United States Patent [19]

Anderson

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[45] ***May 21, 1974**

[54] **PROCESS FOR FORMING CERAMIC SANITARY WARE HAVING A STONE-LIKE APPEARANCE**

[75] Inventor: **Warren Gregory Anderson,** New Orleans, La.

[73] Assignee: **American Standard Inc.,** New York, N.Y.

[*] Notice: The portion of the term of this patent subsequent to Jan. 11, 1989, has been disclaimed.

[22] Filed: **Feb. 8, 1971**

[21] Appl. No.: **113,712**

Related U.S. Application Data

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[52] **U.S. Cl.** **264/60,** 264/73, 264/86, 264/212

[51] **Int. Cl.** **B28b 1/26**

[58] **Field of Search** 264/56, 60, 73, 74, 86, 264/87, 212, 245

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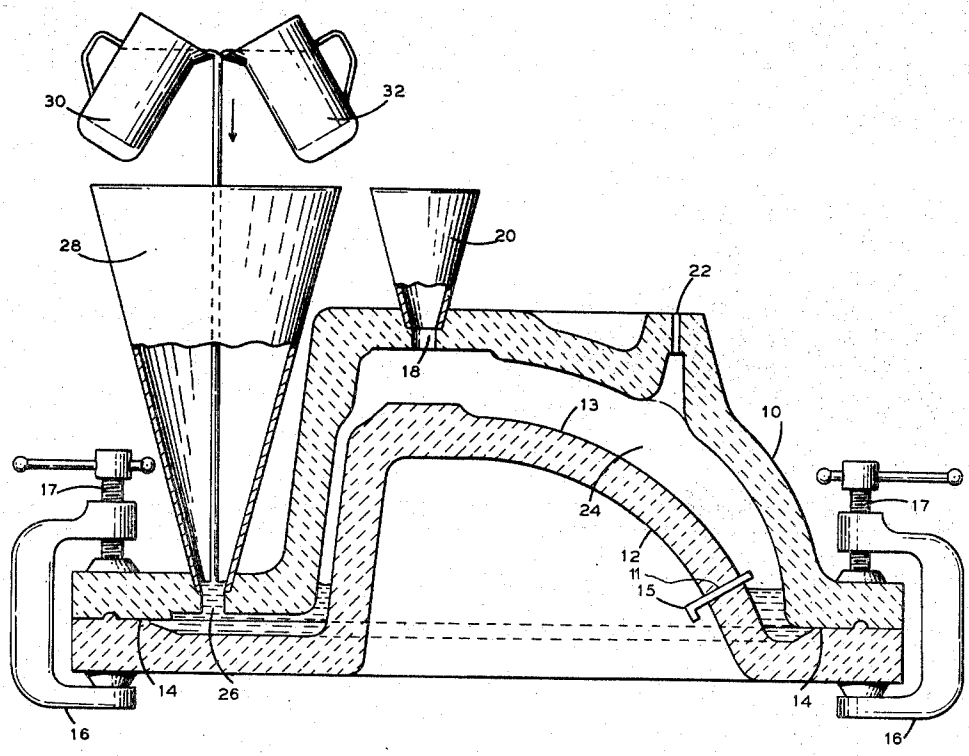
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Primary Examiner—Donald J. Arnold
Attorney, Agent, or Firm—Tennes I. Erstad

[57] **ABSTRACT**

This invention comprises a process for making china or ceramic sanitary ware such as toilets, lavatories, bidets, and urinals, and similar articles which are provided with an appearance resembling natural stone or marble.

7 Claims, 11 Drawing Figures



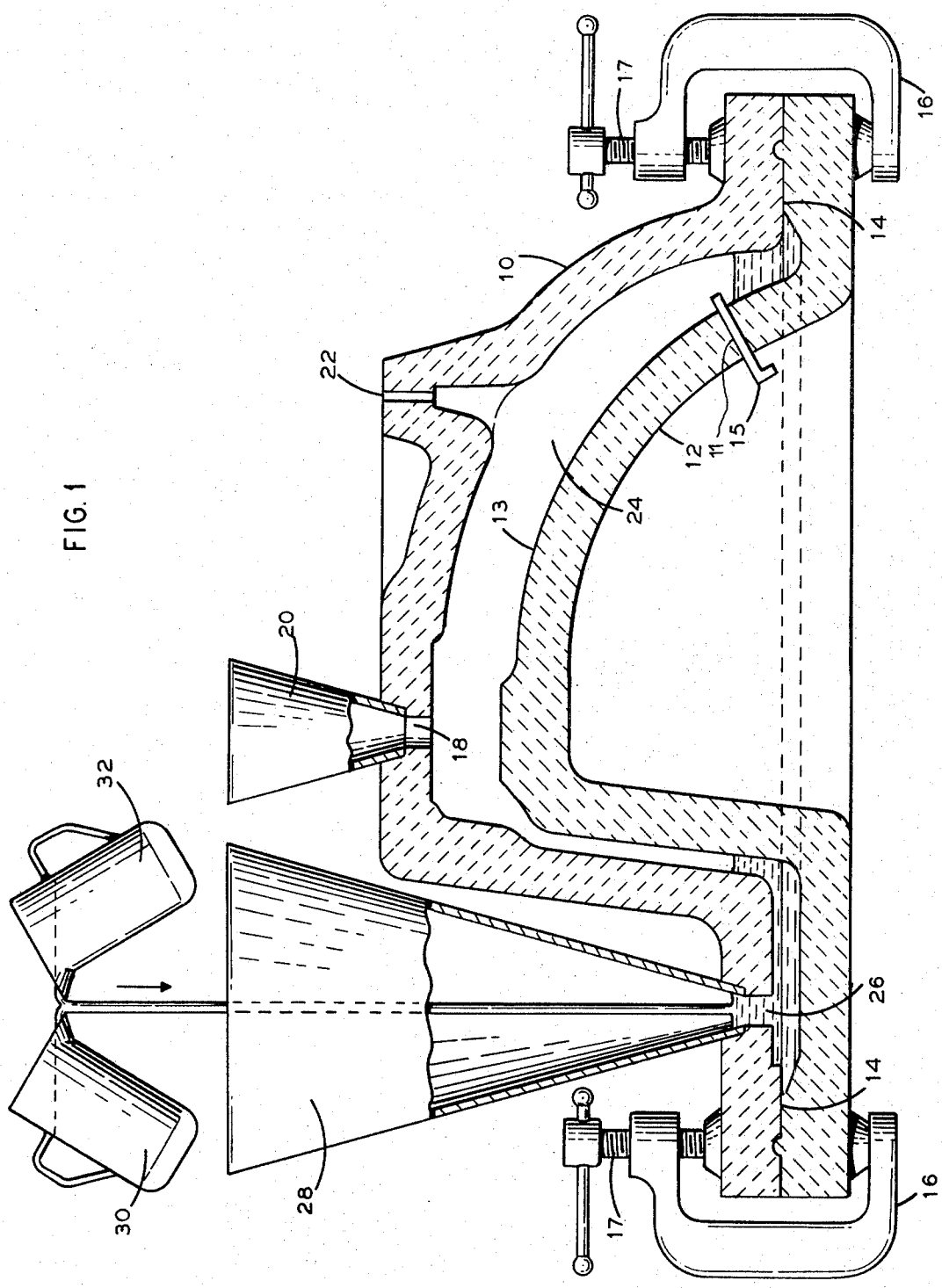


FIG. 1

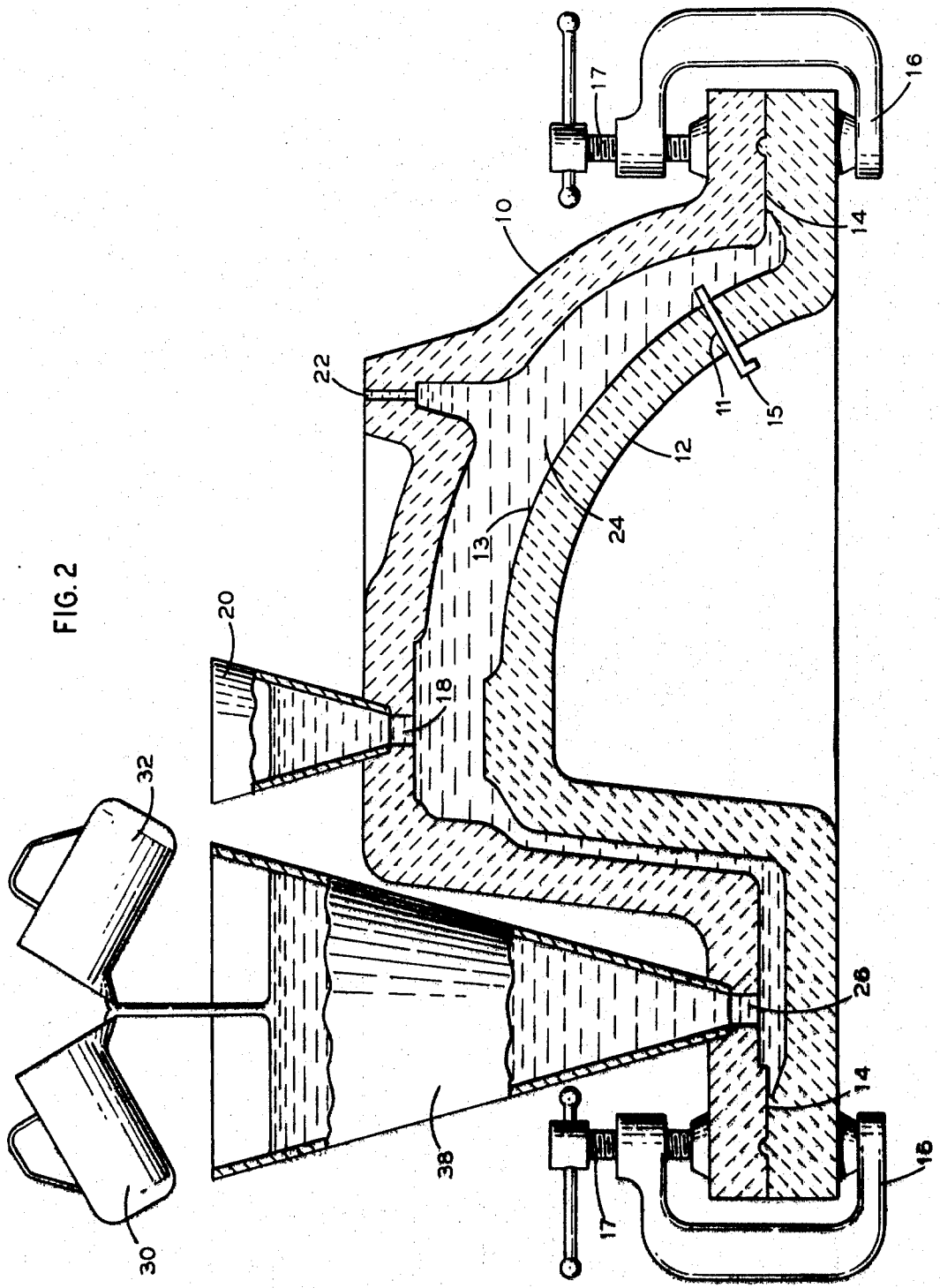


FIG. 2

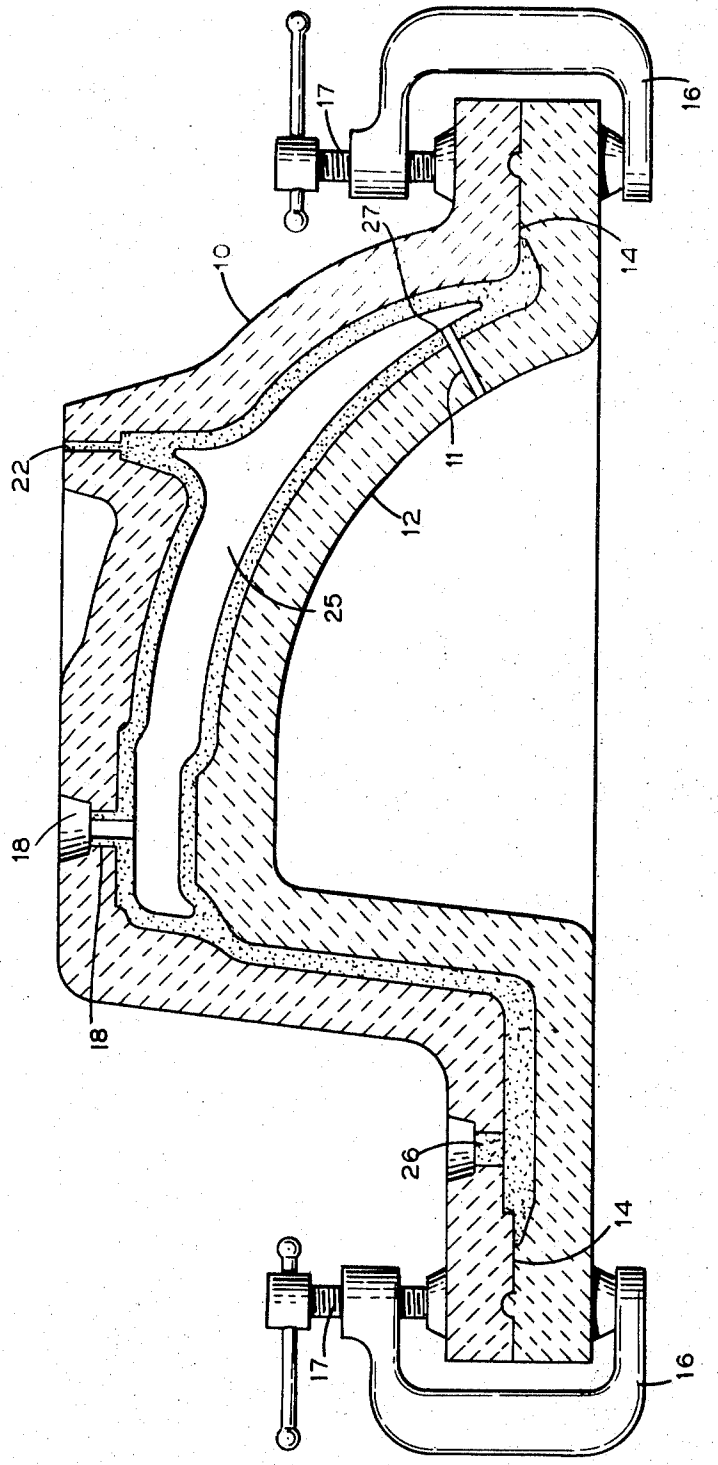


FIG. 3

FIG. 4

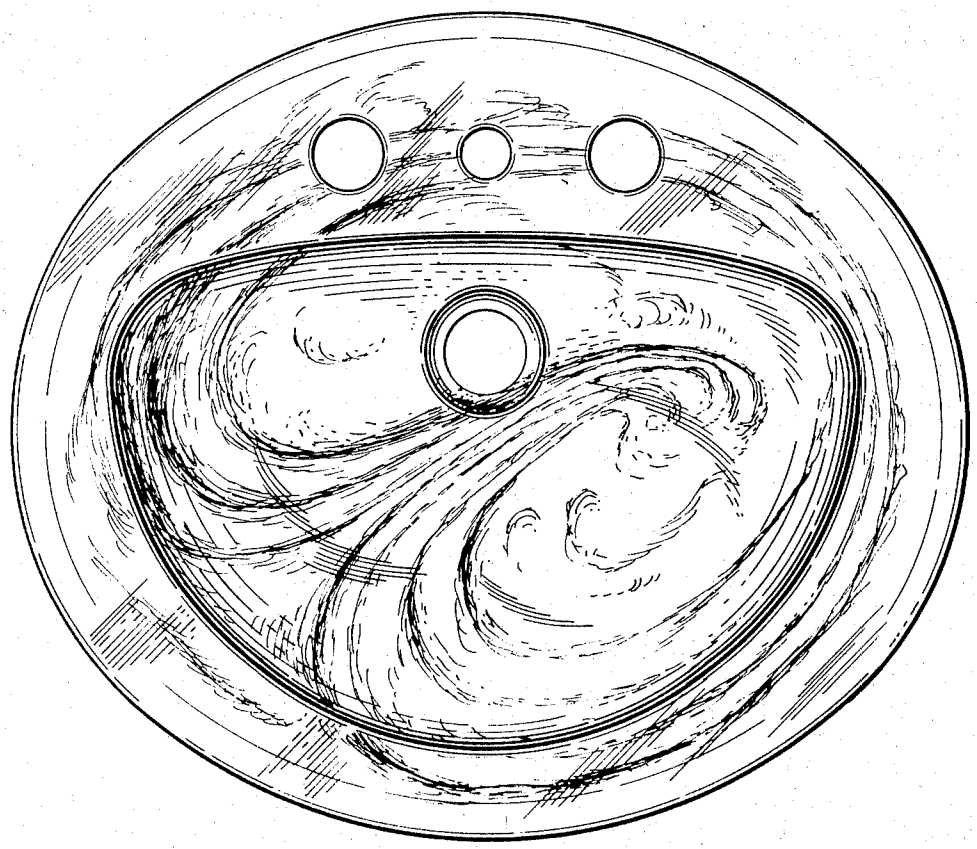
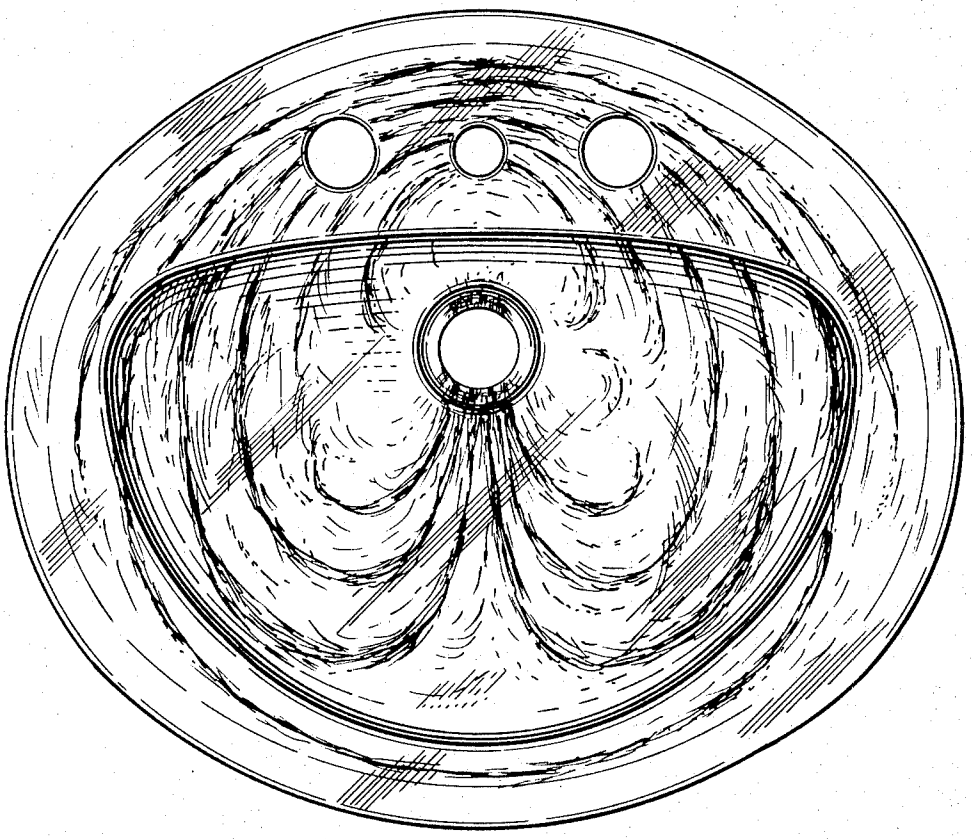


FIG. 5



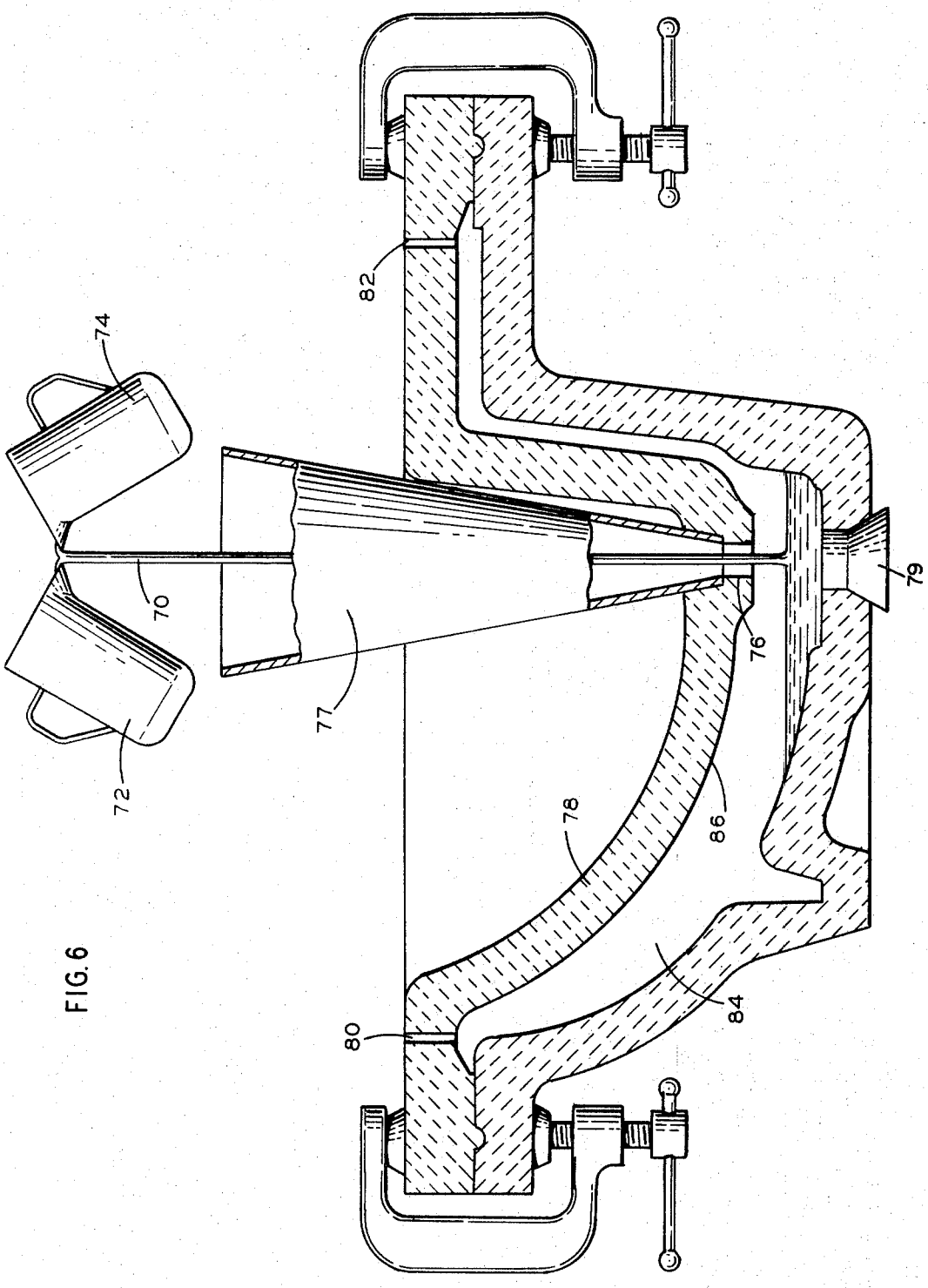


FIG.6

FIG. 7

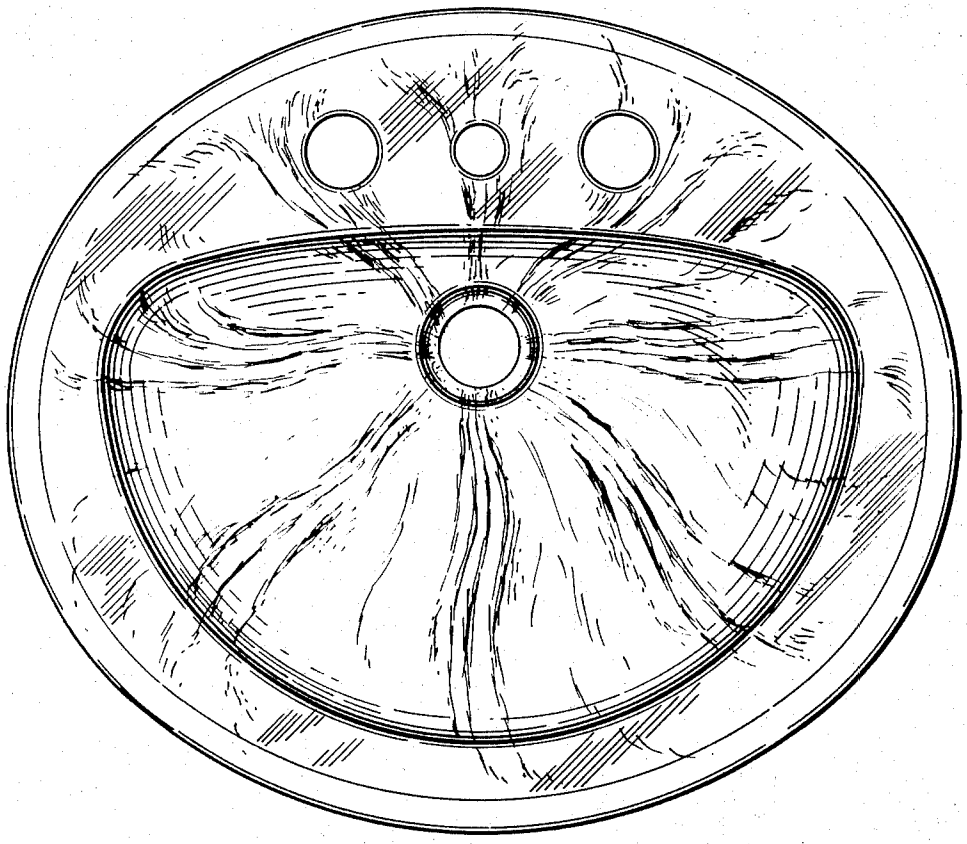


FIG. 8

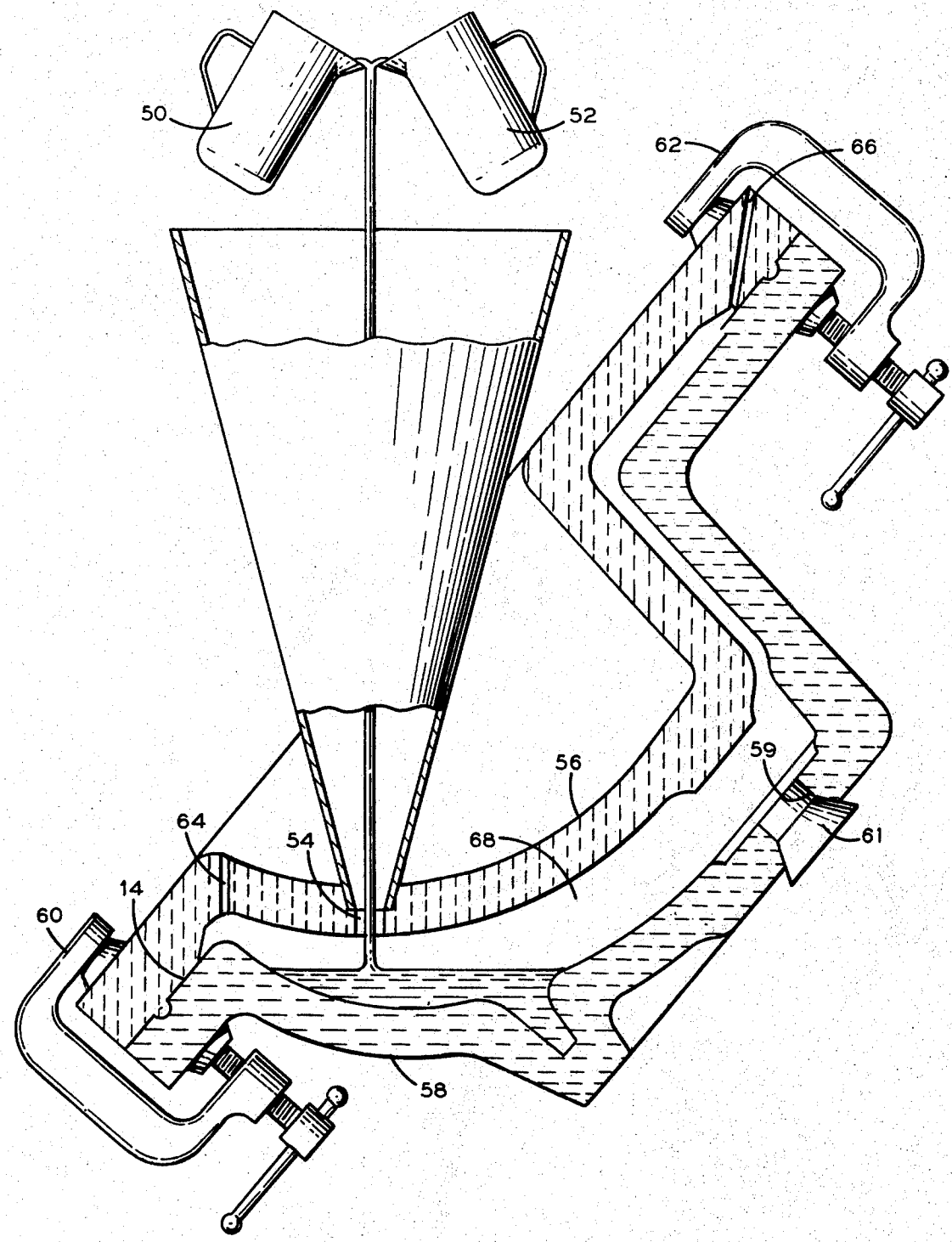


FIG. 9

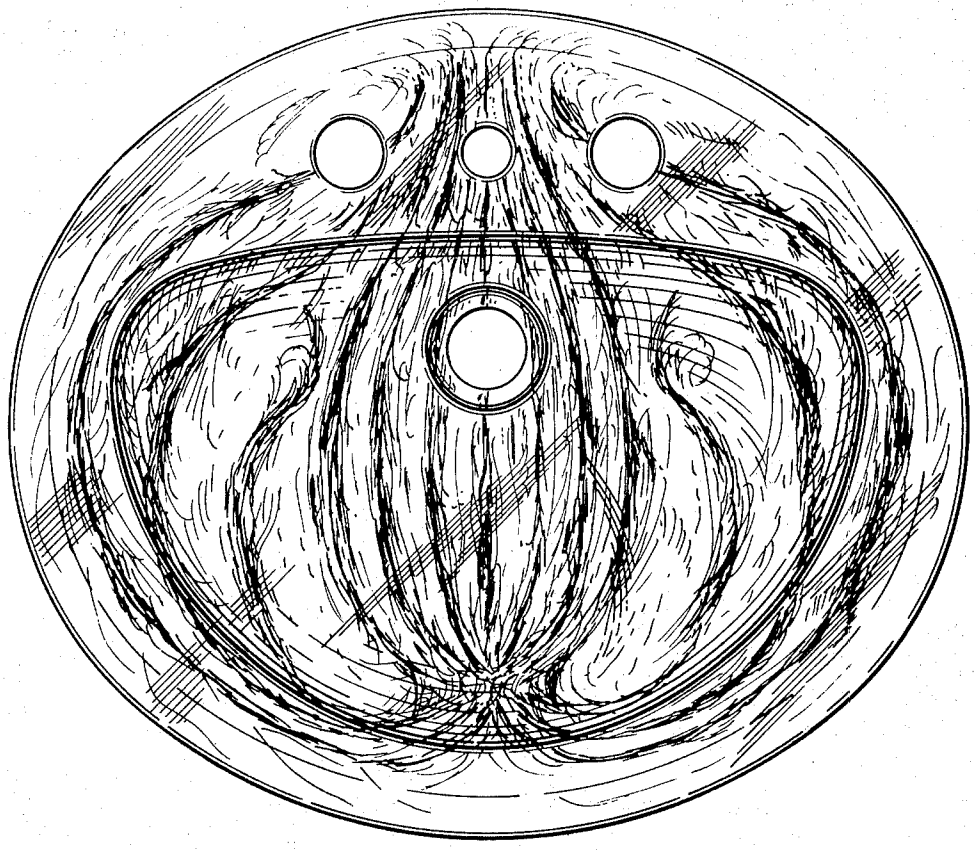


FIG. 10

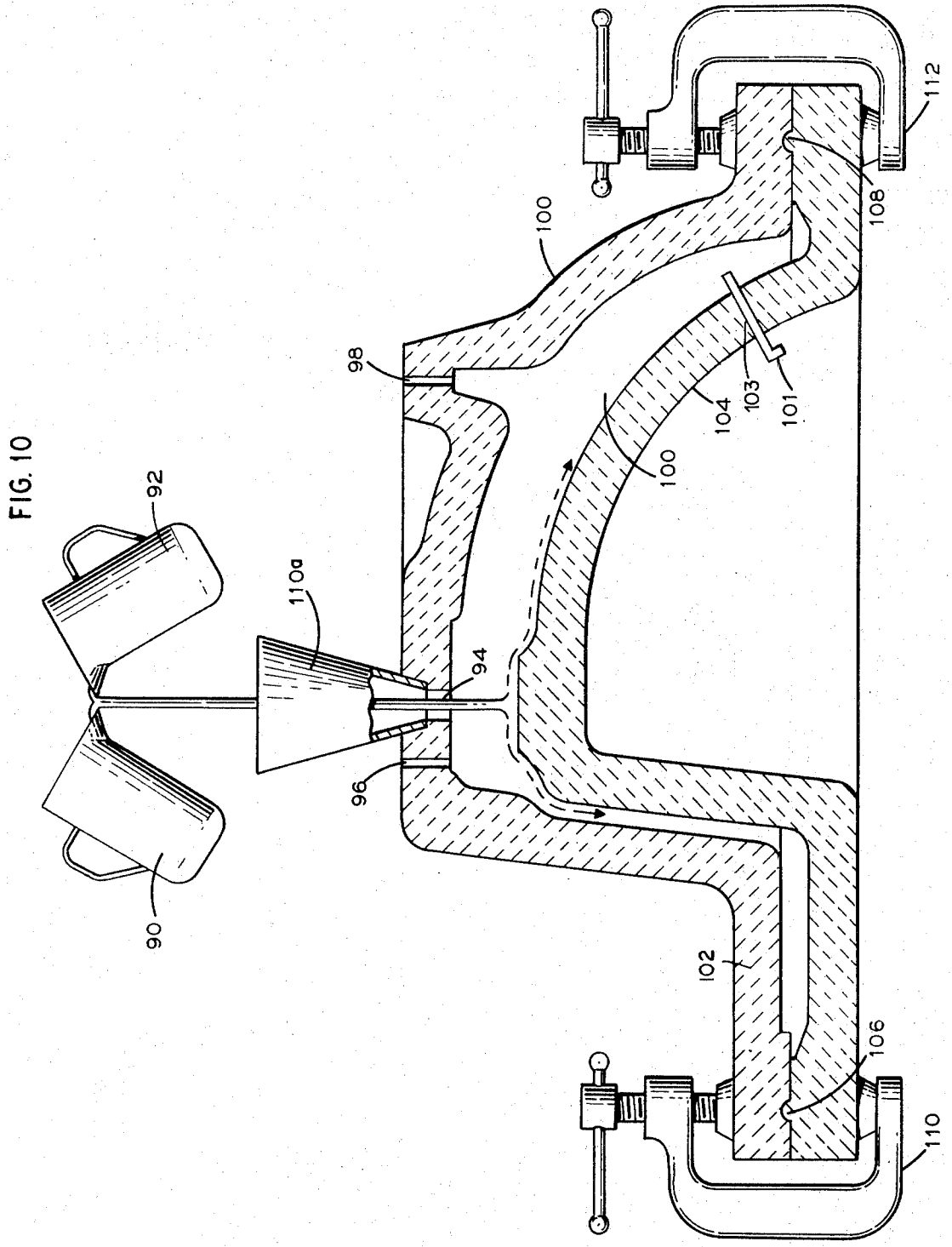
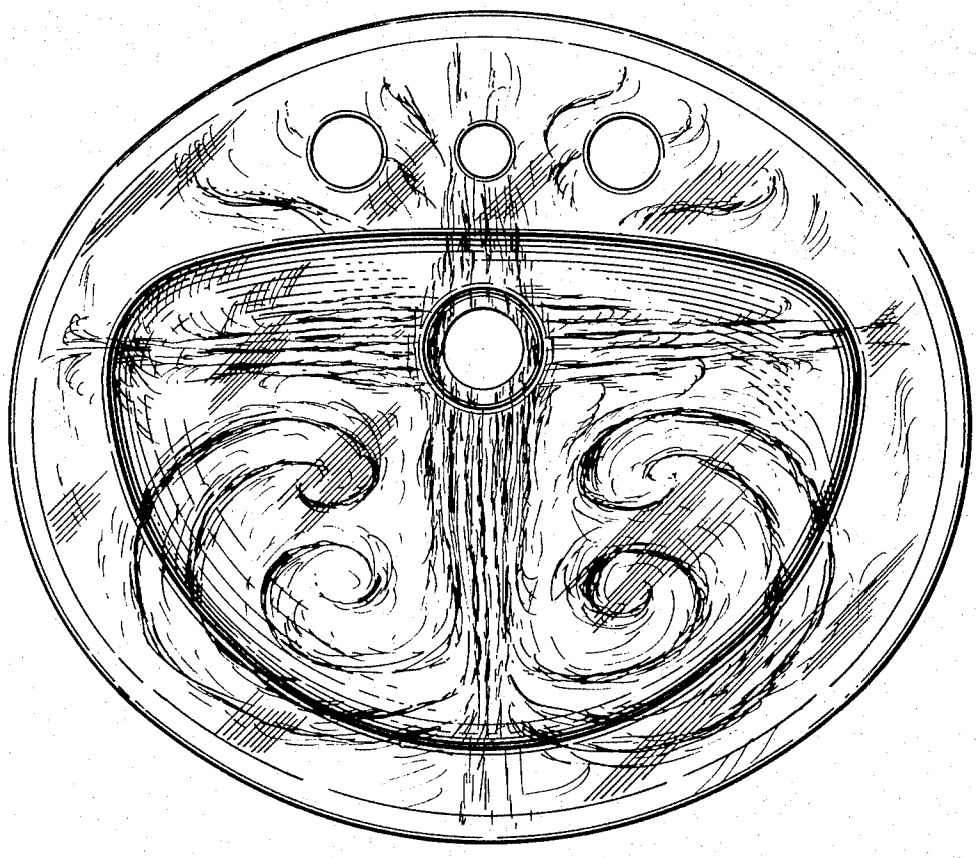


FIG. 11



PROCESS FOR FORMING CERAMIC SANITARY WARE HAVING A STONE-LIKE APPEARANCE

This application is a division of U.S. Pat. application Ser. No. 846,142, now U.S. Pat. No. 3,634,179 filed July 30, 1969.

Two or more ceramic ware forming slips of different colors are combined into a unitary stream but not completely blended when poured into the cavity of a moisture absorbing mold. Special pouring and filling techniques are employed to facilitate the approximate repetition of a design in the formed article for those who desire to be able to repeat a particular design. Where desired, pouring and blending may also be controlled so as to avoid initial contact between the unitary slip stream and the visible or marketing surface of the mold forming the finished product where a product of a particular appearance is desired. This results in a natural stone or marble-like appearance of the finished product, and the particular design can be generally repeated in subsequent articles. Pouring may also be controlled so as to contact the marketing surface where such marbilized appearance is desired. For those who desire variation from product to product, this can be accomplished by varying color and slip compositions and by mold manipulation.

The present invention relates to sanitary ware and similar articles made from glazed ceramic ware which have a stone or marbleized surface appearance and also to an apparatus and to a process for making same.

In the past, sanitary ware made from ceramic ware china, such as lavatories, toilets, toilet tanks, urinals, bidets and other items of sanitary ware used in residential bathroom and public rest rooms were usually made in white colors, the color derived from a glaze coat applied to the body and the gloss achieved through the firing process. An improvement came about when colored sanitary ware was introduced, such as solid blues, greens, tans, pinks, etc., the color being derived from inorganic stains or pigments added to the glaze which was applied to the ware and gloss achieved through the firing process. To make such articles, slip was poured into plaster molds from the top until the mold cavity was filled, and after the desired wall thickness has been obtained, the excess liquid slip was drained from the mold. To avoid such plain solid color appearance, poured plastics were then introduced for sanitary ware which incorporated veining to imitate and resemble natural stone and marble. While such marbleized plastic products were exceptionally beautiful and attractive, they were also more susceptible to breakage and had softer surfaces which did not have the wearing qualities of ceramic ware. Such plastic surfaces could be easily marred by cigarettes, matches, and stained by chemicals such as medicines which are used in the bathroom. Nevertheless, their aesthetic advantages exceeded their mechanical and chemical disadvantages.

An important object of this invention is to provide an improved process for making vitrified sanitary ware, wherein the article produced has a natural stone or marble appearance and also the hardness of vitrified china.

A further object of this invention is to provide for a process and method for making marbleized sanitary ware having the appearance of natural stone or marble.

Another object of this invention is to provide a method for effective veining of the slip cast clay body of vitrified sanitary ware.

Another object of this invention is to provide a new and improved method for the manufacture of ceramic and sanitary ware, which will permit a variety of design configurations to be made and which can be generally reproduced consistently.

A further object is to provide a new and improved method for making ceramic sanitary ware which will permit design configurations to be made different for each product by varying the color ratios and mixture of slip and by manipulating the mold, controlling the amount of colored slip and areas where composite slip is introduced into the mold cavity.

A further object is to provide a process for slip casting wherein multi-colored slip is fed into predetermined areas of a water absorbing mold cavity to effect particular styles of veining.

A further object is to arrange a slip casting process so as to enable a composite multi-color slip to be poured into the mold cavity against a cavity wall that does not form the marketable surface of the article and allows the marketable surface to gain initial contact with the multi-color slip as it rises in the mold cavity due to the continued pouring of the slip.

To the accomplishment of the above and related objects, the invention may be embodied in the forms illustrated in the accompanying drawings, attention being called to the fact, however, that the drawings are illustrative only, and that change may be made in the specific contructions illustrated and described, so long as the scope of the appended claims is not violated.

In the drawings:

FIG. 1 shows a pair of water absorbing plaster of paris molds having a cavity therein with the pouring funnels in place and the mold is partially filled with multi-color liquid slip.

FIG. 2 shows the mold after it has been completely filled with slip of two different colors, but prior to the excess slip being drained therefrom.

FIG. 3 shows partially dehydrated slip remaining in the mold after the excess liquid slip has been drained therefrom.

FIG. 4 is a top view showing the natural marble appearance of a ceramic basin formed by the apparatus and process shown in FIGS. 1–3 wherein the pouring hole has been off set to one side of the lavatory.

FIG. 5 is a top view showing the natural marble appearance of the ceramic lavatory formed by the apparatus and process shown in FIGS. 1–3 wherein the pouring hole has been centered relative to the sides of the lavatory.

FIG. 6 shows an alternative method for pouring two different color slips through the area which will form the waste opening of a lavatory to form a lavatory having a natural stone or marble appearance.

FIG. 7 shows the stone pattern achieved by pouring slips of two different colors in the manner shown in FIG. 6

FIG. 8 shows a mold positioned at a tilted angle, so that slip can be poured into the mold without initially contacting the surface of the male mold member which will form the marketable surface of the finished lavatory.

FIG. 9 shows the natural marble pattern achieved by pouring slips of two or more different colors in the manner shown in FIG. 8.

FIG. 10 shows a mold cavity being filled with an incompletely blended multi-colored slip through the drain hole of an inverted mold.

FIG. 11 shows the pattern resulting from a mold filled in the manner shown in FIG. 10.

The articles of chinaware I have used to illustrate the invention are lavatories which have a natural stone or marble appearance. Instead of lavatories, the mold could have been shaped to form toilets, bidets, tanks, urinals or other items of ceramic ware which today are made in solid colors.

In FIG. 1 I have shown a pair of water absorbing matched molds 10 and 12 for forming a lavatory wherein the veining will extend from one corner of the lavatory up on one side and across the basin and up the opposite side of the basin. These molds have a cavity formed therein which is of the shape of the product to be formed. Molds of this type are wellknown in the slip casting art and are usually made from plaster of paris.

The two molds are held together at their peripheral flanges 14 by suitable means such as C clamps 16, or other similar holding means. These C clamps are opened and closed by a suitable clamp screw 17 in a manner well-known in the art. A suitable drain hole 11 is provided to drain excess slip from the mold cavity. A plastic plug 15 is inserted into the hole 11 to plug the same when it is not desired to have slip drained from the hole 11. When the excess slip has been drained out of the mold through hole 11 by the removal of plug 15, and the solids remaining in the mold have set, the C clamps are opened. This permits the female 10 and male 12 molds to be separated to release the molded article which is then in a state commonly known in the art as greenware. It is sufficiently solidified to hold its shape, but soft enough to be readily deformable and cutable by a knife or other suitable cutter.

The inverted female mold 10 is provided with an opening 18 adjacent the area of the lavatory which is to become the drain hole of the lavatory into which a funnel 20 is inserted. One or more vent holes 22 are provided in the upper portion of the mold 10 to allow air to escape as the slip rises in the cavity 24. A pouring hole 26, into which a tall funnel 28 is inserted is provided at the base of the inverted mold member 10 which will form the back edge. All initial pouring is effected through this funnel 28 to accomplish certain appearance affects in the final product as will be more fully explained hereinbelow. The pouring hole can be off set to either side of the back ledge of the lavatory or it can be centered.

By off setting the hole 26 to one side the veining of the lavatory will spread diagonally across the lavatory surface as shown in FIG. 4. If the pouring hole is centered in the back ledge then symmetrical swirling occurs as shown in FIG. 5 with the joint line being opposite to the pouring hole. Accordingly the position of the pouring hole will locate the joint line substantially opposite to the pouring hole and the position of the pouring hole can be changed to achieved interesting patterns.

Two or more slips, either of different colors, or of neutral and colored slip are poured together from different suitable sources of supply. I have shown pouring pails 30 and 32 as being the sources of supply. The poured slip streams join physically together at the bottom mouth of the funnel 28 without effecting a uniform blending of the slips with each other.

The slips employed may be of the usual well-known compositions employed for making ceramic sanitary ware. For example, an ordinary slip composition which is neutral in color can be used for this purpose is:

30 % Ballclay
20 % China Clay
20 % Feldspar
30 % Flint
100% Total

such ingredients are available on the public market and sold by various companies listed in Trade Directories and Journals.

Inorganic colors are added in a conventional manner to one or more separate batches of said slips which are poured together in the manner shown in FIG. 1 so they join in a common stream but do not become uniformly blended with each other.

Such stains or pigments are obtainable on the open market and are known as body or glaze stains, sold by various companies listed in Trade Directories and Journals for use in a conventional manner for staining or coloring slips.

The amount of coloring that is added to a batch of slip has to be varied in accordance with the degree of color and contrast that is desired, in a manner similar to the way one adds color to paint.

The common stream of joined slips, received from the sources of supply 30 and 32, then begin filling the mold from the bottom of the mold cavity 24. It will be appreciated that while the pails or containers 30 and 32 have been employed for purposes of illustration, other means such as pumps, metering valves, supply hoses, etc. could be used instead for feeding slips of different colors to the funnel 28. The important factor is that there should be no uniform blending of the different colored slips taking place as a result of the feeding operation.

By depositing the slips on the side of the mold which is opposite to the marketable surface, the slip will distribute itself horizontally and as it rises in the cavity the slip then first comes into contact with the marketable surface of the mold. This results in striations or veining which has depth in the body of the final finished product and will show up in a manner similar to the way veining is formed by nature in sedementary rock so that the ceramic article appears to be made from natural stone or marble.

The combined slips deposited inside of the cavity 24 rise upwardly in the cavity 24 from the bottom of the cavity. In this embodiment, the first contact of the slip with the marketable surface 13 of the plaster mold 12 will be as the slip rides upwardly from the bottom and not by pouring the slip directly on the male mold.

FIG. 1 shows the slip rising in the mold cavity 24 and at this time the cavity is partially filled with slip.

It will be noted that the male portion 12 of the mold forms the finished marketable surface 13; that is, the surface of the finished product that will be permanently visible to the consumer. By following the method and process of pouring described and shown in FIG. 1, the first contact of combined neutral and colored slip with the male mold member 12 will be as the slip arises up-

wardly in cavity **24** and not as it runs down the side of the mold surface.

The colored slip as it rises and as it moves horizontally in its initial contact with the marketable surface of the mold leaves streaks or striations, due to the stretching out of the colored slip as it moves in the mold cavity, thereby leaving striations of color along the mold surface. By following the same procedures and positioning of the mold when filling the mold cavity, it is possible to generally reproduce the striation pattern by controlling the physical characteristics, rate of feed, and composition of the slip used to fill the mold.

The filling funnel **28** fits tightly in the hole **26** in which the funnel is positioned, so very little, if any, slip leaks out at this junction. When the cavity **24** has been completely filled with slip, as shown in FIG. **3**, all cavity portions thereof will be filled and excess air will have escaped through the vent openings **22**, and through the waste opening **18**.

Water is absorbed from the poured slip by the walls of the plaster of paris molds **10** and **12**. As such water is absorbed into the plaster of paris molds **10** and **12**, the reserve slip in the funnels **20** and **28** descends to make up for this water removal. As the water is removed, the solids are drawn to the mold surface by the capillary action of the water migrating to the outer surface of the mold. In this manner, a build up of solids is effected on the mold walls which ultimately forms the green ware when the molds are separated to remove the formed article.

The slip is allowed to remain in the mold cavity **24** a length of time sufficient to permit the desired amount of water to be absorbed from the slip which results in the walls of the article building up to the thickness desired. The pin **15** is then removed from hole **11** and the excess slip still remaining in a liquid form the runs out through the hole **11**. When this excess slip has been drained out from the hole **11** in this manner, an overflow passageway **25** is formed, as shown in FIG. **4** which connects with the drain outlet **18**. A hole **27** is cut in the upper edge of the basin with a knife or cookie cutter, when the clay is firm enough to work, to form an overflow entrance from the basin into the overflow passageway, in a manner wellknown in the art.

When the clamps **16** are removed, the upper mold **10**, and the lower mold **12** can be readily separated from each other to release the formed green ware. The formed green ware, shown in FIGS. **4** & **5** made from a composite slip of two different colorings, poured in the manner and with the apparatus shown in FIGS. **1–3** has marble or stone like appearance such as shown in FIGS. **4** or **5** depending on the location of the pouring hole.

By using a mold, such as shown in FIGS. **1–3** wherein inlets for the slip are at the bottom of the mold cavity, and following the process and method just described, it is possible to generally reproduce similar stone striations on each pouring in those cases where a manufacturer finds it desirable to have general similar veining in his products.

It is also possible to vary the intensity of the contrasts by changing the amount of coloring in the colored slip and in the neutral slip. Similarly, it is also possible to add one or more color slips simultaneously with the neutral slip to get pleasing variations in color, striations, and veining. I have thus accomplished my objective of generally reproducing the product appearance from one molding operation to the next and providing a process for accomplishing the manufacture of such products. While the striation and veining will not be an exact duplication of the preceding product, it will be generally duplicative in the aesthetic similarities to previous pourings, as long as the mold, its position, the colored slips and rate of pouring is maintained consistent.

When different patterns of veining are not desired, variations can be obtained by varying the factors just mentioned, namely, the mold shape, its pouring position, the color combinations, and rate of pouring. Similarly, instead of introducing the composite slip at the bottom of the mold cavity, it can be introduced at some other point in the mold cavity, thus obtaining a different aesthetic appearance in the final product.

In the embodiment shown in FIG. **6**, I have shown how a mixed slip **70** from two separate colored slip sources of supply **72** can be poured with the mold right side up, directly through the funnel **77** into the drain opening **76** formed in the male mold member **78** made from plaster of paris. Conventional vent openings **80** and **82** are formed in the male mold member **78** to allow air in the mold cavity to escape as the poured slip rises in the cavity fills the same with multi-colored slip.

In this case also, the poured slip comes into contact with the marketable surface **86** of the mold as it rises in the mold cavity. In this case, the veining and striations will tend to extend from the drain opening and will radiate from this opening in concentric circles and will tend to by symmetrical on opposite sides of the article of sanitary ware. Excess slip is drained from the mold cavity in the manner previously described, by removing the plug **79**. FIG. **7** shows generally how the symmetrical striations and veining will appear when slip is poured in the manner just described.

In the embodiment shown in FIG. **8**, slip is poured through the top edge of the mold while the male and female mold members are supported at an angle in a manner shown. The simultaneous pouring of the several colored slips from pails **50** and **52** is effected through an opening **54** formed in the male mold member **56**. The male member **56** and female member **58** are held together by suitable C clamps **60** and **62** in the same manner as shown in FIG. **1**. Vent holes **64** and **66** are provided to allow excess air to escape from the mold cavity **68** when the pouring is being effected. The embodiment shown in FIG. **8** shows how slip can be poured without depositing any of the poured slip mixed with the color slip directly on to the marketing surface of the mold member. This permits initial contact of the poured slip with the marketing surface of the mold as the slip rises in the mold. As the colors come in contact with the marketable surface of the mold in rising they move rectilinearly of the mold surface which leaves striations and veining in the slip body. No slip runs out of the vent holes **64** and **66**, because as water is absorbed out of the slip by the molds, the holes plug themselves.

In the same manner as has been mentioned in connection with FIG. **1**, when the desired wall thickness has been obtained, the mold is then righted so that excess slip still remaining liquid can be drained off through the hole **59** by the removal of plug **61**. This leaves a hollow cavity in the cast slip between the outer and inner surfaces thereof. When the green ware has been removed from the mold, the usual holes are cut

therein such as the overflow, drain and inlet fixture holes. The overflow hole connects with the hollow cavity and this serves the usual purpose of providing an overflow passageway to carry any overflow water from the top of the lavatory down into the drain outlet.

FIG. 9 shows the pattern of the final product after it has been removed from the mold shown in FIG. 8. In this case we have a pattern radiating from one side of the lavatory near the drain outlet. This pattern may be generally reproduced on each molding when the positioning of the mold and the quality, color and rate of feed of the different colored slips is maintained consistent.

FIG. 10 shows how partially blended different colored slips 90 and 92 can be poured from suitable sources of supply into the inverted mold through the drain opening 94. Suitable vent holes 96 and 98 are provided to enable the mold cavity 100 to be completely filled with partially blended multicolored slip.

The plaster of paris molds 102 and 104 are aligned with each other by means of dowel balls 106 and 108 and are held together by suitable clamps 110 and 112. In this case the poured material comes into contact initially with the marketable surface of the mold and runs down the sides of the male mold. The pattern configuration shown in FIG. 11 will be obtained in this arrangement. When the multi-colored, partially blended slip has completely filled the mold cavity, an additional head is also poured into the funnel 110 to provide for shrinkage due to water absorption. This keeps the mold cavity completely filled with slip, despite the shrinkage and permits the slip to remain in the mold for the amount of time required to allow the product walls to build up to the thickness desired. The excess liquid slip is then drained from the mold by removing pin 101 from drain hole 103, thus leaving a hollow cavity in the finished article which can be used for the overflow. After the mold is removed from the formed product, suitable holes, for draining, overflow and fittings are then cut in the formed product.

The molded product which is then in a form known as green ware, is then sent through a kiln for heat treatment of about 2,300° in a manner well known in the art to vitrify the same. Prior to sending the green molded ware through the kiln for vitrification, it is dried and then it is sprayed with a glaze which is translucent or transparent and forms a glossy surface after it has passed through the kiln.

From the foregoing description, it will be apparent that I have provided an improved item of sanitary ware made from ceramics which is hard, durable and very pleasing in appearance and resembles an article of stone ware made from such a stone product as marble.

It is now possible for the public to choose interesting design variations in their ceramic bathroom fixtures and not be confined only to variations in solid color or plain white.

Although this invention has been described in its preferred forms with a certain degree of particularity, it is understood that the present disclosure of the preferred forms has been made only by way of example, and that numerous changes in the details of construction and the combination and arrangement of parts may be resorted to without departing from the spirit and the scope of the invention.

What is claimed is:

1. The process of making ceramic ware resembling natural stone which comprises providing a water absorbing mold having a cavity therein for forming an article of ceramic sanitary ware of a particular shape, filling said space with slip from at least two sources of supply, one of which has a contrasting color, said filling being effected so that the separate streams of slip join before they enter the mold, but do not completely blend with each other to thereby show contrasting colors in the formed ceramic ware.

2. The process for making ceramic ware resembling natural stone as provided for in claim 1 wherein said separate slips join each other in the vicinity of area where the slips enter into the hollow cavity of the mold but do not completely inter blend and each slip maintains a substantial part of its original coloring identity as it fills in the mold cavity.

3. The process for making ceramic ware resembling natural stone as provided for in claim 1 wherein the cavity forming the mold has one surface forming the marketable surface of the product and another surface forming a surface which is normally not visible to the user of the product, and pouring slip into said cavity so it first contacts the mold surface which forms the area of the product which is ultimately not visible to the consumer, and the slip as it rises in the cavity then contacts the surface of the mold which forms the surface of the product which is normally visible to the user of the product.

4. The process of making ceramic lavatory resembling natural stone as provided for in claim 1 wherein slips of different colors incompletely mixed with each other are poured into the mold cavity of an inverted mold through the waste outlet portion of the mold.

5. The process for making a ceramic lavatory resembling natural stone as provided for in claim 1 wherein slips of different colors incompletely mixed with each other, are poured into a mold cavity of an inverted mold through an opening formed in the lower portion of the mold so that the liquid slip will run along the surface of the mold which forms the marketable surface of the product as it rises in the mold cavity.

6. The process for making a ceramic lavatory having a resemblance to natural stone, as provided for in claim 6 wherein the mold has a cavity formed therein of the configuration of a lavatory, supporting said mold so the lavatory cavity will be at an angle with the front portion of the lavatory being in a lower position than the back portion of the lavatory, pouring a slip stream made up of at least two incompletely mixed colored slips through a hole formed in said process portion of the mold into the cavity thereof so that the slip first comes into contact with the mold surface which forms the surface of the article normally not visible to the public and contacts the mold surface which forms the surface of the article normally visible to the public as the slip rises in the mold cavity to cause veining in the molded article.

7. The process of making ceramic ware resembling natural stone, as described in claim 1 which comprises providing a water absorbing mold having a mold cavity therein for forming an article of ceramic sanitary ware of particular shape, filling said cavity with slip from at least two of supply, one of which has a different color, said filling being effected so that both poured streams join each other at the area where they enter into the cavity of the opposing mold members, allowing the combined slips to solidify to form the article of sanitary ware and then removing it from the water absorbing mold, applying a glaze to said article and firing the same to make an article of ceramic sanitary ware having the appearance of marble.

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