, and including a form and method of forming the same color design on the surface of many cast articles.

2. Description of the Prior Art

Various types of molds have been used in the past to form objects having a decorative face. To form the impressions and patterns desired, the design in relief was shaped into the bottom of the mold. This involved forming the desired design in a rigid material. Smooth curves were difficult and expensive to form. The surface of the cast panels, because of the difficulty of forming gradual and even curved shapes, often had imperfections. Further, even at great expense and labor, it was difficult, if not impossible, to form a smooth but contoured surface in a cast object by the prior art devices and methods.

In the past, imperfections often occured in the surface of the article after casting. These honeycombs, or air bubbles, could not be discovered until after the object was dry and removed from the mold, and the casting process was completed.

It was also difficult, utilizing the prior art, to create the same coloring pattern on a plurality of cast objects with the same contoured face.

SUMMARY OF THE INVENTION

The present invention provides a mold, a coloring frame, and method of manufacturing cast objects therefrom that overcomes certain disadvantages of the prior art, especially where smooth curves and contours are desired. It is the primary object of the invention to provide an inexpensive and dependable means for producing cast objects with a contoured facing and uniform coloring design. Further, a mold and process whereby an extremely smooth surfaced object can be obtained and where defects can be detected and eliminated before an object is completed.

In the present invention, a resilient film material is stretched over a plurality of feature strips and side walls, that are secured to the upper side of the base of the mold. The feature strips are arranged in any desired order or design. Casting material is poured on top of the resilient film material, or molding sheet. The weight of the slurry deforms the resilient sheet so it stretches evenly and symmetrically between the support of the feature strips. The outline of the raised feature strips, in relation to the corresponding sagging of the molding sheet, forms a relief design in the object. The casting material on the mold, while engaged in a supporting means, may be vibrated, and a vacuum applied, to help air escape from the material and enable the article to set without defects.

A coloring frame with a plurality of pads is held over the resilient film with the pads engaging the film after coloring matter has been applied to the surface of the resilient film, and before the casting material is applied. After the casting material is completely poured onto the mold, the frame is removed and the casting material allowed to set.

One feature of the present invention resides in the provision that the base and molding sheet are transparent, thereby enabling one to see the lower surface of the slurry, and check for air pockets before the casting has been removed from the mold.

Another feature of the invention is the ability to form perfectly symmetrical and even contours in a panel, inexpensively and easily, while obtaining an extremely smooth surface thereon.

An object of the invention resides in the provision that the molding apparatus can be altered quickly and easily to change or create a desired design.

Still further objects of this invention reside in a process or using the mold whereby the mold and casting mixture can be vibrated and subjected to a vacuum during casting to enable a smooth and flawless article to be obtained.

Another feature of the invention resides in the provision of a coloring frame which is utilized to adapt the process to create many cast objects with the identical coloring design.

These, together with the various ancillary objects and features, which will become more apparent as the following description proceeds, are attained by this novel mold and use thereof, the preferred use and a preferred embodiment of which is illustrated in the accompanying drawings, by way of example only, wherein:

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a perspective view of the mold and supporting apparatus illustrating the position of the mold just before it is placed into the supporting apparatus;

FIG. **2** is a partial top plan view of the mold, with a section of the film broken away;

FIG. **3** is a partial vertical sectional view of the mold taken along the plane of line **3—3** in FIG. **2**;

FIG. **4** is a partial vertical sectional view of the mold engaged in the supporting means taken along the plane of line **4—4** in FIG. **1**;

FIG. **5** is a partial vertical sectional view of the mold engaged in the supporting means showing the slurry thereon;

FIG. **6** is a vertical sectional detail view of the mold and supporting apparatus illustrating the deformation of the molding sheet;

FIG. **7** is a partial top plan view of a cast panel;

FIG. **8** is a partial vertical sectional view of the cast panel taken along the plane of line **8—8** in FIG. **7**;

FIG. **9** is a perspective view of the coloring frame and mold illustrating the position of the frame just before it is placed onto the mold;

FIG. **10** is a partial vertical sectional view of the frame taken along the plane of line **10—10** in FIG. **9**;

FIG. **11** is a vertical sectional detail view of the mold and frame engaged in the supporting apparatus;

FIG. **12** is a vertical sectional detail view of the mold engaged in the supporting apparatus just after the coloring frame is removed;

FIG. **13** is a perspective view of one arrangement of the molds used in a vertical position;

FIG. **14** is a top plan view of the molds used in another arrangement in a vertical position;

FIG. **15** is a vertical cross sectional view of the mold engaged in the supporting apparatus illustrating the use of a piston arrangement;

FIG. **16** is a partial bottom plan view of the mold illustrating the vacuum inlets;

FIG. 17 is a vertical sectional detail view of the mold engaged in the supporting apparatus illustrating the position of an added backing;

FIG. 18 is a partial vertical sectional view of a composite panel; and

FIG. 19 is a vertical sectional view of another embodiment of the mold.

DETAILED DESCRIPTION OF THE INVENTION

With continuing reference to the accompanying drawings, wherein like reference numerals designate similar parts throughout the various views, reference numeral **12** generally designates a mold constructed in accordance with the concepts of the invention. Mold **12** includes a rectanglar base **14** of transparent, rigid material. Perpendicular to the base **14** and at a periphery thereof is fixed the peripheral side walls **16** of the mold **12.** Arranged on the upper side of base **14** and located within the bounds of the side walls **16** are feature strips **18** and **20.** The feature strips **18** and **20** are bonded to the base **14** and can be of various desired shapes. As shown in FIG. **2** and FIG. **3,** the strips **18** and **20** are elongated and rectangular in cross section. They can be manufactured from wood, plastic, metal, or the like. The strips **18** and **20** can be arranged in any configuration or height, to obtain a desired pattern. Feature strips **20** being of a smaller horizontal width than strips **18** will create different size impressions **50** and **52,** in a cast panel **48.**

Molding sheet **22** is a thin, flexible, resilient film of transparent material stretched and pulled taut parallel to and spaced above base **14** and over the top of feature strips **18** and **20** and side walls **16.** Sheet **22** is fixedly secured by any suitable means with respect to the walls **16,** and may curve downwardly over the outer edge of walls **16** and inwardly at base **14.** Molding sheet **22** is preferably transparent and of such a strength and resilience, that it will not tear when forced over the feature strips **18** and **20** and will support without rupture the desired weight of casting material. However, a force applied downwardly, on sheet **22** located such that there is no feature strip **18, 20** directly underneath, will cause the molding sheet to deform.

A downward force is applied evenly and uniformly to the molding sheet **22** by the weight of casting material **24.** This causes the molding sheet **22** to deform and stretch downwardly from the feature strips **18** and **20** acting as supports for the molding sheet **22.** The molding sheet **22,** being of a uniform cross section, will deform increasingly downwardly as the distance increases from a feature strip substantially as in a catenary curve. The molding sheet **22** will form a symmetrical arc, with the lowest point exactly in the center of two feature strips, when an evenly distributed force is applied downwardly over the surface of the molding sheet **22.** Thereby, the resilient molding sheet **22** adapts the mold **12** to create smooth, even and uniform contours **50** and **52** in a cast panel **48.**

The molding sheet **22** is of such a material that it deforms evenly, and without creating wrinkles or stretch striations, thereby adapting the mold **12** to form smooth relief designs in a cast panel **48.**

In forming a cast panel **48,** the mold **12** is placed in a supporting apparatus including table **26** as can be seen in FIG. **1.** The table **26** has an opening **28** in the center thereof into which the mold **12** is removable placed. The mold **12,** supported by a supporting ledge **44,** or the like, sits horizontally with the molding sheet **22** located below the upper surface of the table **26.** The vertical sides of the opening **28** form containing walls **30** and engage the side walls **16** and molding sheet **22** of mold **12.** The containing walls **30** of table **26,** in combination with molding sheet **22,** form a molding cavity **32** into which casting material **24** is poured.

Any suitable casting material or mixture **24** can be placed into molding cavity **32,** including a heated slurry comprising tap water ranging from 120° to 160° Fahrenheit.

Mixture **24** is placed into the molding cavity **32** wherein its weight and possibly its temperature act to deform the molding sheet **22.** Coloring matter may be added to slurry **24** as desired to uniformly change the color of the casting material **24,** or placed on the surface of the molding sheet **22** before the slurry **24** is poured, to create various coloring designs.

The mold **12** is vibrated by way of a vibrator **34,** acting to cause the casting composition **24** to settle onto the molding sheet **22** evenly, and without air pockets. A vacuum pump (not shown) with an inlet valve **33,** located above molding sheet **22** and below the upper surface of slurry **24,** acts to draw undesired air out of slurry **24,** eliminating air pockets in the surface of the film **22.**

The vibrating and vacuum means supplied to the composition **24** enable it to settle without air bubbles and form a smooth but contoured surface.

The transparent base **14** and the transparent molding sheet **22** enable the surface of the composition **24** to be visible after it has been poured onto the mold **12,** from beneath table **26.** This allows for detecting flaws, so that a perfect cast panel **48** with a flawless face **40** can be obtained, such as by moving suction hose **38** to remove air bubbles. Thus, imperfections and air pockets existing in the casting material **24** on the molding sheet **22** can be discovered and remedied before the material **24** has set, dried and hardened into a finished panel **48.**

After composition **24** has set, the finished panel **48** is removed from the casting void **32** and a new casting process begins.

When a coloring pattern is desired on the facing of a cast article, a coloring frame **60** is utilized. Frame **60** includes a perforate screen **62** onto which are secured flexible covering pads **64.** Screen **62** can be manufactured from metal, wire, or the like, and pads **64** are secured to the lower and upper sides thereof. The pads **64** are resilient and can be manufactured out of dense foam rubber, or the like. At the periphery of screen **62** is located the frame walls **66.**

As shown in FIG. **10,** the screen **62** is secured to frame walls **66** the same distance up from the bottom of walls **66** as the dimension of the vertical distance that pads **64** extend downward from screen **62.** Frame **60** is manufactured such that its outside dimensions are exactly the same as mold **12.**

A coloring design outline can be marked on the lower side of film **22** by guidelines **68.** Coloring dye is applied by brush, or the like, to the upper surface of film **22** following lines **68,** designating areas **23** that will not be covered by pads **64.** Frame **60** is then placed on top of mold **12** while mold **12** is engaged in supporting apparatus **26.** The bottom of walls **66** engage the top of side walls **16** of mold **12,** and the lower surface of pads **64** engage and conform to film **22.** Thereafter, casting material **24** is poured onto frame **60** and casting material

24 filters through the holes 70 in screen 62, onto sections 23 of film 22 not covered by pads 64. On these exposed areas 23 the coloring matter mixes with casting material 24. After the entire amount of casting material 24 has been poured into molding cavity 32, coloring frame 60 is lifted entirely out of cavity 32 by handles 61. The casting material 24 then settles onto the areas previously covered by pads 64 to completely cover molding film 22.

Pads 64, while covering certain areas of film 22, allow the coloring matter to mix with casting material 24 in certain predetermined areas 23, and allow these same areas in subsequent castings to be treated precisely in the same manner. Frame 60, therefore, adapts mold 12 to create relief designs and coloring designs exactly the same in subsequent objects.

Coloring matter may also be applied to the exposed areas of screen 62, instead of on the upper surface of film 22. This creates a different coloring effect than that of application of the coloring to film 22, but it may be repeated to create the same effect on subsequent objects.

Mold 12 can be adapted and used in a variety of positions to form a multiplicity of objects and relief designs.

Mold 12 can be used in combination with plain forms 15, or other similar molds 12, of the same or different design, in a vertical position as shown in FIG. 13 and FIG. 14. Molds 12 can be held in place by any known supporting means 13 to adapt mold 12 to form a contoured facing on a formed in place wall, column, or the like.

As shown in FIG. 15, pressure can be applied downwardly on casting material 24 to increase the deformation of film 22. A piston means 72 or the like, the same peripheral size and dimensions as molding cavity 32 can be utilized to apply a uniform downward pressure to the upper surface of material 24. The force supplied by piston 72 would be maintained until casting material 24 has set.

Mold 12 may have a plurality of vacuum suction inlets 74 located above base 14 and below film 22. Inlets 74 may be located in various sections 75 defined by feature strips 18 and 20 as shown in FIGS. 15 and 16. The suction supplied by an inlet 74 acts to deform downwardly the molding film 22 in the sections 75 bordered by feature strips 18 and 20, base 14, and film 22. By supplying suction to various inlets 74 the deformation of film 22 in certain areas can be extended beyond that which the weight of casting material 24 could achieve. Accordingly, relief designs including deep contours and fine details may be cast into an object.

A composite panel 76 can be manufactured comprising a contoured face 40, a strong rigid backing panel 78, bonded to the back of a cast panel 48. Once casting material 24 has been poured into molding cavity 32, a casting board 78 is placed on top of the casting material 24 before it sets. The board 78 is such a material, gypsum board, for example, that it is absorbent of the casting material, plaster for example. Thereby board 78 adheres to the upper surface of casting material 24 when it sets. Thereafter backing board 78 and cast panel 48 are removed from molding cavity 32 as a composite panel 76. Board 78 and Panel 48 are bonded together without the use of adhesives, fasteners, or the like. Panel 76 comprises a contoured front facing 40 on panel 48, and a rigid rear section 78 bonded thereto to obtain added strength and rigidity.

Mold 12 can be adapted to create any type of relief shape in a cast article. By using differently shaped feature strips 18 and 20 with various cross sectional forms and dimensions, a multiplicity of impressions can be cast into an object. Further, feature strips 18 and 20 may have varying heights with respect to each other and with respect to side walls 16, one possibility of which is depicted in FIG. 18.

A latitude of modification, substitution and change is intended in the foregoing disclosure, and in some instances some features of the invention may be employed without a corresponding use of other features.

I claim:

1. A mold insert which in combination with a supporting table defines a mold cavity, said mold insert comprising a rigid base having side walls perpendicular to said base at a periphery thereof, a plurality of elongated feature strips of rectangular cross section arranged within said side walls and bonded to said base, the height of said feature strips being at least equal to the height of said side walls, a transparent, resilient, tear resistant molding film stretched over and supported by said feature strips and side walls said molding film being fixedly secured to said side walls and curving downwardly over the outer edge of said side walls and underneath the base.

2. A mold insert according to claim 1 wherein said base is transparent.

3. A mold insert according to claim 1 wherein some of said strips are of a greater height than other of said strips.

4. A mold insert according to claim 1 wherein some of said strips are of a different height than said side walls.

5. Mold apparatus for forming cast objects comprising a supporting table having an opening in the center thereof, said opening having a supporting ledge and vertical sides, a mold insert in said opening removably supported and contained by said supporting ledge and vertical sides, said mold insert comprising;

a rigid base having vertical side walls perpendicular to said base at a periphery thereof, a plurality of elongated feature strips of rectangular cross section arranged within said side walls and bonded to said base, the height of said feature strips being at least equal to the height of said mold insert side walls, but less than the height of the vertical sides of said opening, a transparent, resilient, tear and resistant molding film stretched over and supported by said feature strips and side walls, said molding film being fixedly secured to said side walls and curving downwardly over the outer edge of said side walls and underneath the base;

wherein the vertical sides of said opening engage the molding film secured to the peripheral side walls of said mold insert, the vertical sides of said opening above the peripheral side walls and feature strips of said mold insert in combination with said molding film forming a mold cavity for receiving casting material.

* * * * *