Jan. 17, 1961 G. H. HOWELL 2,968,064

CLAMPING FRAME FOR VACUUM FORMING PARTS

Filed June 24, 1959 3 Sheets-Sheet 1

FIG 1.

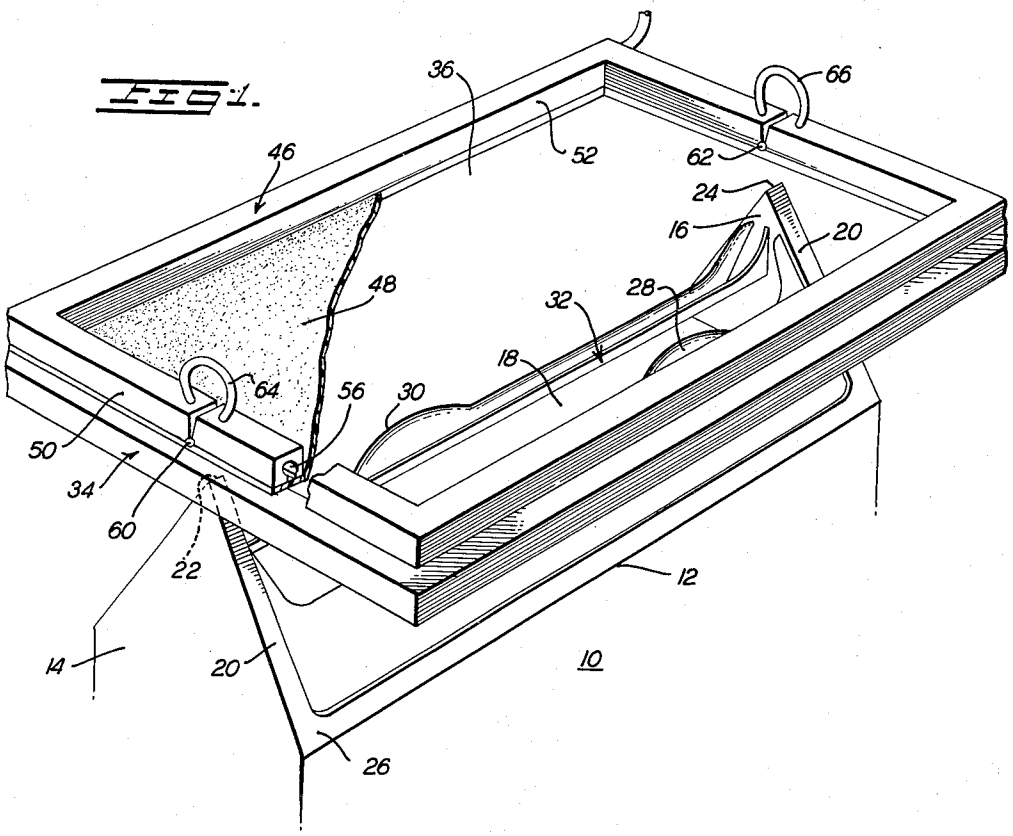
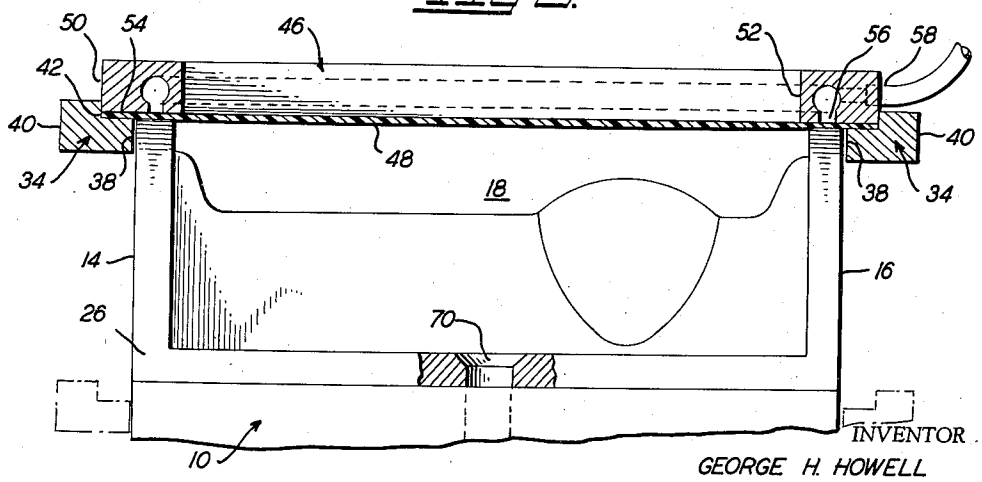


FIG 2.



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Fig. 3.

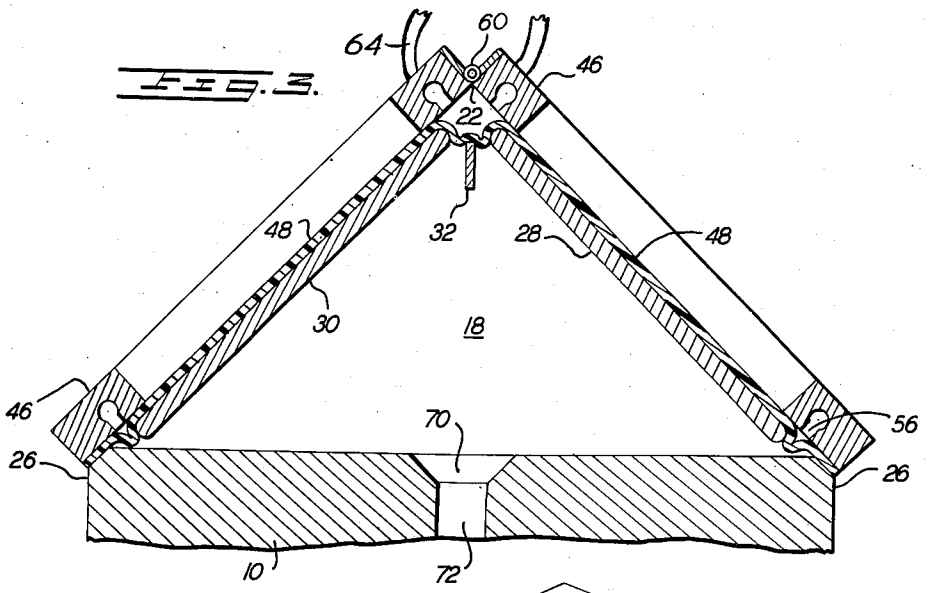
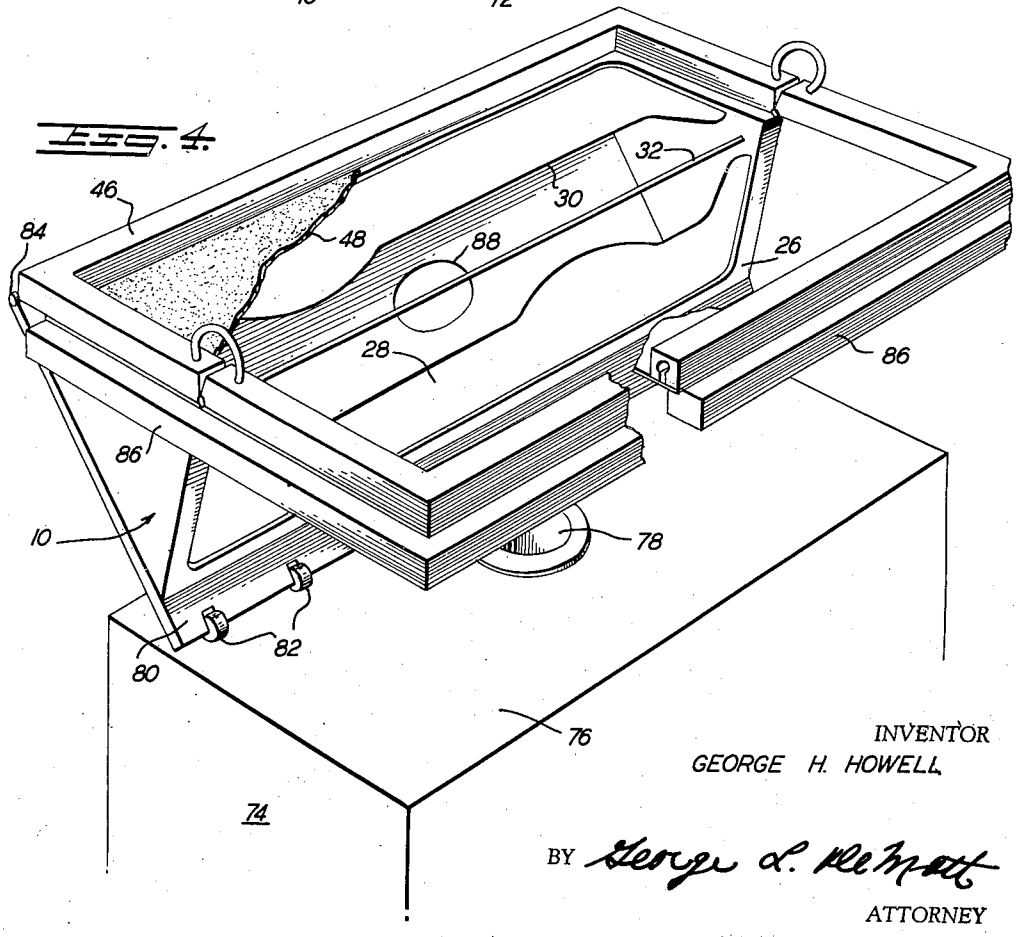


Fig. 4.



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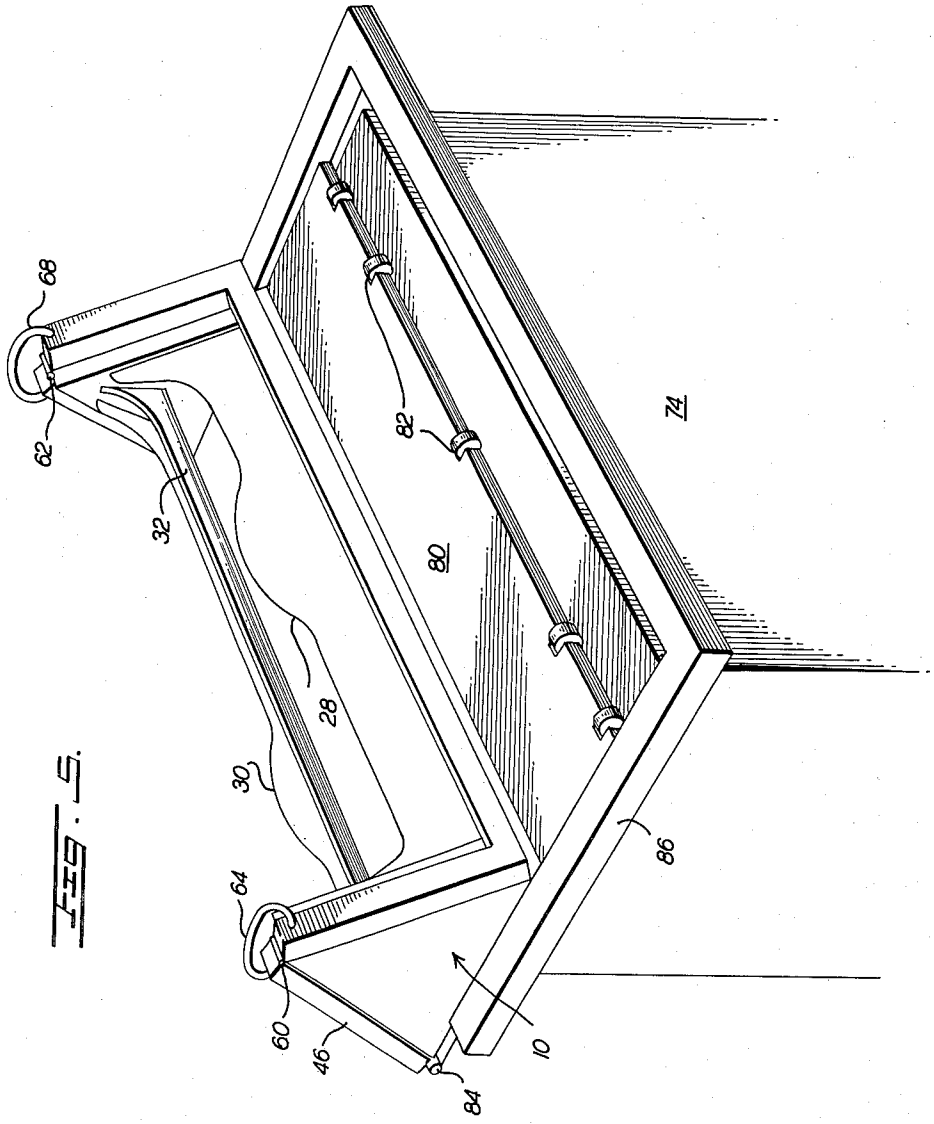


Fig. 5

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CLAMPING FRAME FOR VACUUM FORMING PARTS

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9 Claims. (Cl. 18—19)

This invention relates to plastic molding apparatus and more particularly to a drape frame structure employed in such apparatus.

Drape plastic molding has recently become widely utilized. This method of molding is accomplished by heating a plastic sheet to a soft pliable state and then draping the sheet over a forming die. A frame is generally used to hold the sheet of plastic in a horizontal position above the die while being heated. Difficulties have been encountered in obtaining quality products when draping the plastic sheet over dies with complex shapes.

It is an object of this invention to provide a new frame and die structure which facilitates frame and die alignment so that the plastic sheet may be draped uniformly about irregular die forms.

A further object of this invention is to provide a drape frame and die structure having an improved sealing engagement between the frame and die in the molding position. Other objects and advantages will become apparent from the following detailed description wherein reference is made to the accompanying drawings in which:

Figure 1 is a perspective view of the principal elements of the invention,

Figure 2 is an elevational view, partly in cross section, of the principal elements shown in Figure 1,

Figure 3 is a cross sectional view of the molding apparatus of Figure 1 in molding position,

Figure 4 is a perspective view of the molding elements of Figure 1 combined with special operating apparatus, and

Figure 5 is a perspective view of the apparatus of Figure 4 in molding position.

As shown in Figure 1 my invention consists of a die holder **10** which comprises a base portion **12** and a pair of upwardly extending end walls **14**, **16** oppositely positioned on the base. The end walls **14** and **16** define a cavity **18** therebetween. The side surfaces **20** of the end walls are inclined to the plane of the base and terminate at their upper ends in substantially parallel ridges **22** and **24**. The sloping side surfaces **20** of the end walls and the outer periphery of the base section may be formed integral to provide a common facing or ledge **26** extending around the entire periphery of the die holder.

In the preferred embodiment, a pair of dies **28**, **30** are secured within the cavity **18** between the end walls **14**, **16**. A single die could be positioned in the cavity, but in this instance a pair of crash pad dies are secured therein and separated by a tension bar **32** having a contoured top surface adapted to support and stress the molding material during the forming operation.

Referring now to Figure 2, a support frame **34** having a central aperture **36** (Fig. 1) is provided with an inner peripheral side edge **38**. The inner peripheral dimension of the frame **34** as defined by the edge **38** is greater than the outer peripheral dimension of the die holder **10**. The outer peripheral side edge **40** of the support

frame may be spaced any suitable distance from the inner peripheral side edge **38** to provide a seating portion **42** around the inner periphery of the substantially flat upper surface of the support frame. In this illustration a seat having a width of about one inch is preferred. The upper surface of the support frame may be flat, as shown in Figure 1, or have a raised outer edge, as shown in Figure 2.

An apertured holding frame **46** for a plastic sheet **48** is formed by a space enclosing rim with an outer peripheral edge **50** of larger dimension than the inner peripheral edge **38** of the rim of the support frame **34**. The inner peripheral edge **52** of the holding frame **46** is suitably dimensioned so that a seat **54** is provided around the outer periphery of its bottom surface. The seat **54** is about one inch in width so as to correspond to the seating portion **42** on the upper surface of the support frame **34**. A plurality of vacuum ports **56** opening onto the sheet **48** are inwardly spaced from the seat **54** around the inner periphery of the bottom surface of the holding frame and connected by an internal passage **58** to vacuum apparatus (not shown). It is understood that means other than vacuum ports may be utilized for securing the plastic sheet to the holding frame.

As illustrated in Figures 1 and 3, a pair of hinges **60**, **62** pivotably connect adjacent portions of the frame **46** at opposite points on the frame and thus divide the frame into foldable sections. The adjacent portions may be substantially U-shaped. The vacuum ports **56** in the frame are connected at these points by means of vacuum hoses **64** and **66**. The bottom surface of the frame is coextensive with and contoured to engage the facing **26** of the die holder **10**. The plastic sheet **48** is securely held around the inner periphery of the holding frame **46** by vacuum in the ports **56**. A work table may be used to support the die holder **10**. In the molding position of Figure 3, the holding frame **46** is sealingly engaged around the facing **26** of the die holder **10**. A vacuum port **70** is associated with the die members **28** and **30** within the cavity **18**, and through vacuum pressure line **72** is connected to suitable vacuum apparatus (not shown).

Figures 4 and 5 show the embodiment of Figure 1 as utilized with special forming apparatus. A die table **74** is provided with a flat working surface **76** in which is located a vacuum port **78**. A flat support platform **80** is shown, in Fig. 4, inclined to the working surface **76**. A plurality of rollers **82** or other translation means are secured to one edge of the support platform **80** to support the platform on the table. The opposite edge of the support platform is connected by hinges **84** to the holding frame **46**. A three sided support frame **86** guides the holding frame into engagement with the die holder. The die holder **10** is securely fastened to the support platform intermediate the opposite edges of the support platform, and a vacuum port **88** extends through the support platform to cooperate with the port **78**.

In operation of the apparatus shown in Figure 1, a plastic sheet **48** is positioned and held between the holding frame **46** and the support frame **34**. The plastic sheet **48** after positioning is heated to a pliable state. When the plastic sheet is sufficiently heated, the support frame is lowered over the die holder or the die holder is raised so that the hinges **60** and **62** are positioned in corresponding relation to the substantially parallel ridges **22**, **24** on the die holder **10**. As the support frame **34** is lowered around the die holder **10**, the ridges **22**, **24** engage the hinge portions **60**, **62** of the holding frame **46** and cause the holding frame to be folded into engagement with the facing **26**. In the final position of the support frame **34** as shown in phantom in Fig. 2, the die holder **10** has moved completely through the support

frame aperture 36 and the holding frame is then supported in sealing engagement with the die holder. A vacuum is created within the cavity 18 so that the plastic sheet is drawn down and around the dies. The tension bar 32 serves to maintain a strain on the sheet to avoid wrinkling of the material during forming.

The special apparatus shown in Figs. 4 and 5 holds the plastic sheet 48 in a heating position just above the die holder 10 in the inclined position of the support platform 80. When the plastic sheet is sufficiently heated, the support platform is moved from the heating position of Figure 4 to the forming position of Figure 5 by lateral movement on the rollers 82, actuated by the vertical movement of either the support frame 86 or the die table 74. This movement brings the support platform into substantially parallel alignment with the working surface 76 of the die table 74 and simultaneously lowers the support frame 86 over the die holder 10 to fold the holding frame 46 into engagement with the facing 26 as shown in Figure 5. The vacuum port 78 is aligned with the port 88 in the die holder at the forming position.

Thus, it is apparent that I have provided a new and useful means of drape molding wherein the alignment of a heated plastic sheet and its subsequent vacuum molding is more readily accomplished.

I claim:

1. A support for moldable plastic materials comprising an apertured frame formed by a pair of substantially U-shaped rim members, hinge means connecting said rim members at their open end to provide a substantially continuous rim foldable about said hinge means, said rim having a substantially flat bottom surface, a seat formed by the outer peripheral portion of said bottom surface, holding means for a sheet of plastic material spaced inwardly from said seat and around the entire inner peripheral portion of said bottom surface, and said holding means being operatively associated with said sheet in all positions of said foldable rim.

2. A support for moldable materials as defined by claim 1 wherein said holding means comprises a plurality of vacuum ports in said rim members opening through said bottom surface, a passage in each of said members interconnecting said vacuum ports, and flexible hose means interconnecting the passage in one member with the passage in the other member.

3. Molding apparatus comprising in combination a die holder having a base section, a frame supporting ledge formed around said base section by the peripheral facing of said die holder, opposite peripheral portions of said die holder extending upwardly from said base section to form a die retaining cavity therebetween, the side surfaces of said upwardly extending peripheral portions of said die holder that form part of said peripheral facing being inclined to the base and terminating in substantially parallel ridges, forming means in said cavity; a holding frame for plastic molding material having a surface coextensive with and adapted to engage said supporting ledge of said die holder, said frame having a plurality of sections, means to secure moldable material to said frame sections inwardly adjacent said frame surface, and hinge means connecting said sections along said frame surface at points corresponding to said parallel ridges of said die holder whereby said frame may be folded about said pivotal hinge means to engage said frame surface with said ledge of said die holder and thereby position said moldable material adjacent said die.

4. Molding apparatus comprising the combination of a die holder having a base and a pair of opposite upwardly extending end walls defining a die receiving cavity therebetween, the edges of each end wall being inclined to said base and terminating in parallel ridges, a continuous facing formed by the edges of said end walls and the edges of said base; die means in said cavity between said end walls and below said ridges, vacuum forming means associated with said die means in said cavity; a rigid apertured support member having an inner peripheral dimension larger than the outer peripheral dimension of said die holder to allow said support member to be lowered therearound; a frame comprising a rim co-extensive with and contoured for engagement with said facing of said die holder, a seat formed on the outer periphery of said rim and having an outer peripheral dimension greater than the inner peripheral dimension of said support member to hold said frame on said support member, means for holding moldable material around the inner periphery of said rim, and hinge means connecting portions of said rim at points on said rim corresponding to the points on said facing of said die holder where said parallel ridges are located whereby said frame is folded into engagement with said facing as said support member is lowered around said die holder.

5. Molding apparatus comprising in combination a die table having a horizontal working surface, a vacuum port on said surface; a flat support platform movable from a first position inclined to said working surface to a second position parallel to and closely adjacent said working surface, rolling means spaced along one edge of said platform and supporting said platform on said working surface; a die holder carried by said platform and having a base section, a frame engaging ledge formed around said base section by the peripheral facing of said die holder, opposite peripheral portions of said die holder extending upwardly from said base section to form a die retaining cavity therebetween, the side surfaces of said upwardly extending peripheral portions that form a portion of said peripheral facing being inclined to the base and terminating in substantially parallel ridges, forming means in said cavity connected with said vacuum port when said platform is in said second position; a support frame comprising a space enclosing rim, hinge means connecting one edge of said support frame to an edge of said platform opposite said rolling means, the inner peripheral dimension of said support frame being greater than the outer peripheral dimension of said die holder to allow said die holder to pass through said support frame as said platform moves from said first to said second position; a holding frame for plastic material formed by a rim co-extensive with and contoured for engagement with said ledge of said die holder, a seat formed on the outer periphery of said rim and having an outer peripheral dimension greater than the inner peripheral dimension of said support frame for supporting engagement therewith, means for holding moldable material around the inner periphery of said rim, and hinge means connecting portions of said rim of said holding frame at points corresponding to the points on said facing of said die holder where said ridges are located whereby said holding frame may be folded into engagement with said facing as said platform moves from said first to said second position.

6. Molding apparatus comprising in combination a die holder having a base section, said die holder having a continuous peripheral facing extending upwardly from said base section to form a die retaining cavity, portions of said peripheral facing being inclined to one another; a holding frame for plastic material having a surface coextensive with and contoured for engagement with said peripheral facing of said die holder, said frame comprising a plurality of sections, and flexible means interconnecting adjacent sections along said surface to permit relative movement between sections whereby said frame surface may be moved into engagement with said peripheral facing and thereby position said plastic material adjacent said die.

7. Molding apparatus comprising in combination a die holder having a base section and a continuous peripheral facing extending upwardly therefrom to form a die retaining cavity, portions of said peripheral facing being inclined to one another; vacuum forming means associated with said die means in said cavity; a holding frame

for plastic material having a surface coextensive with and contoured for sealing engagement with said peripheral facing of said die holder; means for holding said plastic material around the entire inner periphery of said surface including a plurality of vacuum ports opening through said surface, said frame comprising a plurality of sections, and flexible means interconnecting adjacent sections along said surface to permit relative movement between sections whereby said frame surface may be moved into sealing engagement with said peripheral facing.

8. Molding apparatus comprising in combination a die table having a horizontal working surface, a vacuum port on said surface; a flat support platform movable from a first position inclined to said working surface to a second position parallel to and closely adjacent said working surface, rolling means spaced along one edge of said platform and supporting said platform on said working surface; a die holder having a base section and a continuous peripheral facing extending upwardly from said base section to form a die retaining cavity, portions of said peripheral facing being inclined to one another; forming means in said cavity connected with said vacuum port when said platform is in said second position; a support frame comprising a space enclosing rim, hinge means connecting one edge of said support frame to an edge of said platform opposite said rolling means, the inner peripheral dimension of said support frame being greater than the outer peripheral dimension of said die holder to allow said die holder to pass through said support frame as said platform moves from said first to said second position; a holding frame for plastic material having a surface coextensive with and contoured for engagement with said peripheral facing of said die holder, a seat formed on the outer periphery of said surface and having an outer peripheral dimension greater than the inner peripheral dimension of said support frame for supporting engagement therewith, means for holding

moldable material around the entire inner periphery of said surface, said frame comprising a plurality of sections, and flexible means connecting adjacent sections along said surface to permit relative movement between sections whereby said holding frame surface may be moved into engagement with said facing as said platform moves from said first to said second position.

9. A holding apparatus comprising in combination a die table having a horizontal working surface, a vacuum port on said surface; a flat support platform movable from a first position inclined to said working surface to a second position parallel to and closely adjacent said working surface, rolling means spaced along one edge of said platform and supporting said platform on said working surface; a die holder having a base section and a die retaining cavity; forming means in said cavity connected with said vacuum port when said platform is in said second position; a support frame comprising a space enclosing rim, hinge means connecting one edge of said support frame to an edge of said platform; a holding frame for moldable material having an outer peripheral dimension greater than the inner peripheral dimension of said support frame, a seat formed about the outer periphery of said holding frame for supporting engagement with said support frame; means for holding moldable material around the inner periphery of said holding frame; and the inner peripheral dimension of said support frame being greater than the outer peripheral dimension of said die holder to allow said die holder to pass through said support frame to position said moldable material closely adjacent said die holder as said platform moves from said first to said second position.

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UNITED STATES PATENT OFFICE

CERTIFICATION OF CORRECTION

Patent No. 2,968,064 January 17, 1961

George H. Howell

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 4, line 64, column 5, line 7, and column 6, line 3, for "flexible", each occurrence, read -- flexile --.

Signed and sealed this 27th day of June 1961.

(SEAL)
Attest:

ERNEST W. SWIDER
Attesting Officer

DAVID L. LADD
Commissioner of Patents