Oct. 30, 1962 J. A. STAHMANN 3,060,608

THREE-DIMENSIONAL CARRIER SHEET FOR DECORATING HOLLOW WARE

Filed Jan. 16, 1956

FIG. 1.

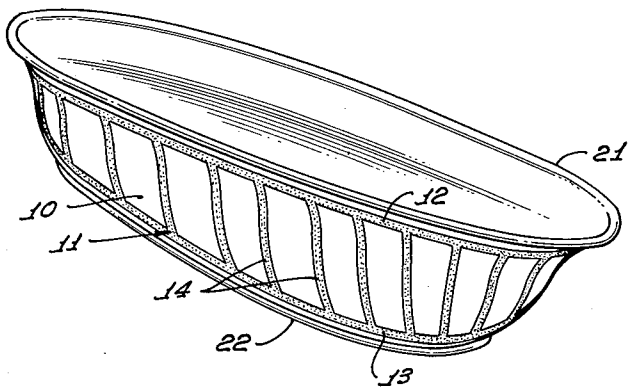


FIG. 2.

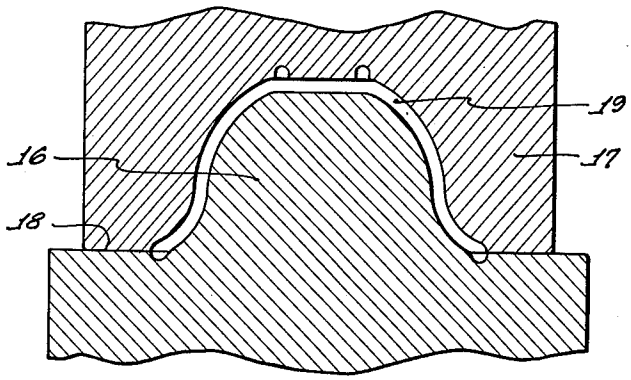


FIG. 4.

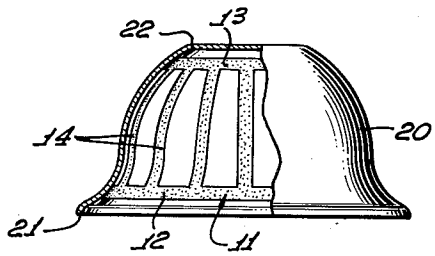
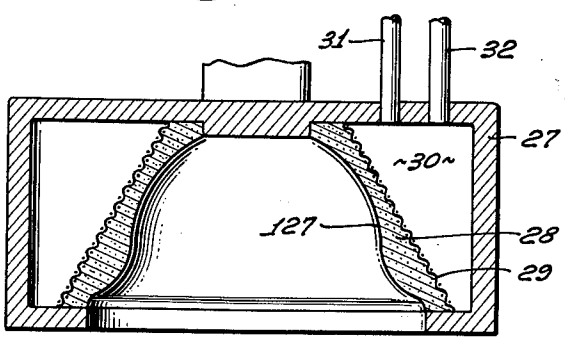


FIG. 3.



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United States Patent Office

3,060,608

Patented Oct. 30, 1962

3,060,608

THREE-DIMENSIONAL CARRIER SHEET FOR DECORATING HOLLOW WARE

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Filed Jan. 16, 1956, Ser. No. 559,186

5 Claims. (Cl. 41—10)

This invention relates to an article of manufacture particularly adapted for use in the production of decorated dinnerware, hollow ware, artware and various other objects provided with compound curved surfaces, and to methods whereby such article of manufacture may be made and utilized.

In recent years dinnerware has been manufactured from various curable organic plastics or resinous compositions, generally of the thermosetting type, such as the various urea-aldehyde and melamine-aldehyde types of thermosetting compositions. Such dinnerware, as plates, saucers, cups, etc., have generally been of relatively simple form and the internal and external surfaces have not been decorated or in some instances the decoration has only been applied to relatively flat, planar areas, such as the central area of a plate. The application of the decoration to the curved areas has presented numerous problems. Decoration has been previously applied to the surfaces of buttons (Patent No. 1,301,069), the decoration being in the form of a colored fabric, but buttons are not subjected to the careful scrutiny which is given dinnerware and imperfections at the curved edges of buttons did not render such buttons useless, whereas similar imperfections on dinnerware render the finished article unsaleable.

In all prior processes known to applicant the decoration was carried upon a planar sheet material which was then cemented onto or imbedded in the planar surface of the article being decorated. Although such process may be used in the production of panels or the decoration of flat surfaces, it cannot be employed for the decoration of the irregularly curved surfaces or for the decoration of compound curved surfaces on objects which may be unsymmetrical as is the case with many articles of dinnerware, such as for example, tureens, vegetable dishes, etc. The reason for inability to use planar sheet material as a carrier for the decoration which is to be imbedded in an article of dinnerware lies in the fact that the carrier material will either split or become crinkled and folded upon itself when it is pressed against a curved surface, such splitting or folding destroying the symmetry and completeness of the decoration, causing distortions in the decoration and impairing the uniformity desired in the appearance of both the decoration and the body or background upon which the decoration is carried. In some instances attempts have been made to place small, spaced decorations on the sides of cups or the like, each bit of decoration occupying but a fraction of the total surface and each decoration being carried by a small carrier, the decorative units and their respective parts being spaced from each other around the periphery or circumference of the finished object. Such small decorations are not as subject to distortion but their placement in a desired and fixed position is difficult and, when the body of the ware is of a light-colored white or creamy tone the edges of each carrier are visible on the finished object, creating an effect similar to that which would be obtained by simply gluing individual decorations in spaced relation on the surface of such object. Molten impregnant flows out of the edges of such patch-like decorations, producing a peripheral area of high gloss surrounding such insert and contributing to its unsatisfactory appearance.

The present invention is directed toward an article of manufacture capable of being used in applying a continuous perimetric or circumferential decoration on either the internal or the external surfaces of a plastic object having compound curved surfaces, without distortion, without the production of folds or tears and without permitting the carrier to be visibly distinguishable from undecorated areas of the body of the article. It is to be understood that random or overall decorative designs are included within the concept of the invention, and that the "decoration" may have utilitarian purposes or perform functions, as will be apparent from subsequent examples.

It is an object of the present invention, therefore, to disclose and provide a shaped three-dimensional, self-supporting carrier adapted to receive and carry a predetermined decoration whereby such decoration can be applied to and be made an integral part of a plastic object having compound curved surfaces.

A further object of the invention is to disclose and provide means, methods, materials and conditions whereby the above object and numerous advantages referred to in greater detail hereinafter may be attained.

In order to facilitate understanding, reference will be had to the appended drawings, illustrating exemplary forms by means of which the objectives of the present invention may be attained. In such drawings:

FIG. 1 is a perspective view of an oval vegetable dish having compound curved, external surfaces upon which a predetermined decoration has been applied by the use of the present invention.

FIG. 2 is a transverse section of a die for making a vegetable dish of the character illustrated in FIG. 1.

FIG. 3 is a schematic representation of means and steps employed in making a three-dimensional carrier.

FIG. 4 is a partial section of a three-dimension carrier upon which a decoration has been applied, such decoration and carrier eventually becoming an integral part of a finished plastic composition article.

Although, as previously indicated, the means and methods of the present invention are applicable to the production of various articles made from thermosetting resinous compositions and including compound curved surfaces bearing a decoration of any desired color, combination of colors, or design, the following description will be particularly directed to the production of an oval vegetable dish, such as is illustrated in FIG. 1. As shown, it is evident that the vegetable dish is unsymmetrical, being oval in plan. The exterior and interior surfaces of such dish are in the form of compound curves, a portion of the internal surface being concave and then merging into a convex portion adjacent the base. The radii of curvature may vary; it will be evident that vertical sections may exhibit different profiles and horizontal planes at different heights from the foot or base may also exhibit different curvatures. However, the external surface of such vegetable dish may be provided with a continuous decoration of predetermined character free from breaks, diffused areas, folds or other distortions by the use of the article of manufacture hereinafter disclosed in detail. For example, the external surface 10 of the vegetable dish illustrated in FIG. 1 may carry the decoration generally indicated at 11, including continuous upper and lower bands 12 and 13 and regularly and uniformly spaced and angulated intermediate connecting lines of the same or different color, as indicated at 14.

The body portions of an object, such as is illustrated in FIG. 1, may be made in any suitable type of adequately heated press, such as for example, the press schematically illustrated in FIG. 2, wherein a male die 16 and a female die 17 meeting in a flash line 18 provide a cavity 19 in which the object can be formed from a pellet or charge of suitable thermosetting resinous composition. In FIG. 2 the cavity 19 is adapted to form the vegetable dish illus-

trated in FIG. 1. Normal pressing operations generally comprise introducing a predetermined volume or weight of the resinous composition into the open cavity, compressing the charge for an appropriate length of time at a pressure and temperature determined by the composition of the charge, opening the press for a short interval in order to permit escape of gases and then reclosing and repressing the partly molded article to impart the finishing touches to such article. In accordance with the present invention, a three-dimensional carrier, bearing the desired decoration, is applied to the partly molded article during or after the de-gassing step. During the final pressing operation, the three-dimensioned carrier is made an integral part of the article, the resin contained in the carrier being liquified and completely polymerized, some diffusion taking place between this resin and the resinous composition of the body of the article, whereby the carrier becomes imbedded within the body and becomes an inseparable, integral portion thereof.

The means and steps employed in making a three-dimensional form are illustrated in FIG. 3, a partial section of said three-dimensional form being shown in FIG. 4. By referring to FIG. 4 it will be noted that the carrier indicated at **20** is a self-supporting object having a size and contour identical to that of the surface to which the decoration is to be applied. The carrier illustrated in FIG. 4 is adapted to apply decoration to the exterior curved surfaces of a vegetable dish and it will be noted that such carrier **20** extends from the outer edge of the dish at the flash line which would normally be formed at **21** to the foot of the dish at **22**. Preferably, the carrier **20** is made of alpha-cellulose fiber and has a thickness of between about 0.008 inch and 0.030 inch; its thickness is at all events but a fraction of the thickness of the finished dish or article. The thinner the carrier the more readily it merges into the resinous composition of the finished article. The alpha-cellulose fibers of the three-dimensional carrier are preferably bound together by an amount of a polymerizable resin which is compatible with the resinous composition used for the body of the finished article. Moreover, the finished, three-dimensional carrier is provided with smooth, curved surfaces free from folds and bears the pigmented decoration which is to become a part of the finished article.

Various means and methods may be utilized in producing the three-dimensional carrier. One sequence of steps is indicated schematically in FIG. 3 wherein **27** represents a housing containing an inner layer **28** of relatively rigid but extremely porous composition. Gypsum compositions have been found suitable. This composition layer **28** is supported upon a wire mesh reinforcing structure **29** within the housing **27**, a chamber **30** existing between the wire support and porous lining and the housing **28** so that either suction or air under pressure may be supplied to the chamber **30** through suitably valved lines indicated at **31** and **32**.

The interior surface of the finely porous layer **28** is molded precisely to the contours of the surface to which the carrier is to be applied and such surface is indicated at **127**. A thin suspension of alpha-cellulose fibers in a suitable liquid medium (which may contain a small proportion of dispersed or dissolved polymerizable resin) is now sprayed over the surface **127** while suction is applied to the chamber **30** through line **31**. A thin, uniform film of alpha-cellulose fibers felted and fibered together is thus formed on the surface **127**. In some instances it is then desirable to spray the so-formed film of fibrous material with a bonding resin in a vaporizable solvent. Suction and heat may be applied for the purpose of enhancing penetration of the fibers by the resin and in setting or partly polymerizing the resin so as to impart strength to the formed carrier. The resin employed should be polymerizable and compatible with the resinous composition; diallyl phthalate and polyester resins, alkyd resins, ureas and even phenolics can be used. The amount of resin used as an impregnant will vary with the type of fiber or material used in making the carrier and its thickness; the impregnant should not be in excess sufficient to undesirably flow out during final pressing into the object, but in amount sufficient to combine with the body of the object. Such resin may be present in an amount of between 35% and 80% by weight of the carrier; alpha-cellulose carriers may preferably contain between 45% and 65%.

After the carrier has been formed as stated, the desired design or decoration is applied thereto at any desired time or place. Obviously such design may be applied in a number of different manners, as for example, by a silk screen process, by an offset printing process, by hand, etc. One way of applying the design is by means of an invertible or expandable stamp or series of stamps capable of entering the recess of the forming head (or holder for the carrier) and expanding therein so as to deposit the pigmented vehicles upon the inner surface of the carrier. Those skilled in the art of decorating and printing are familiar with the numerous compositions of inks and pigmented vehicles which can be employed. Bleeding characteristics of dyes used, the solvent effect of hot plastic upon the dyes or pigments employed, drying rates of solvents and vehicles used, etc., must be taken into consideration in the compounding or preparation of the inks or pigmented vehicles employed in applying the decoration to the three-dimensional carrier. The resins employed in these inks may be similar to those used as impregnants for the carrier; toluene, butyl lactate, ethoxyethyl acetate, etc. are exemplary solvents. One satisfactory ink was composed of 6% ethyl hydroxyethyl cellulose, 54% 2-ethoxyethyl acetate and 40% of inorganic pigment; another contained 40% of a low viscosity polyamid resin, 40% of a low viscosity epoxy resin and 20% of pigment.

After the decoration has been applied to the inner surface of the three-dimensional carrier made within the forming device, such three-dimensional carrier may be removed from the forming device (or holder used) by simply admitting air under pressure into the chamber **30** through line **32**. The resulting article, illustrated in FIG. 4, will be found to be of precisely the contours fitting the external surface of the vegetable dish, able to maintain its three-dimensional or formed shape, and eminently adapted for use in applying the decoration to the external surface of the dish. Such three-dimensional carriers may be stored, shipped and used as production requirements indicate.

In actual practice of the invention in the manufacture of dinnerware, after the initial pressing operation has taken place in an apparatus such as is indicated in FIG. 2 and the upper portion of the die has been raised for "de-gassing," the three-dimensional carrier or form is placed upon the external surfaces of the partly completed dish within the press and the press closed to complete the forming operation. The carrier may also be applied to the partly pressed article when the press is opened after a prior de-gassing. During this last portion of the pressing resin contained in the carrier is liquified and completely polymerized, some diffusion taking place between this resin and this resinous composition from which the article is being made, permitting the color of such original body composition to be evidenced uniformly over the entire external surface of the article except in those areas wherein the three-dimensional form carried the pigmented vehicle, ink or decoration. It is to be noted that no slippage or deformation can take place inasmuch as the three-dimensional form conforms exactly to the complex curved surfaces of the article. Moreover, since the three-dimensional form extends to the flash or parting line **18** and to the foot **22**, the entire curved surface between the foot and the flash line at the lip is of a uniform texture, gloss and color. In addition, it will be noted that in the example given, the decoration was applied to the inner

surface of the three-dimensional form, this arrangement permitting the alpha-cellulose form or carrier to contribute to the protection of the decoration on the finished article from abrasion or wear.

When the completed article is removed from the press the flash at the parting line is buffed off and this buffing tends to merge the margin of the three-dimensional form originally used with the adjacent or confluent undecorated surfaces of the article.

Although in the primary example given herein the interior surface of a three-dimensional carrier bears the decoration and such decoration is applied to the external surface of the plastic object, the stable, self-sustaining, preformed, three-dimensional carriers can be also used in applying decoration to the internal, curved surfaces of objects either separately or jointly. Moreover, the decoration carried by the carrier may be either on that surface of the carrier which will face or contact the object or on that surface which will face away from the object, although the former arrangement is preferred. In some instances it has been found desirable to apply decoration elements on both surfaces of a carrier, the elements being compatible or cooperating to produce a coherent, unitary effect; in such cases an effect of depth and perspective is attained, one of the elements appearing to be at a deeper level within the article than other decorative elements.

Although the carrier (when used in the dinnerware field) is preferably made of fibrous or other material which has a neutral or white color and is capable of becoming substantially transparent or not differing materially in index of refraction or from the color of the body of the finished object when made an integral part of the article, it may be made of opaque or colored materials. In some instances the entire surface of a three-dimensional carrier may be provided with a virtually opaque, uniform pigment of a different color from the color of the resinous composition of the body of the article, such carrier being impregnated with a substantially transparent, polymerizable resin. By the use of the above modifications a finished article can be obtained which appears to be made of two, differently colored compositions; it may have a white internal surface and a black or colored external surface; decorative elements may be superimposed upon the colored surface of the article.

In the specific example given hereinabove, the carrier was said to be made of alpha cellulose fibers, but in many instances other materials can be used, such as macerated fabrics, rayon, cotton, glass or polyamid fibers, asbestos fibers or carriers made of bentonite and aluminum silicate. Texturing depends upon the fineness of the material used, and for some industrial applications mentioned hereafter, is not objectionable. Moreover, the carrier need not be made by spraying a suspension of fibers upon a mold of the type illustrated in FIG. 3; a modification of the dipping process used in papier-mache operations can be used, a very fine wire mesh properly contoured forming head being dipped into a suitable suspension. Electrostatic deposition of finely divided materials upon suitable forms can also be employed.

The carriers, before being decorated, are preferably dried and can be stored or shipped and decorated at any desired time. The form of the carrier may be the same, but different decorations applied to some of such forms. Overall or random designs can be used as well as geometric or continuous, perimetric designs. For example, a carrier for use in decorating the entire internal surface of an oval, unsymmetrical vegetable dish having compound curved surfaces, as well as a bottom to such internal surface, may be readily decorated by an adaptation of the silk screen process. Instead of a silk screen, the screen can be made of fine silver wires or of thermoplastic fibers and deformed into a shape conforming to the surface of the carrier into which the decoration is to be applied. Such deformed or preformed screen is rendered impermeable in areas where pigment is not desired and maintained pervious in areas concordant with the design of the decoration. For example, a film of polyvinyl acetate plus dichromate may be formed on the metal wire screen, a design light-imparted to such film, and the screen then washed to leave pervious areas corresponding to the design. Pigmented, resinous ink can then be deposited upon the carrier through such preformed screen by screeding or, preferably, by depositing a predetermined film of pigment upon a normally flat surface of an elastic sheet held in a suitable frame and then applying fluid pressure to the reverse side of such sheet to press its ink-carrying surface against the screen, the elasticity, stretchability and resiliency of the sheet causing perfect conformation to the contours of the screen and depositing the ink through the design-forming, pervious portion of the screen upon the carrier.

As has been indicated previously hereinabove, the term "decoration" is not limited to floral, linear, curved, fret-like or other artistic designs whose primary or sole function is to impart esthetic appeal to a plastic object and enhance its appearance. There are many industrial and technological functions which may be attained by the use of the three-dimensional carriers of this invention. For example, the electrical characteristics of radomes, reflectors, high-frequency components, and other plastic objects can be materially enhanced and modified by the use of the devices and methods here disclosed. A preformed, three-dimensional carrier may carry a "decoration" composed largely of colloidal or finely divided metal, titanium dioxide or silica, and when made a part of a radome, absorber, sensor, reflector emission or reception element having a curved surface, the absorption, resistivity, conductivity, emission, transmission, receiving and other electrical characteristics become more stable, are desirably localized, controlled, modified, or rendered uniform, etc., depending upon "decoration" used. Such "decoration" may uniformly cover the entire surface of the carrier or may be in the form of radial lines, grids, concentric circles, indicia, etc., depending upon the effect desired and use made of such "decoration."

All modifications and changes coming within the scope of the appended claims are embraced thereby.

I claim:

1. An article of manufacture adapted for use in the manufacture of cups, bowls and other dinnerware from thermosetting resinous compositions of the urea-aldehyde and melamine-aldehyde types, said ware having surfaces exhibiting compound curvatures, comprising: a three-dimensional, coherent, self-supporting carrier from matted alpha-cellulose fiber having a thickness of less than 0.030 inch, and a smooth surface exhibiting a predetermined, compound curvature complementary to the curved surface of a piece of ware, the alpha-cellulose fibers of said carrier being bound together by a polymerisable resin, said smooth curved surface of said carrier being free from folds and bearing a pigmented decoration.

2. The article of manufacture stated in claim 1, such carrier containing from between about 35% to 80% of polymerizable resin.

3. An article of manufacture as stated in claim 1, said carrier presenting a continuous peripheral edge at the lip of the ware.

4. As an article of manufacture for use in the manufacture of cups, bowls and other dinnerware, from thermosetting resinous composition of the urea-aldehyde and melamine-aldehyde types, said ware having surfaces exhibiting compound curvatures, comprising: a three-dimensional, coherent, self-supporting carrier from matted alpha-cellulose, fiber having a thickness of less than 0.030 inch, and a smooth, unfolded surface exhibiting a predetermined compound curvature complementary to a curved surface of a piece of dinnerware, the alpha-cellulose fibers of said carrier being bound together by a polymerisable resin, said smooth, curved surface of said carrier bearing a pigmented decoration, said alpha-cellulose fiber carrier having an index of refraction not

materially different from that of the resinous composition composing the wall in which said carrier is embodied, whereby said carrier becomes substantially transparent and invisible while the decoration is visible.

5. As an article of manufacture adapted for use in applying decoration to compound curved surfaces of an object made from a resinous composition: a three-dimensional, self-supporting, coherent, thin-walled, readily handleable carrier made of a finely divided fibrous material bonded with 35% to 80% by weight of a polymerizable resin, said carrier being of a size and surface contour complementary to compound curved surfaces of a partly formed object and of a thickness between about 0.008 inch and 0.030 inch, said carrier bearing a decoration containing pigmenting components.

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