United States Patent [19]

Valiela

[11] **3,756,165**

[45] **Sept. 4, 1973**

[54] **METHOD FOR PRINTING ON CERAMIC TABLEWARE**

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[73] Assignee: **Interpace Corporation,** Parsippany, N.J.

[22] Filed: **May 22, 1972**

[21] Appl. No.: **255,738**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 43,044, June 3, 1970, abandoned.

[52] **U.S. Cl.** **101/426,** 101/41, 101/211

[51] **Int. Cl.** **B41f 17/28**

[58] **Field of Search** ..... 101/211, 35, 41, 101/44, 426; 117/123 A, 123 B

[56] **References Cited**

UNITED STATES PATENTS

2,077,790	4/1937	Hakogi	101/35
2,202,465	5/1940	Pattison	101/41
2,739,532	3/1956	Fernandez	101/41 X
2,745,339	5/1956	Fernandez	101/41
3,255,695	6/1966	Johnson et al.	101/211
3,384,508	5/1968	Bopp et al.	117/123 A
3,418,926	12/1968	Hakogi	101/44 X
3,511,681	5/1970	Huey, Jr.	117/123 A X
3,554,836	1/1971	Steindorf	101/426 X
3,688,695	9/1972	James	101/211

FOREIGN PATENTS OR APPLICATIONS

763,572	12/1956	Great Britain	101/41
1,067,448	10/1959	Germany	101/41

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[57] **ABSTRACT**

A method for applying oil-based, relatively viscous colorants one at a time to ceramic tableware by silk-screen printing each of the colorants in a relatively thick layer onto a total-release transfer surface (preferably of silicone rubber), allowing at least 1 minute and up to 3 hours for the colorant layer to form a skinlike film and then causing intimate mechanical contact between the film and the tableware and thereafter withdrawing quickly the transfer surface from the film to transfer the colorant film in its entirety intact to the ware. Successive films of colorant may be applied to the ware even over previously-applied films of colorant and without waiting for previously-applied films of colorant to dry.

35 Claims, 8 Drawing Figures

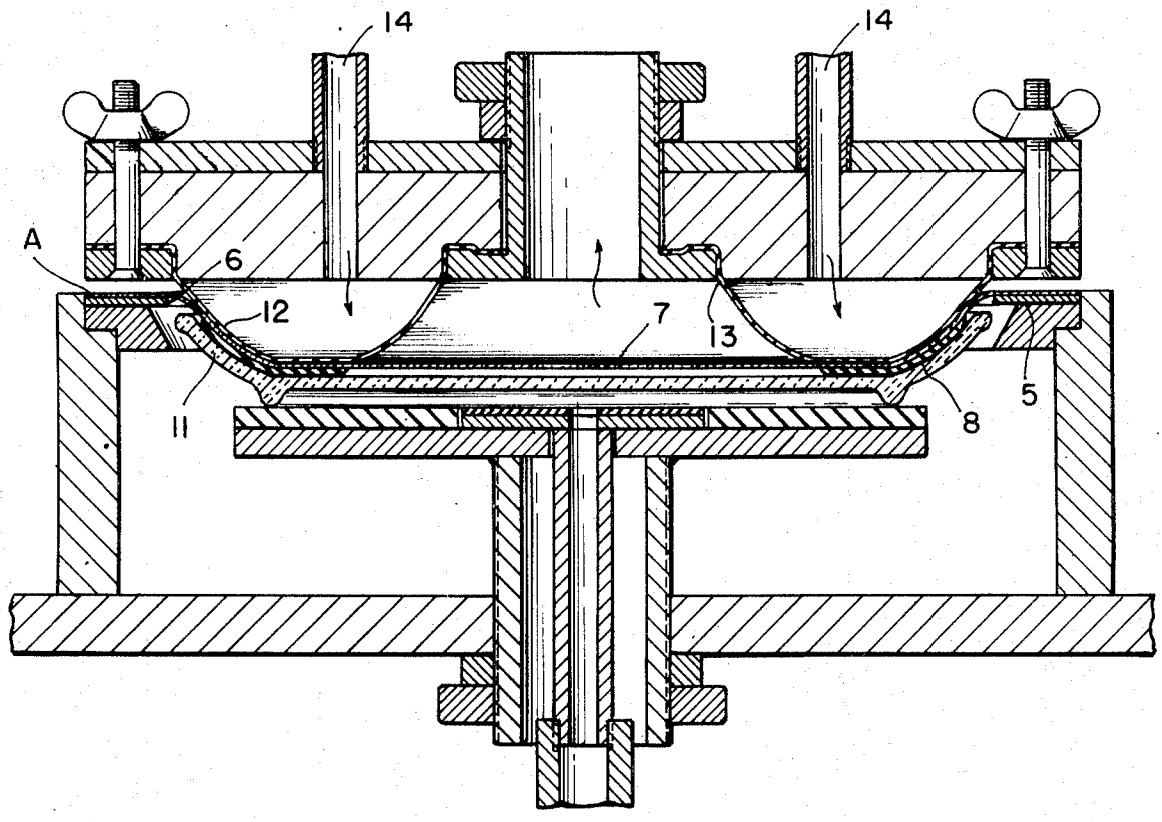
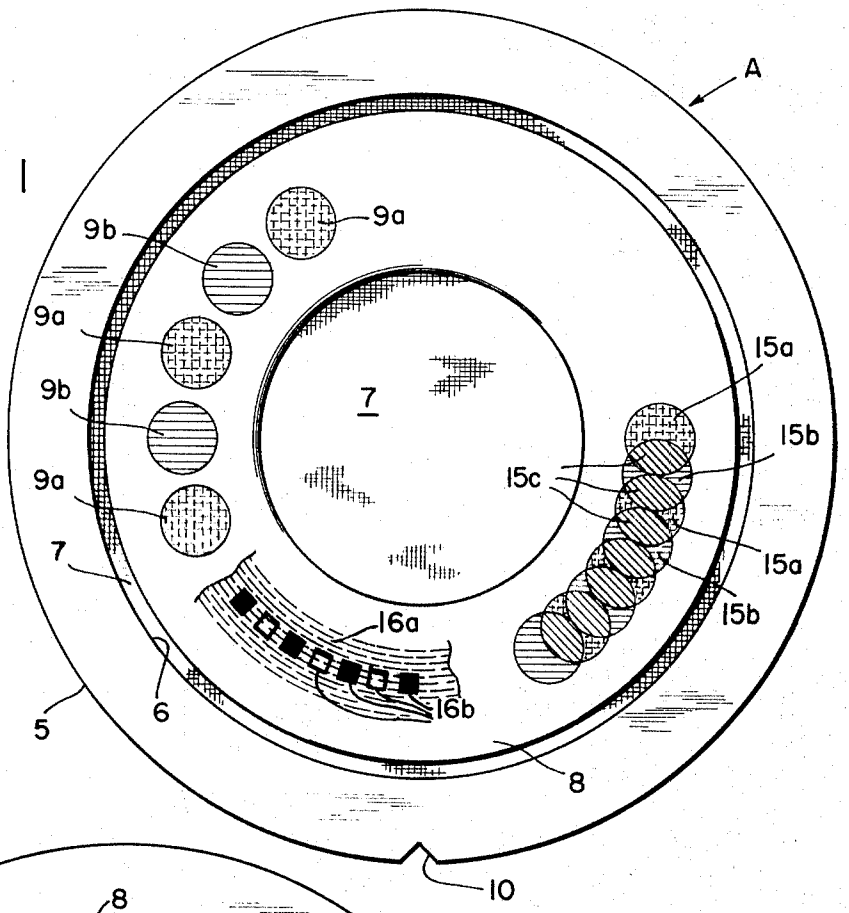


FIG. 1



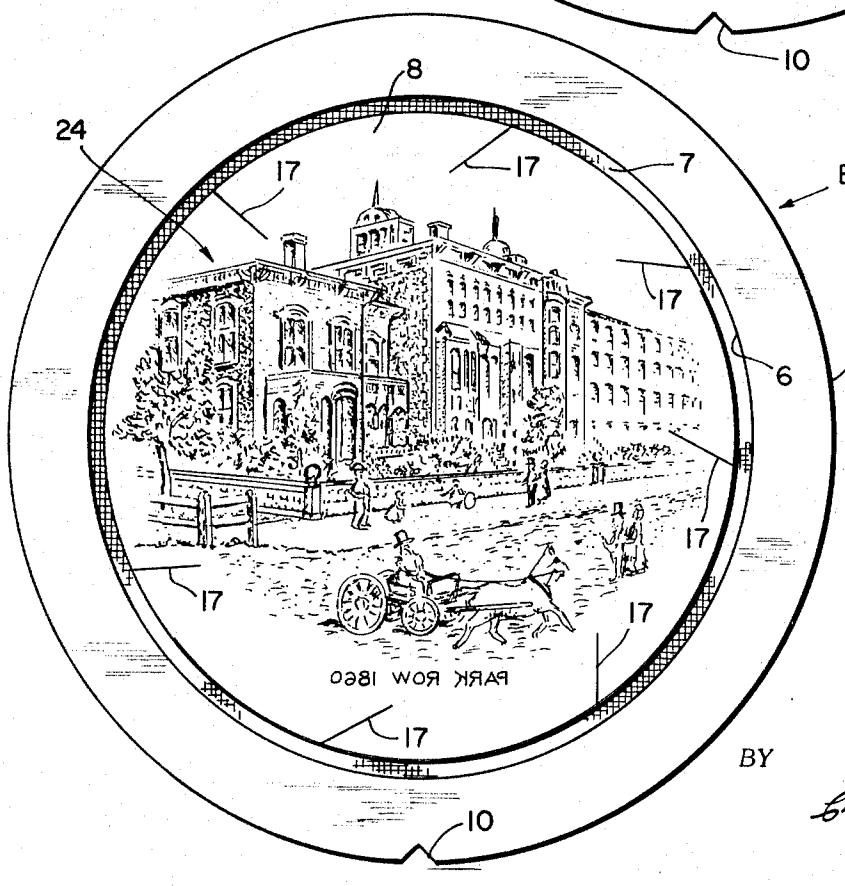


FIG. 2

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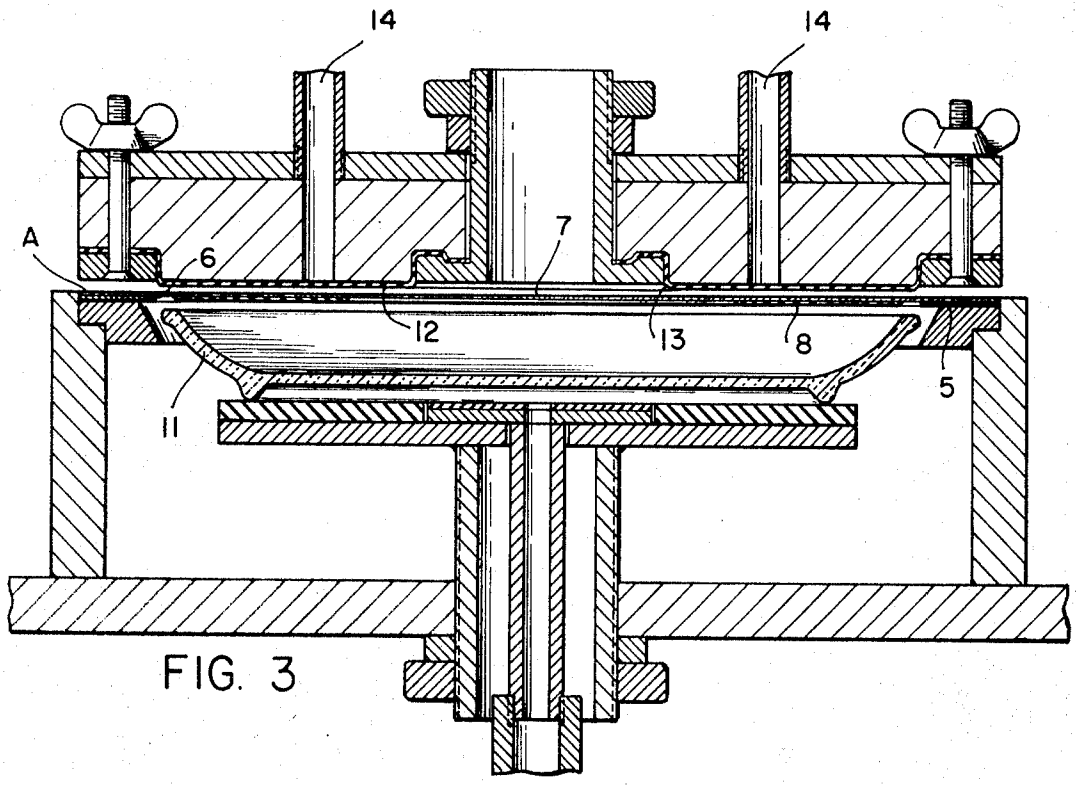


FIG. 3

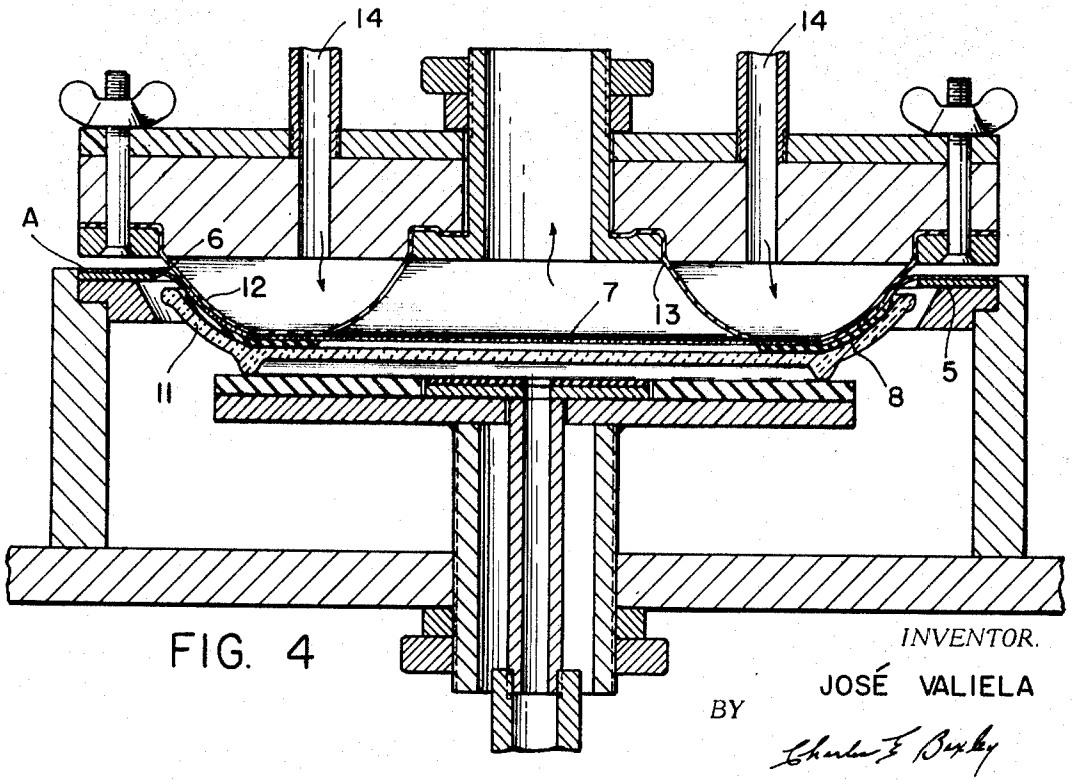


FIG. 4

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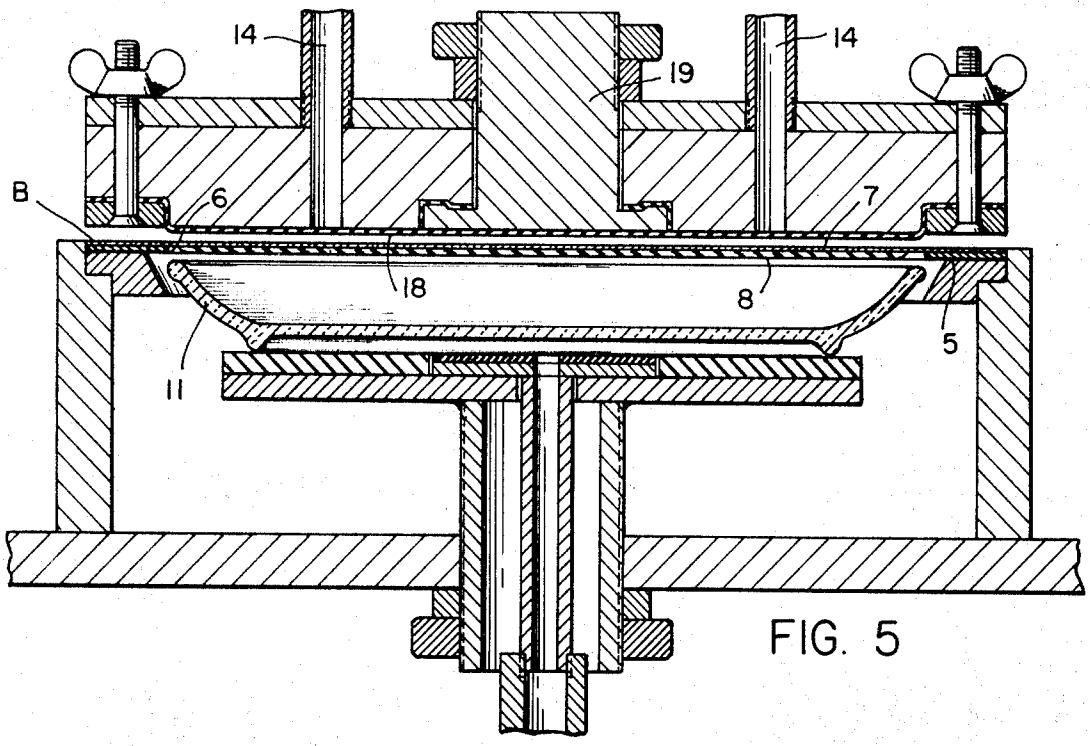


FIG. 5

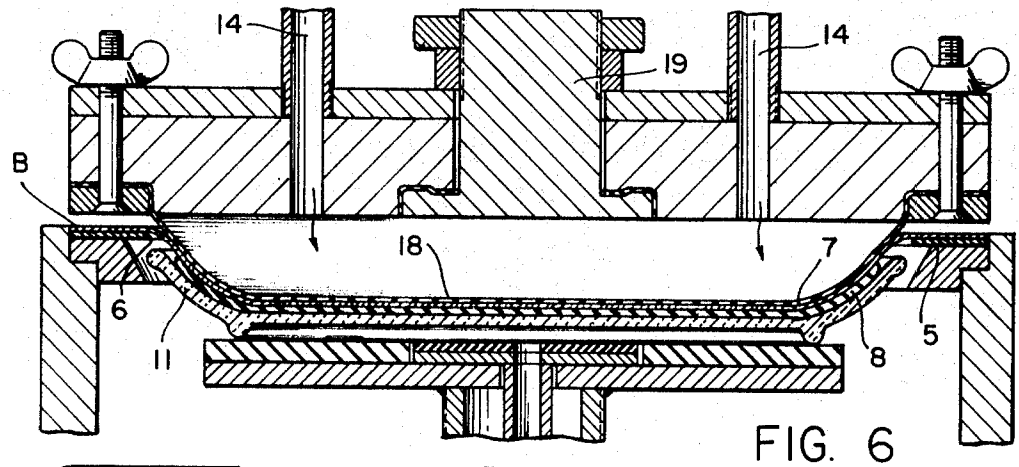


FIG. 6

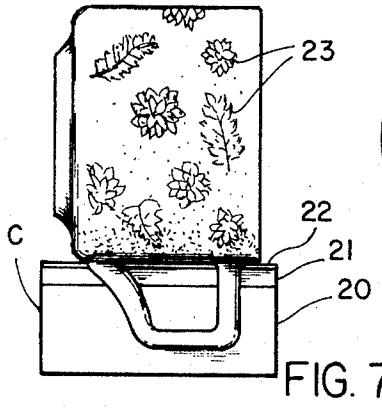


FIG. 7

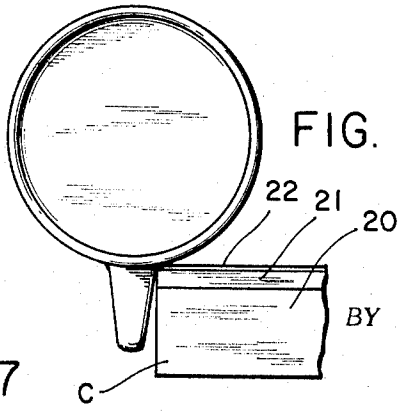


FIG. 8

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METHOD FOR PRINTING ON CERAMIC TABLEWARE

CROSS REFERENCE

This application is a continuation in part of my co-pending application 43,044 filed June 3, 1970, now abandoned.

THE INVENTION

This invention relates generally to new and useful improvements in decoration of ceramic tableware and seeks particularly to provide a novel method for transfer printing onto such ware.

It is well known that ceramic tableware may be decorated by hand painting, rubber stamping, stencilling, paper transfers, lithographic decals, silk screen decals, under glaze and over glaze decoration as well as direct and indirect silk-screen printing.

The present invention relates to a combined silk-screen and transfer printing technique in which one or more colorants organized in a decorative design is first silk-screen printed onto a total-release transfer surface (as defined herein), such as silicone rubber which initially will accept the colorant by silk-screen printing thereon, but will tend thereafter to repel the colorant therefrom. The colorant is then transferred to the ceramic tableware by mechanical impression. Due to the fact that the colorant has a much greater affinity for the tableware than it has for the total-release transfer surface, it is possible to apply sequentially successive colorants to complete an overall design without having to wait for any previously applied colorants to dry. Colorants may be applied directly over previously applied colorants which are still wet, thereby producing blends of colorants. Furthermore, by controlling properly formulation of the colorants, their drying can be regulated so as to accommodate use of the silk-screen printed total-release transfer elements after 1 minute or to accommodate preparation of a multiplicity of total-release transfer elements hours in advance without danger of their completely drying prematurely.

Two types of total-release ink-transfer elements are contemplated; 1. a pad onto which generally cylindriform articles of ware, such as cups and vases to which the decorations are to be applied externally, are rolled and 2. an elastic membrane that is expanded into contact with rims or cavity portions of plates, saucers or the like. Screen life is substantially increased because the colorant is silk-screen printed onto a smooth silicone rubber transfer surface, rather than onto more abrasive surfaces of the tableware. Therefore, an object of this invention is to provide a novel method for applying decorative colorants to ceramic tableware; such as over glaze, under glaze, earthenware or glass, but preferably under glaze; by silk-screen printing the colorant on a total-release transfer surface, allowing it at least 1 minute to form a skinlike film thereon and then causing intimate mechanical contact between that total-release transfer surface and the article of tableware to be decorated so as to transfer the colorant thereto.

A further object of this invention is to provide a method of the character stated in which the total-release transfer surfaces are silicone rubber or like elements.

A further object of this invention is to provide an elastic membrane ink-transfer element of the character stated which comprises a flat metal or plastic base ring

having a normally relaxed elastic net secured to one face and covering the central opening and a flat ring of silicone rubber cast onto the exposed face of the elastic net within the area of the central opening of the base ring and coaxial therewith.

A further object of this invention is to provide an elastic membrane ink-transfer element of the character stated which can print continuous bands on deeply curved dishes without any need for overlap-avoiding techniques. Such overlap-avoiding techniques require skilled craftsmen and consume considerable time.

A further object of this invention is to provide a pad type ink-transfer element of the character stated which comprises a resilient pad having a silicone rubber or like surface.

A further object of this invention is to provide cool inks that are particularly useful in this new method of printing and transfer decorating of ceramic tableware.

A further object of this invention is to control drying of the inks so that ink-transfer elements may be prepared for use as soon as 1 minute after printing or for use up to several hours after printing.

A further object of this invention is to provide a method of the character stated in which a succeeding ink film may be applied to the tableware without having to wait for a preceding ink film to dry, thus markedly speeding the overall rate of decoration.

A further object of this invention is to provide a method of the character stated in which a succeeding ink film may be applied directly over a preceding ink, film thereby producing a blend of the preceding and succeeding inks.

A further object of this invention is to provide a method of the character stated in which the tableware may accept glazing and firing while ink film thereon are still wet.

A further object of this invention is to improve efficiency in decorating ceramics as well as to improve quality of ceramic decoration.

With these and other objects in view, the invention will be understood more fully by reference to the drawings, the accompanying detailed description and the appended claims.

In the drawings:

FIG. 1 is a top plan view of an elastic membrane ink-transfer element having open net portions and constructed in accordance with this invention;

FIG. 2 is a top plan view of a second embodiment of an elastic membrane ink-transfer element having slit openings and also constructed in accordance with this invention;

FIG. 3 is a transverse section of a pressing station showing the ink-transfer element of FIG. 1 in position relative to an inflatable annular balloon in preparation for transfer of the silk-screen printed ink film to a dish;

FIG. 4 is a view similar to FIG. 3, but with the annular balloon inflated to effect transfer of the ink film to the dish;

FIG. 5 is a transverse section of a pressing station showing the ink film-transfer element of FIG. 2 in position relative to an inflatable full diaphragm balloon in preparation for transfer of screen printed ink to a dish;

FIG. 6 is a view similar to FIG. 5, but with the full diaphragm balloon inflated to effect transfer of the ink film to the dish;

FIG. 7 is a side elevation view of a pad ink-transfer element in accordance with this invention with a cup thereon;

FIG. 8 is an end view of FIG. 7.

Referring to the drawings in detail, it will be seen from FIG. 1 that an elastic membrane ink-transfer element A includes rigid flat base ring 5 that may be formed from any suitable metal or plastic and has central opening 6 of a diameter compatible with that of the ceramic piece of tableware to be decorated. A fine mesh net 7, formed from an elastomeric material such as elastic fabric (for example, latex rubber), spans opening 6 and has its peripheral edge portions secured adhesively to one face of base ring 5. A flat ring 8 of a suitable silicone rubber or the like, such as "Silastic A RTV" (a trademark), commercially available from Dow Corning Corporation, provides a total-release transfer surface and is secured to net 7 by being molded thereon or by a silicone contact adhesive, such as "SR-516" (a trademark) commercially available from General Electric Silicone Products, which bonds ring 8 to net 7 sufficiently to permit multiple transfer operations, yet to permit ready stripping of ring 8 therefrom when the necessity for replacement ultimately arises. As used herein a "total-release transfer surface" is one such as silicone rubber and others of those covered in U.S. Pat. 3,255,695 to Mr. C.R. Johnson et al., which will accept the colorant by silk-screen printing thereon but will tend thereafter to repel the colorant therefrom. It should be noted that there are many elastic fabrics from which net 7 can be made. Elastic synthetic materials which stretch in all directions are preferred, but a net 7 made of any material capable of stretching in the desired manner and of relaxing back to the same position in base ring 5 and capable of accommodating openings sufficient to allow passage of air therethrough can serve as net 7. Construction of flat ring 8 of a suitable silicone rubber or the like secured to net 7 is here regarded to be expedient. However, it should be understood that it is also contemplated that ring 8 and net 7 may be integral and of a single material. For example, net 7 and flat ring 8 could be made of a single material which is perforated or slitted in areas to which ink is not to be applied.

In order to disclose further the nature of this invention, first it will be assumed by way of example, that the cavity border of an unglazed ceramic dish is to be decorated with a ring of circle. Shaped figures 9*a* and 9*b* in two separate inks alternately arranged around the periphery of the dish. In this case two silk screens are prepared, one for each of the two inks to be applied, and one ink 9*a* will be squeegee applied to positions on silicone rubber ring 8 of a first elastic membrane ink-transfer element A; and a second ink 9*b* will be applied to the silicone rubber ring of a second elastic membrane ink-transfer element A in proper rotationally offset relation to the positions of the first ink 9*a*. The elastic membrane ink-transfer elements are provided with notches 10 to index their rotational offset relationship.

At this stage an article to be decorated such as dish 11 is secured in a station of any known ceramic printing machine that is modified in accordance with this invention (see FIGS. 1, 3 and 4) to include an air-inflated vacuum-deflated annular balloon 12 having a central opening 13 corresponding to the central cavity of dish 11 and an external surface adapted generally to be congruent with the silicone rubber ring 8. For most effective transfer contact of the total-release transfer surface with the ware should be practically instantaneous, say for from 0.1 to 0.5 seconds and the total-release transfer surface should be removed quickly from contact with the ink film. Other means for contacting ink-transfer elements to the ceramic article are also feasible.

The first ink-transfer element A is interposed and held securely between balloon 12 and dish 11 as shown in FIG. 3 after which balloon 12 is inflated quickly by air to the position indicated in FIG. 4 which displaces net 7 and silicone rubber ring 8 so that ink film 9*a* is brought into contact with the adjacent surface of dish 11. Air within the central cavity of dish 11 readily passes through the openings of elastic net 7 and central opening 13 of the balloon as the balloon inflates, thus avoiding any air pocket adjacent the printed surface of dish 11 and permitting a total clean impression transfer of ink film 9*a* intact thereto. Because a total release of the ink film from the transfer surface of silicone rubber or the like ring 8 is desired, it has been found preferable to inflate balloon 12 via conduits 14 with air under sufficient pressure to create a firm impression of the ink and then to deflate the balloon by vacuum via conduits 14 in order to permit elastic net 7 quickly to relax to its normal planar configuration and thus quickly withdraw the total-release transfer surface of silicone rubber or the like ring 8 away from ink film 9*a* therefor.

Now, dish 11 is retained in position while the second ink-transfer element A is brought into and is held in the station so that an ink film on its total-release transfer surface similarly may be transferred to the dish, thus completing the shown design.

Using an analogous printing method, a light ink film 16*a* can be overprinted with a dark ink film 16*b* as shown in FIG. 1. Also as shown in FIG. 1, ink film 15*a* and 15*b* can be overprinted to produce color areas 15*a*, 15*b* and 15*c*. For example, ink film 15*a* could be yellow and ink film 15*b* blue so that color area 15*a* would be yellow, 15*b* blue and 15*c* green.

FIGS. 5 and 6 depict the station of the known ceramic printing machine of FIGS. 3 and 4 and further adapted for use with an ink-transfer element such as that shown as B in FIG. 2. The ink-transfer element of FIG. 2 includes rigid flat base ring 5 with central opening 6 of a diameter compatible with that of the ceramic piece to be decorated. A fine mesh net 7 formed from elastomeric material has its peripheral edge portions secured adhesively to one face of base ring 5. A flat disk 8 of silicone rubber or the like is secured to net 7 to provide a total-release transfer surface which has slits 17 in areas which ink film design 24 does not cover. As shown in FIGS. 5 and 6, full diaphragm balloon 18 is used with ink-transfer element B and the station of the ceramic printing machine is further provided with plug 19 to seal balloon 18. Ink-transfer element B is held firmly between balloon 18 and dish 11 as shown in FIG. 5 after which balloon 18 is inflated quickly by air entering via conduits 14 so that ink design 24 is brought into contact with the adjacent surface of dish 11 as shown in FIG. 6. Air is then exhausted quickly from balloon 18 via conduits 14 quickly to withdraw elastic net 7 and ring 8.

When the exterior of an article of tableware generally of cylindrical form is to be decorated, a pad type of ink-transfer element C (see FIGS. 7 and 8) is used, because an ink film is transferred by rolling contact between

pad C and the ware. Pad C comprises a rigid plastic or metal base **20** having layer **21** of sponge rubber cemented to one surface and sheet **22** of silicone rubber or the like cemented to the exposed face of the sponge rubber. Design elements **23** of ink are silk screen printed onto silicone rubber **22** for subsequent transfer as a film to the ware to be decorated. Here again, the required number of pads are printed in advance and the ink film are applied successively to the ware without waiting for a previously-applied ink film to dry.

It will be understood further that inks (or other colorants) used with this method and apparatus must be of a special nature because 1. they cannot contain any solvent that would attach or react with the silicone rubber or the like total-release surface; 2. they must have sufficient adhesive affinity for silicone rubber that they will remain in place when initially printed thereon; 3. they must have a sufficiently greater adhesive affinity for the ware to be decorated that they will not delaminate therefrom by contact with the bare areas of the silicone rubber of successively employed ink-transfer elements used to complete the design without waiting for any previously-applied ink film to dry; 4. they must be deposited as a thick layer on the ware; 5. they must strip cleanly from the silicone rubber or the like without leaving a mark thereon when the transfer step takes place; and 6. they must have a suitable viscosity to make a clear and well-defined print. This latter requirement will also vary with the mesh of the silk screen used. For example, a 380 mesh nylon screen will require a lower viscosity ink than will a 160 mesh screen.

The following are typical examples of ink formulae that are useful in the practice of this invention:

EXAMPLE I

	grams
Under glaze color black	1,000
Dehydrated castor oil	250
Pine oil	25
Balsam of Copaiba	20
Butyl lactate	10
Olive oil	10

EXAMPLE II

Under glaze color black 1,000	
Boiled linseed oil	250
Pine oil	30
Olive oil	20
Butyl lactate	10

These inks are applied cool, that is at room temperature, and do not require elevated temperatures or close temperature control for proper application. As mentioned before, the inks may be so formulated in each case that they may be silk-screen printed onto the ink-transfer elements well in advance of the actual transfer printing operation without affecting either the total-release characteristic of silicone rubber, or the property to transfer readily to the ceramic surface to be decorated or without premature drying to the degree that they are no longer useful. The constituents of these inks may be varied to accommodate scheduling of printing and transferring. Scheduling may be rapid as from 1 minute to 10 minutes after printing or delayed 2 or 3 hours. Volatile constituents are increased for rapid printing after transfer and these volatile constituents are reduced for delayed printing after transfer. Accordingly the pine oil and butyl lactate constituents are reduced to avoid drying. The 30 grams of pine oil suggested in Example II would be reduced to 5 grams and the 10 grams of butyl lactate would be reduced to 2 grams for a longer waiting period; but when these constituents are so reduced, transferring cannot be effected before 5 minutes after printing. Accordingly the volatile constituents control duration after printing during which inks may be transferred from the total-release transfer surfaces.

The pine oil and butyl lactate of the preceding formulae may be substituted for by acrylic resins dissolved in varnish. These acrylic resins are very useful in ceramic decoration because as a medium or vehicle of the color they do not show defects in glazes or carbon residue in finished products. If used in the preceding formulae, acrylic resins must be added in the same proportion as the pine oil and butyl lactate (and no more) together with the other oils and pigments.

After application of the colorant to the tableware, the ware may have a glaze applied to it and thereafter the ware is fired. Under glaze decorated ware is fired at from 2,000° F. to 2,050° F. for vitreous hotel ware and porcelain and from 1,850° F. to 1,900° F. for domestic nonvitreous ware. Over glaze decorated ware is fired at from 1,375° F. to 1,400° F. for precious metals and from 1,425° F. to 1,475° F. for ordinary over glaze colors. For hard over glaze colors a firing temperature of 1,550° F. is usually employed. Generally speaking the practical range for firing of tableware is from 1,200° F. to 2,200° F.

It is of course to be understood that variations in arrangements and proportions of parts and ingredients of this disclosure may be made within the scope of the appended claims.

I claim:

1. A method for applying an oil-based relatively viscous colorant to an item of ceramic tableware and comprising steps of:

providing an element with a total-release transfer surface, silk-screen printing the colorant in a relatively thick layer onto the transfer surface,

providing for a time delay of from 1 minute to 3 hours for allowing the colorant layer to dry partially on the transfer surface so as to form a tacky skinlike film with cohesive integrity exceeding its bonding adhesion to the transfer surface,

causing intimate mechanical contact between the film and the item of ceramic tableware and thereafter withdrawing quickly the transfer surface from the film whereby the film is transferred in its entirety intact to the item,

firing the item at a temperature high enough to fuse the colorant.

2. The method according to claim **1** and

the element discrete and portable,

performing the silk-screen printing at a first work station,

performing the intimate mechanical contact at a second work station, the first and second work stations spaced apart physically from each other.

3. The method according to claim **2** and

providing a relatively large number of the elements,

providing a plurality of the second work stations.

4. The method according to claim **3** and

providing an elastic membrane as the element, providing for gas passage through the membrane to improve the mechanical contact.

5. The method according to claim 3 and the total-release surface of silicone rubber cast on an elastic fabric net.

6. The method according to claim 3 and all of the steps conducted at room temperature.

7. The method according to claim 3 and the time delay in a range from 5 minutes to 3 hours.

8. The method according to claim 2 and
providing an elastic membrane as the element,
providing for gas passage through the membrane to improve the mechanical contact.

9. The method according to claim 2 and the total-release surface of silicone rubber cast on an elastic fabric net.

10. The method according to claim 2 and all of the steps conducted at room temperature.

11. The method according to claim 2 and the time delay in a range from 5 minutes to 3 hours.

12. The method according to claim 1 and
providing an elastic membrane as the element,
providing for gas passage through the membrane to improve the mechanical contact.

13. The method according to claim 1 and the total-release surface of silicone rubber cast on an elastic fabric net.

14. The method according to claim 2 and all of the steps conducted at room temperature.

15. The method according to claim 1 and the time delay in a range from 5 minutes to 3 hours.

16. A method for applying a first and a second oil-based relatively viscous colorant to an item of ceramic tableware and comprising steps of:
providing a first element with a first total-release transfer surface,
silk-screen printing the first colorant in a relatively thick layer onto the first transfer surface,
providing for a time delay of from 1 minute to 3 hours for allowing the first colorant layer to dry partially on the first transfer surface so as to form a tacky skinlike first film with cohesive integrity exceeding its bonding adhesion to the transfer surface,
causing intimate mechanical contact between the first film and the item of ceramic tableware and thereafter withdrawing quickly the first transfer surface from the first film whereby the first film is transferred in its entirety intact to the item,
providing a second element with a second total-release transfer surface,
silk-screen printing the second colorant in a relatively thick layer onto the second transfer surface,
providing for a time delay of from 1 minute to 3 hours for allowing the second colorant layer to dry partially on the second transfer surface so as to form a tacky skinlike second film with cohesive integrity exceeding its bonding adhesion to the second transfer surface, causing intimate mechanical contact between the second film and the item of ceramic tableware and thereafter withdrawing quickly the second transfer surface from the second film whereby the second film is transferred in its entirety intact to the item,
firing the item at a temperature high enough to fuse the colorants.

17. The method according to claim 16 and the second film at least partially overlaying the first film on the item of ceramic tableware.

18. The method according to claim 17 and in which the total number of the elements is in excess of two and is equal to a total number of colorants to be applied to the item and in which each successive of the colorants is transferred to the item without waiting for previously transferred colorant on the item to dry.

19. The method according to claim 18 and
providing elastic membranes as the elements,
providing for gas passage through each of the elastic membranes to improve the mechanical contact.

20. The method according to claim 18 and said total-release surfaces of silicone rubber cast on an elastic fabric net.

21. The method according to claim 18 and all of the steps conducted at room temperature.

22. The method according to claim 18 and the time delay in a range from 5 minutes to 3 hours.

23. The method according to claim 17 and
providing elastic membranes as the elements, providing for gas passage through each of the elastic membranes to improve the mechanical contact.

24. The method according to claim 17 and the total-release surfaces of silicone rubber cast on an elastic fabric net.

25. The method according to claim 17 and all of the steps conducted at room temperature.

26. The method according to claim 17 and the time delay in a range from 5 minutes to 3 hours.

27. The method according to claim 16 and in which the total number of the elements is in excess of two and is equal to a total number of colorants to be applied to the item and in which each successive of the colorants is transferred to the item without waiting for previously transferred colorant on the item to dry.

28. The method according to claim 27 and
providing elastic membranes as the elements,
providing for gas passage through each of the elastic membranes to improve the mechanical contact.

29. The method according to claim 27 and the total-release surfaces of silicone rubber cast on an elastic fabric net.

30. The method according to claim 27 and all of the steps conducted at room temperature.

31. The method according to claim 27 and the time delay in a range from 5 minutes to 3 hours.

32. The method according to claim 16 and
providing elastic membranes as the elements, providing for gas passage through each of the membranes to improve the mechanical contact.

33. The method according to claim 16 and the total-release surfaces of silicone rubber cast on an elastic fabric net.

34. The method according to claim 16 and all of the steps conducted at room temperature.

35. The method according to claim 16 and the time delay in a range from 5 minutes to 3 hours.

* * * * *

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,756,165 Dated September 4, 1973

Inventor(s) Jose Valiela

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 2, line 36, "ink film" should read -- ink films --.

Column 4, line 28, after "ink film 9a" delete " therefor"

Column 4, line 36, "before 15a" "ink film" should read -- ink films --.

Column 5, line 9, "ink film" should read -- ink films --.

Column 5, line 10, "ink film" should read -- ink films --.

Column 5, line 14, "attach" should read -- attack --.

In Example II the quantity 1,000 should be in the right hand column under grams, rather than the left hand column.

Column 7, line 26, "claim 2" should read -- claim 1 --.

Signed and sealed this 21st day of May 1974.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents

FORM PO-1050 (10-69)

USCOMM-DC 60376-P69
* U.S. GOVERNMENT PRINTING OFFICE : 1969 O—366-334.