

Sept. 22, 1959

J. A. STAHMANN
APPARATUS FOR PLACING A DESIGN ON A THREE
DIMENSIONAL POROUS CARRIER

2,904,916

Filed March 11, 1957

2 Sheets-Sheet 1

FIG. 1.

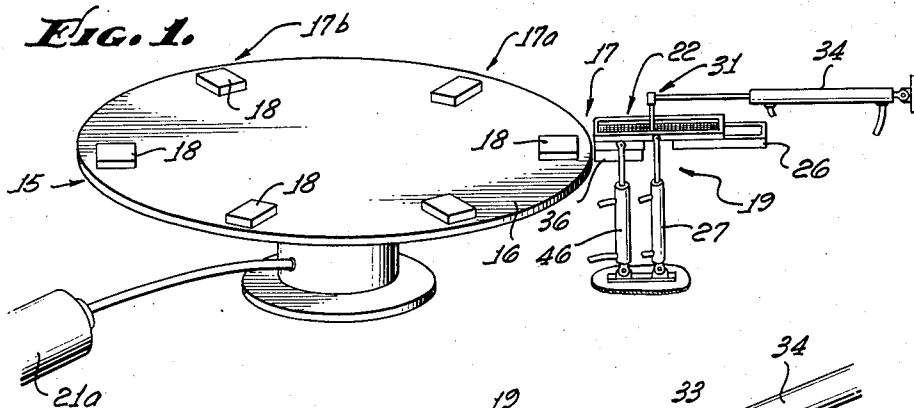


FIG. 2.

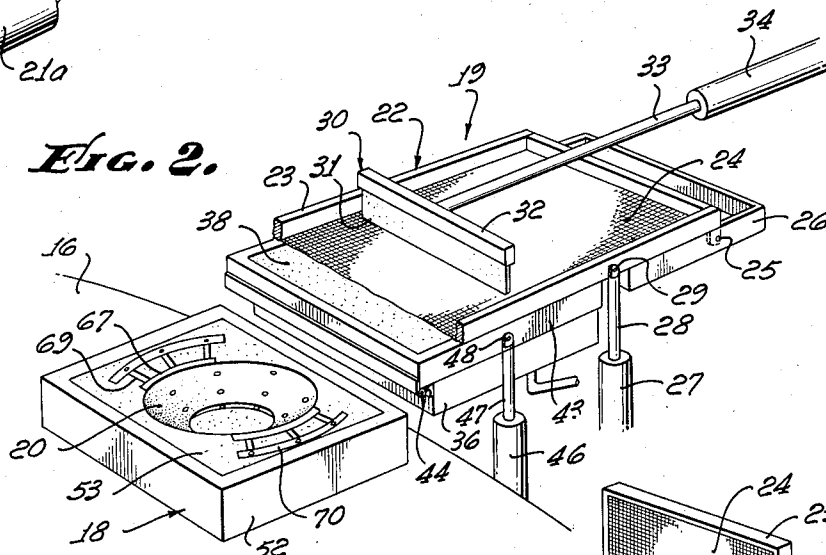
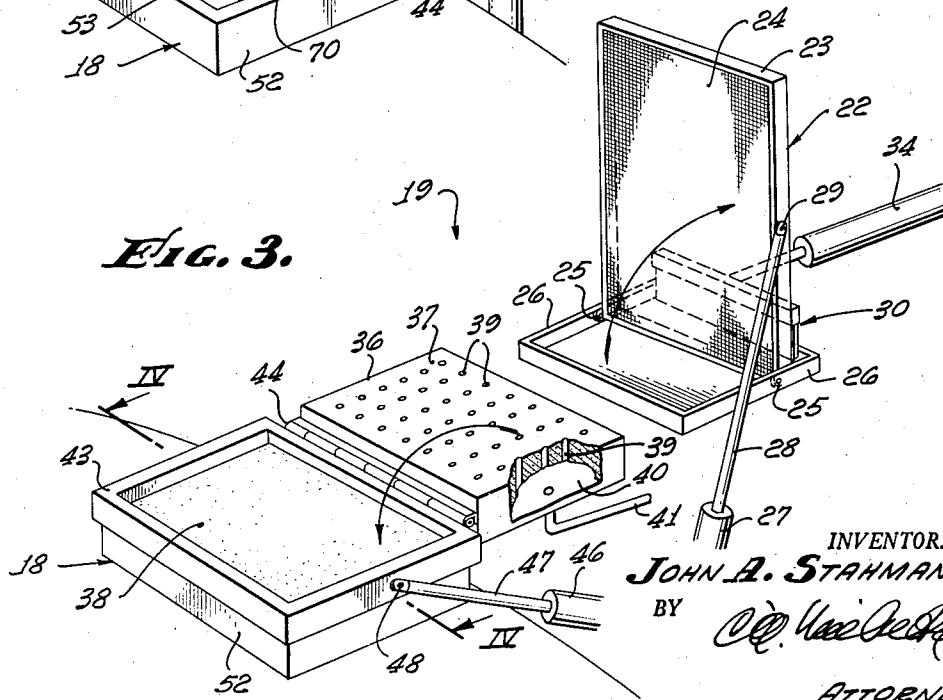


FIG. 3.



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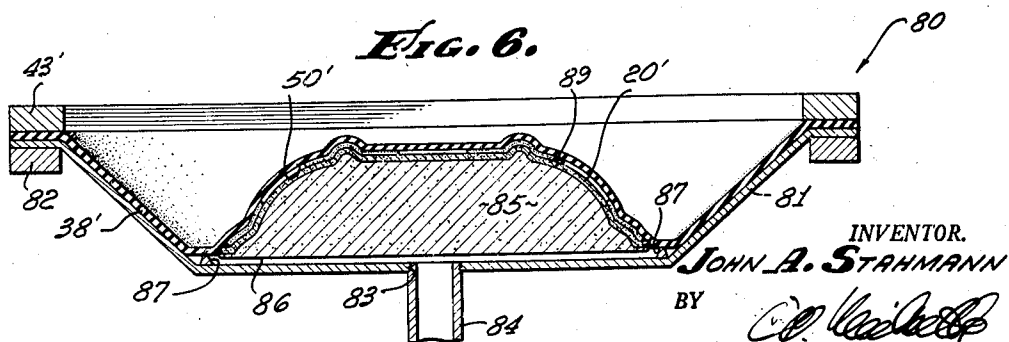
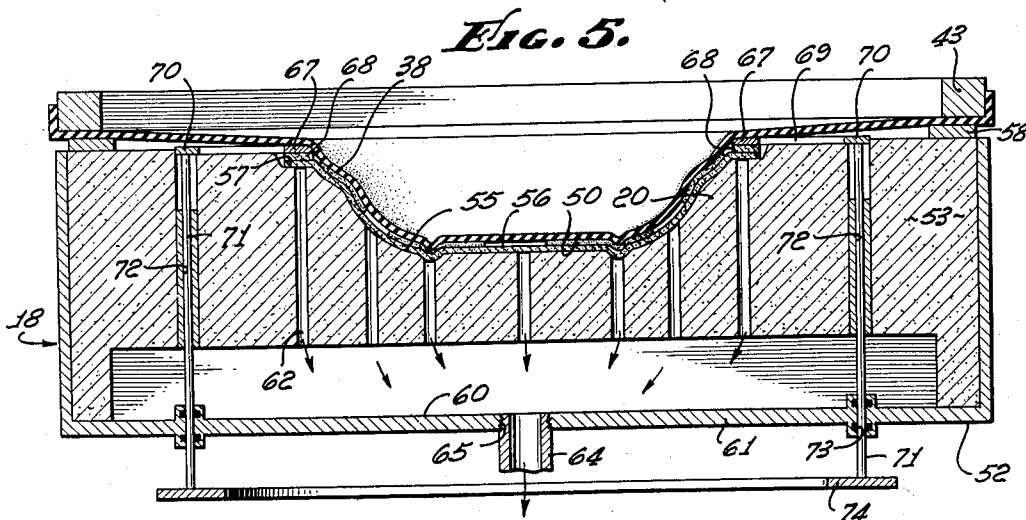
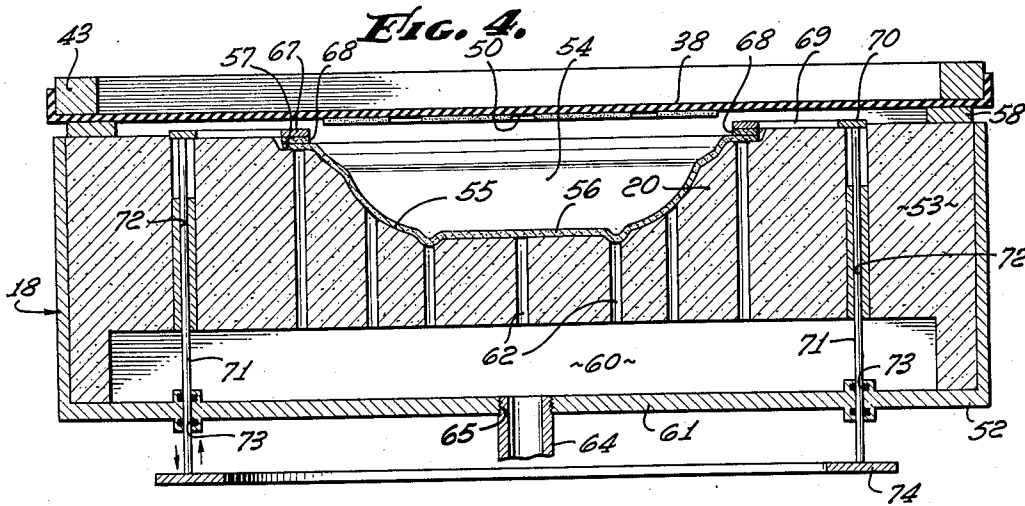
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APPARATUS FOR PLACING A DESIGN ON A THREE DIMENSIONAL POROUS CARRIER

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Application March 11, 1957, Serial No. 645,103

12 Claims. (Cl. 41—1)

This invention relates to an apparatus for decoration of three dimensional, compound curved surfaces. The invention, in particular, is directed to decoration of a three dimensional porous design carrier or form described and claimed in my copending application, Serial No. 559,186, filed January 16, 1956, and adapted to be utilized with an article of dinnerware, hollow ware, artware and the like for decoration thereof.

In the said copending application, there is described a three dimensional carrier having compound, convex and concave surfaces adapted to bear a decorative design and adapted to be applied to and imbedded in a surface of an article of dinnerware so as to become an integral part of said dinnerware and to furnish decoration on compound curved surfaces thereof. As described in said application, the three dimensional carrier may be made of a polymerizable resin and fiber composition and is of very thin porous uniform section such as .008 to .030 inch. Several methods were generally described in said application for applying a decorative design to the three dimensional carrier and it is the purpose of the present invention to disclose a particular method and apparatus for applying a decorative design to such a carrier.

Heretofore, dinnerware of curable organic plastics or resinous compositions such as the various urea aldehyde and melamine aldehyde types of thermosetting compositions have been of simple form and decoration, has been applied to only relatively flat, planar areas of said articles of dinnerware. Prior proposed methods of decorating the surface portions of compound curvature of such articles have included using a rubber transfer member having a design carried thereon, said member being subjected to superatmospheric pressure to press the member into contact against surfaces of an article of dinnerware for imprinting or transferring the design thereto. In such prior proposed arrangements, many difficulties in decoration of the article were encountered because of non-uniform and distorted deposition of the design on the article, such non-uniform deposition of the design being caused by entrapment of air between the transfer member and the impervious surface of the article of dinnerware. Prior proposed methods of application of decorative designs to compound curved surfaces of articles of plastic composition were generally commercially impractical, and as a result, production of plastic dinnerware has been limited to solid colors, or decorative designs provided on only relatively flat areas.

This invention contemplates an apparatus for decorating a three dimensional porous design carrier or preform in order to decorate plastic composition dinnerware having compound surfaces of curvature and in which the design carrier becomes an integral part of the ware.

It is therefore the primary object of this invention to disclose and provide an apparatus for producing a design on a three dimensional carrier or preform.

An object of this invention is to disclose and provide an apparatus for producing multicolor decoration on a porous three dimensional carrier.

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Another object of this invention is to disclose and provide an apparatus for producing a decoration on a design carrier having compound concave and convex curvature wherein the carrier is of a porous material and wherein a holder for said design carrier is also of a porous material to facilitate accurate printing or deposition of a design upon the carrier.

A further object of this invention is to disclose an apparatus for multicolor decoration of a carrier body wherein a rotatable table means is provided with a plurality of circumferentially spaced carrier holders and is indexed to precisely position said holders at predetermined stations, said carrier holders being each associated with vacuum producing means whereby a flexible design transfer member may be drawn into surface contact with said design carrier to accurately deposit or print a design thereon.

A still further object of this invention is to disclose and provide a porous carrier holder provided with a surface contoured to correspond accurately to the contour of a design carrier, said carrier holder being provided with passageways extending from said surface to a plenary vacuum chamber.

A more specific object of this invention is to disclose and provide a carrier holder including means for positively and accurately positioning a design carrier therein, and wherein said carrier holder and design carrier are porous to facilitate withdrawal of air therefrom to draw an elastic impervious transfer member bearing a design on its surface into pressure contact with a surface of the carrier to be decorated.

Other objects and advantages of this invention will be readily apparent from the following description of the drawings in which exemplary embodiments of this invention are shown.

In the drawings:

Fig. 1 is a perspective view of an apparatus embodying this invention and including several printing stations on a rotary table, only part of the apparatus at said stations being shown.

Fig. 2 is an enlarged perspective view of a carrier holder, a transfer member, and a silk screen means arranged at each station provided by the rotary table.

Fig. 3 is a fragmentary perspective view such as Fig. 2, indicating retraction of the silk screen means and the transfer member operatively positioned over the carrier holder.

Fig. 4 is a fragmentary sectional view of a carrier holder at one of said stations shown in Fig. 1, the section being taken in a vertical plane bisecting the holder and illustrating the transfer member, carrier member and holder in operative position.

Fig. 5 is a sectional view similar to Fig. 4, illustrating the printed face of the transfer member sucked into contact with the porous carrier.

Fig. 6 is a sectional view of a different embodiment of this invention showing printing of external surfaces of a porous carrier.

In Fig. 1 an apparatus 15 embodying this invention may include a movable support or rotatable table means 16 provided with a plurality of circumferentially or peripherally spaced printing stations 17, 17a, 17b, etc. Each station 17 includes a carrier holding means 18 and a cooperably positioned design printing means 19 for depositing or printing a design or decoration on a porous, preformed, three-dimensional, compound configured design carrier or form 20 of the exemplary type described in said copending application, Serial No. 559,186, said carrier 20 being supported by and positioned in said carrier holder means 18 as later described. It should be noted that the three-dimensional carrier 20 made of fibrous material with a bonding resin, even when slightly

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impregnated with resin, as described in said copending application is porous and permeable to gas. The printing means 19 is illustrated at only one station and is only partially shown by way of example. Each of the printing means 19 may be independently and separately mounted in predetermined spaced relation to the periphery of the rotatable table means 16 and in cooperative relation to holder means 18.

The means for rotating the table means 16 is well known and is not described. Such means for rotating the table may include indexing means to precisely position each carrier holder means 18 at stations 17. As shown in Fig. 1 a conduit 21 leads to a vacuum producing means such as a suction pump 21a of well known construction, said conduit means 21 being provided communication with each of the carrier holder means 18 beneath the table means in well known manner and as later described.

Each printing means 19 may include a silk-screen means 22 comprising a rectangular frame 23 having stretched thereacross a suitable silk-screen 24 provided with a selected pattern or design thereon. The silk screen 24 is of well known construction. If desired, the screen may be made of fine silver wires or of fibers of any suitable material. The silk screen 24 may be attached to the frame 23 in any well known manner.

The frame 23 may be pivotally mounted at 25 at the end thereof remote from said table to a stationary, rectangular support member 26 of any suitable material. A fluid operable cylinder means 27 for positioning the screen means 22 may include a piston 28 pivotally connected at 29 to the frame 23 in spaced relation to pivot mounting 25 so that as the piston 28 is extended, screen means 22 may be retracted to a substantially vertical position (Fig. 3). The opposite end of cylinder means 27 may be pivotally mounted to a fixed support in well known manner. When the piston 28 is retracted, the silk screen is brought into intimate overlying contact with a design transfer member 38 as later described.

A squeegee or doctor blade 30 of well known construction may include a flexible transverse member 31 having a bottom transverse edge adapted to move across said silk screen and to press suitable printing material through the silk screen 24 in accordance with the pattern or design provided thereon. The design or decoration to be pressed through the silk screen may include overall random patterns, geometric, continuous, or any other selected pattern. The printing material may include any suitable pigmented vehicles and ink compositions which may be of opaque, neutral or white characteristics.

The doctor blade 30 may also include a rigid transverse base member 32 which may be connected to one end of a piston rod 33 actuated by a fluid operable cylinder means 34 pivotally connected at its opposite end in well known manner to a suitable support. The doctor blade 30 is reciprocally moved across the silk screen 24 in well known manner by the cylinder means 34.

The printing means 19 may also include a bed member 36 supported adjacent the periphery of rotary table 16 and is provided with a smooth, flat, planar, top-printing surface 37 for supporting in design-receiving position a rubber-like, impervious, elastic, flexible, printing matt or transfer member 38. The transfer member 38 may be made of suitable rubber or rubber-like compositions such as elastomers, latex synthetic rubbers, polyvinyl, and the like. To hold the transfer member 38 in intimate contact with printing surface 37 without wrinkles or air pockets thereunder, the bed member 36 may be provided with a plurality of relatively small diameter through ports 39 which communicate with an internal vacuum chamber 40 which may be provided communication with a vacuum line 41 which may be connected to any suitable vacuum producing source.

The design transfer member 38 may be carried by a rectangular frame 43 having the edge proximate to said

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table 16 hinged as at 44 to the corresponding edge of bed member 36. The transfer member 38 is stretched across and is carried by the frame 43 in such a manner that the upper portion of the bed member 36 may be received within said frame to closely position the transfer member 38 against said printing surface 37. Fluid operable cylinder means 46 includes a piston 47 which may be pivotally connected at 48 to side members of frame 43 intermediate ends thereof so as to move the frame 43 about its hinge connection 44 into design-receiving position and into design transfer position. The cylinder means 46 may be pivotally mounted at its opposite end in well known manner.

Operation of printing means 19 will be readily understood. Actuation of cylinder means 46 will position transfer member 38 over printing surface 37. By producing a vacuum in the bed member 36, the transfer member 38 will be smoothly supported on printing surface 37 without air pockets therebeneath. In such design-receiving position, the silk screen frame means may then be pivoted about pivotal mounting 25 by cylinder means 27 to lay the silk screen smoothly over the design-receiving surface 50 of the transfer member 38. Actuation of cylinder means 34 will then cause reciprocal movement of the doctor blade 30 so as to press a suitable printing material provided in the silk screen frame 23 through the open mesh of the silk screen in accordance with the pattern provided thereon and such printing material will be deposited upon the surface 50 of the transfer member in accordance with the said pattern. Upon retraction of the doctor blade and of the silk screen means 22, the transfer member 38 is now ready for positioning over a carrier holder means 18, the specific construction of which is now described. It is understood that the printing material may be applied to the elastic transfer member 38 by means of a printing roller, by stamping, or other well known means.

Each carrier holder means 18 is accurately mounted at the peripheral margin of rotary table 16 at a selected point to coincide with stations 17 and at a height to be cooperably covered by the transfer member 38. Each holder means 18 may comprise an outer impervious housing 52 having a top opening. Within said top opening is received and positioned a porous body member 53 made of a rigid, very porous composition material such as gypsum. The body member 53 is provided with a central cavity 54 defined by an inwardly facing contoured surface 55 precisely corresponding in its three-dimensional configuration to the shape and form of a thin, porous design carrier or form 56 on which the design is to be deposited. In Fig. 4, carrier 56 is shown positioned in the cavity and uniformly supported by the body member 53. Surrounding the cavity 54 may be a recess or shelf 57 adapted to support peripheral extremities of carrier 56. At the periphery of the top opening of housing 52 may be provided a continuous peripheral sealing strip 58 of any suitable sealing material such as rubber, rubber composition or synthetic compositions. The sealing strip 58 is adapted to cooperate with opposed frame 43 which carries the transfer member so as to provide an air-tight seal between the frame 43 and the housing 52 and peripheral margins of the porous body member 53.

The body member 53 may be provided with a vacuum chamber 60 on the side thereof opposite the cavity 54, said chamber 60 being enclosed by bottom wall 61 of housing 52. At suitably selected intervals, body member 53 is provided with a plurality of through passageways 62 communicating with the contoured surface 55 and with the vacuum chamber 60. The vacuum chamber 60 thus provides a plenary or distribution chamber in communication with the opposite side of the body member through passageways 62 and through the very porous composition material constituting said body member.

Means for producing a vacuum in said chamber 60,

passageways 62, and in said porous body member may include any suitable vacuum producing means such as a suction pump generally indicated at 21a. Vacuum pump 21a is connected to conduit 21 which may be connected to a manifold (not shown) beneath table 16 and from which conduit lines 64 extend, each for communication with a vacuum chamber 60 through a port 65 in bottom wall 61 of each housing 52.

Means to position and retain a design carrier 56 in cavity 54 may include inner, thin, flat, arcuate segments 67 diametrically arranged with respect to said cavity 54 and overlying a portion of shelf 57. Each segment 67 may include a suitable pad 68 on its bottom face for contact with the thin peripheral margin of a carrier 56. Each arcuate segment 56 may be connected by spaced, radially, outwardly extending arms 69 to an outer concentric disposed arcuate segment 70. Outer segments 70 may be connected to a plurality of spaced vertical support rods 71 which slidably extend through bores 72 provided in body member 53 and through a sealed bore 73 provided in bottom wall 61 of housing 52. The bottom ends of rods 71 may be interconnected by a ring member 74. Ring member 74 may be cooperably connected to cam means whereby said rods 71 may be simultaneously raised and lowered in order to releasably press segments 67 against a design carrier 56 positioned in cavity 54.

A design carrier 56 is positioned in each carrier holder means 13 and securely retained therein by the arcuate inner segments 67 which are actuated into retaining position by the said cam means. When the design carriers are thus properly positioned and a design has been printed on the design-receiving surface 50 of the elastic transfer member 38, the cylinder means 46 may be actuated so as to move frame 43 about its pivotal connection 44 to a design transfer position over a carrier holder means positioned directly opposite thereto at a printing station 17. The height of the top of the carrier holder means 18 and the frame 43 when in design transfer position, is accurately predetermined so that downwardly facing, peripheral surfaces of the transfer member 38 will sealingly contact the peripheral sealing strip 53 on the carrier holder means so as to provide a tight seal. Upon actuation of the vacuum pump means and suitable control valves (not shown), connected therewith, a subatmospheric pressure is produced in the vacuum distribution chamber 60, passageways 62 and in the porous body member 53. Since the carrier 56 is also porous, the produced subatmospheric condition causes the elastic transfer member to be drawn toward the contoured surface 55 of the body member 53 and brought into pressure contact with the porous carrier 56 supported on said contoured surface 55. Upon contact with the porous carrier, the printing material carried by the transfer member 38 is transferred to the surfaces of the carrier 56 and deposited thereon precisely in accordance with the pattern or a design carried thereby. Reduction of vacuum permits the transfer member 38 to return to normal position after which the frame 43 may be retracted and returned to design-receiving position over printing bed 36.

In the rotary table arrangement shown, each carrier holder means may next be rotated to a different station 17 where a design of different pattern and color may be deposited on the carrier 56 in order to provide a composite multicolored decoration. Obviously, the same design and color may be imprinted on a carrier at each station if so desired.

After the carrier 56 has been printed with the selected overall pattern, the arcuate inner segments 67 may be lifted so as to permit release and withdrawal of the carrier from the cavity 54. It is understood that the carrier 54 is sufficiently rigid and self-sustaining so that it will not collapse or be distorted from its predetermined configuration.

After the design-bearing carrier or form 20 has been removed from the rotatable table means 16, it may be placed in an apparatus in which a plastic dinnerware ar-

ticle is being formed as described in said copending application. In the manufacture of such plastic dinnerware and after an initial pressing operation in a mold has taken place, the upper die may be raised for "de-gassing" the partially made article and the three dimensional carrier 20 placed upon the surface to be decorated of the partially fabricated article within the press. The press may then be closed by replacing the die to complete the forming operation. During the subsequent forming operation, the resin of the carrier 20 is liquified and completely polymerized from diffusion taking place between the resin of the carrier and the resinous composition of the article of dinnerware being made. In such final forming operation, the very thin fibrous carrier 20 becomes embedded in the resinous composition of the article with the decoration or design carried by the carrier becoming an integral part of the surface of the dinnerware.

The above described embodiment of this invention shows a method of imparting a design to concave internal surfaces of a design carrier. In the embodiment in Fig. 6, a modification of said apparatus is shown by which a decoration or design may be printed on convex surfaces of a design carrier adapted to impart decoration to exterior surfaces of an article of dinnerware.

In Fig. 6 a carrier holder means 80 may include an impervious preformed rubber matt 81 supported by a rigid frame 82 around its periphery. The rubber matt 81 may be provided with a port 83 having a suitable connection to a vacuum line 84 connected to a suitable vacuum producing means as in the above embodiment. Supported centrally in the preformed rubber matt may be a porous body member 85 defining with the rubber matt 81, a vacuum chamber 86 provided with ports 87 communicating with the space between rubber matt 81 and an elastic impervious transfer member 38'. The porous body member 85 is provided with an external compound three dimensional convex surface 89 shaped to correspond to the external surface of an article of dinnerware. Communication between surface 89 and vacuum chamber 86 is through the porous member and, if desired, passageways may be provided therein as disclosed in the prior embodiment.

The elastic transfer member 38' may be carried by a rigid frame 43' and may be part of a printing means 19' of substantially the same construction as that described above. The elastic transfer member 38' is adapted to carry a printed design on its face 50' and deposited thereon as described in the prior embodiment.

A preformed design carrier 20' of construction similar to that described above may be positioned over said surface 89 on the porous body member 85 and since said surfaces accurately correspond in configuration, the design carrier 20' is readily supported and retained in position thereon.

Operation of the modification shown in Fig. 6 is virtually the same as that of the prior embodiment. When a subatmospheric pressure is produced in vacuum chamber 86, the elastic transfer member 38' is drawn downwardly into printing contact with the opposed surface of the design carrier 20'.

It is important to note that in the above described apparatus and method for imparting a design to a design carrier that the three dimensional preformed carrier 20 is porous and pervious to gas. The porous character of the design carrier permits the drawing down of the elastic transfer member by vacuum producing means in such a manner that the design carried by said transfer member is accurately deposited upon and printed on the carrier.

The exemplary printing means 19 pivotally mounts at one end a frame carrying the elastic transfer member so that it may be moved between a design receiving or printing position and a design deposit or transfer position. It is understood that the transfer member may be so mounted that the pivotal axis may be centrally of the

frame carrying the transfer member and in such an arrangement a pair of spaced apart parallel transfer members may be carried by the transfer frame. In such an arrangement the transfer frame with the pair of elastic transfer members may be so positioned above a carrier holding means that one transfer member may be depositing a design upon a carrier while the other transfer member is receiving a printed design thereon. By lateral movement away from the carrier holding means the transfer frame may be pivoted about its central axis or flipped over so that the freshly printed elastic member may be positioned in design transfer position while that elastic member which had just previously deposited a design on a carrier is now positioned to receive a design. It will be understood by those skilled in the art that the printing means may include other arrangements for pivotal mounting of the elastic transfer member so as to conveniently and precisely move the transfer member into design receiving and design transfer positions.

It is understood that various other modifications and changes may be made in the construction of the printing means and of the carrier holder means and all such changes and modifications coming within the scope of the appended claims are embraced thereby.

I claim:

1. In an apparatus for printing a design on a porous thin design carrier of compound curvature, the combination of: movable support means; a plurality of spaced-apart carrier holding means carried by said movable support means adjacent the periphery thereof, each carrier holding means including a contoured surface to support a carrier and provided with means affording fluid communication to said contoured surface; vacuum-producing means operably connected to each carrier holder means in communication with said fluid communication means; and printing means opposite each carrier holding means and including a design transfer member positionable over said contoured surface of a carrier holding means and in sealed relation thereto whereby said vacuum-producing means may draw said transfer member into pressure contact with the design carrier supported on said contoured surface.

2. In an apparatus for decorating a porous design carrier of three-dimensional, compound form, the combination of: carrier holding means of porous material having a surface contoured to correspond to a surface of a design carrier and provided with means affording fluid communication to said contoured surface; vacuum-producing means operably connected to said carrier-holder means in communication with said fluid communication means; printing means operably positioned adjacent the carrier holding means including a thin, elastic, impervious, transfer member, a printing surface to support the transfer member in design receiving position, and means to move the transfer member to design transfer position over the carrier holding means.

3. An apparatus as stated in claim 2 wherein the means to move the transfer member includes fluid operable means pivotally connected with said design transfer member, said design transfer member being pivotally positioned adjacent said printing surface.

4. An apparatus as stated in claim 2 wherein said printing surface is provided on a printing bed means, said bed means including a plurality of passageways in communication with said printing surface.

5. In an apparatus for decorating a porous design carrier of three dimensional compound form the combination of: a carrier holding means of porous material having a surface contoured to correspond to a surface of a substantially rigid design carrier and having fluid communication through said porous material to said contoured surface; vacuum-producing means operatively connected to said carrier holder means and in communication with said porous material; printing means operably positioned adjacent the carrier holding means including

a thin elastic impervious transfer member provided with a design receiving surface, and a frame means supporting said transfer member; means to pivotally mount the frame means to position the design surface opposite the contoured surface for depositing a design on said latter surface and to position the design receiving surface in another position to receive a design deposited thereon; said frame means being movable relative to said contoured surface to cause the design receiving surface to deposit a design carried thereon upon said contoured surface.

6. A printing means for use with an apparatus supporting a member to be decorated comprising: a rigid flat perforated surface and an impervious transfer member operably positioned over said surface, means pivotally mounting said transfer member for moving between a design receiving position on said perforated surface and a design transfer position spaced therefrom, and means to move the transfer member into design transfer position to deposit said design upon a selected surface of the member to be decorated.

7. A carrier holding means for supporting a pervious design carrier of three dimensional compound form for printing of a design on said carrier comprising: a body member of porous material having a surface contoured to correspond to a surface of a design carrier to be supported thereon; an impervious housing for said body member; a plurality of through passageways in said body member adapted to be provided with communication with a vacuum-producing means; means to releasably position and retain a design carrier on said contoured surface, said retaining means including arcuate segments disposed at margins of said contoured surface for pressure contact with peripheral portions of a design carrier; and means extending through said body member for raising and lowering said arcuate segments.

8. A carrier holding means for supporting a pervious design carrier of three dimensional compound form for printing of a design on said carrier comprising: a body member of porous material having a surface contoured to correspond to a surface of a design carrier to be supported thereon; an impervious housing for said body member; a plurality of through passageways in said body member adapted to be provided with communication with a vacuum-producing means; means to releasably position and retain a design carrier on said contoured surface, said retaining means including holding elements disposed for pressure contact with peripheral portions of a design carrier; and means carried by said body member for guiding said holding elements into holding and release positions.

9. In an apparatus for printing a design on a design carrier of selected shape, the combination of: a porous body member having a surface to correspond to a face of a design carrier; means providing fluid communication with said surface of the porous body member; vacuum-producing means in communication with said fluid communication means; printing means adjacent to the porous body member including a thin impervious printing transfer member, said printing means having a printing surface upon which said transfer member is supported in design-receiving position; and means connected with said transfer member to move said member from design-receiving position over said surface on said porous body member.

10. In an apparatus for transferring a design to a design carrier of selected shape having a surface to be decorated, the combination of: a porous body member adapted to support said design carrier; means providing fluid communication through said porous body member to a design carrier supported thereon; vacuum-producing means operably connected with said fluid communication means; and printing means adjacent to said porous body member, said printing means including a printing bed, a flexible impervious transfer member, and means

connected with said transfer member to move the transfer member into a position upon said printing bed to receive a design and into a position over said porous body member to transfer a printed design to said carrier.

11. An apparatus as stated in claim 10 wherein said means to move said transfer member includes a pivotal connection for flipping said transfer member into design-receiving position and into design-transfer position.

12. An apparatus as stated in claim 10 wherein said printing bed is provided with perforations, and vacuum-producing means operably connected with said printing bed perforations.

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