Dec. 15, 1936. C. A. WULF 2,064,284

PROCESS OF PIGMENTING SURFACES AND APPARATUS THEREFOR

Filed Feb. 1, 1934 2 Sheets-Sheet 1

Fig. 1.

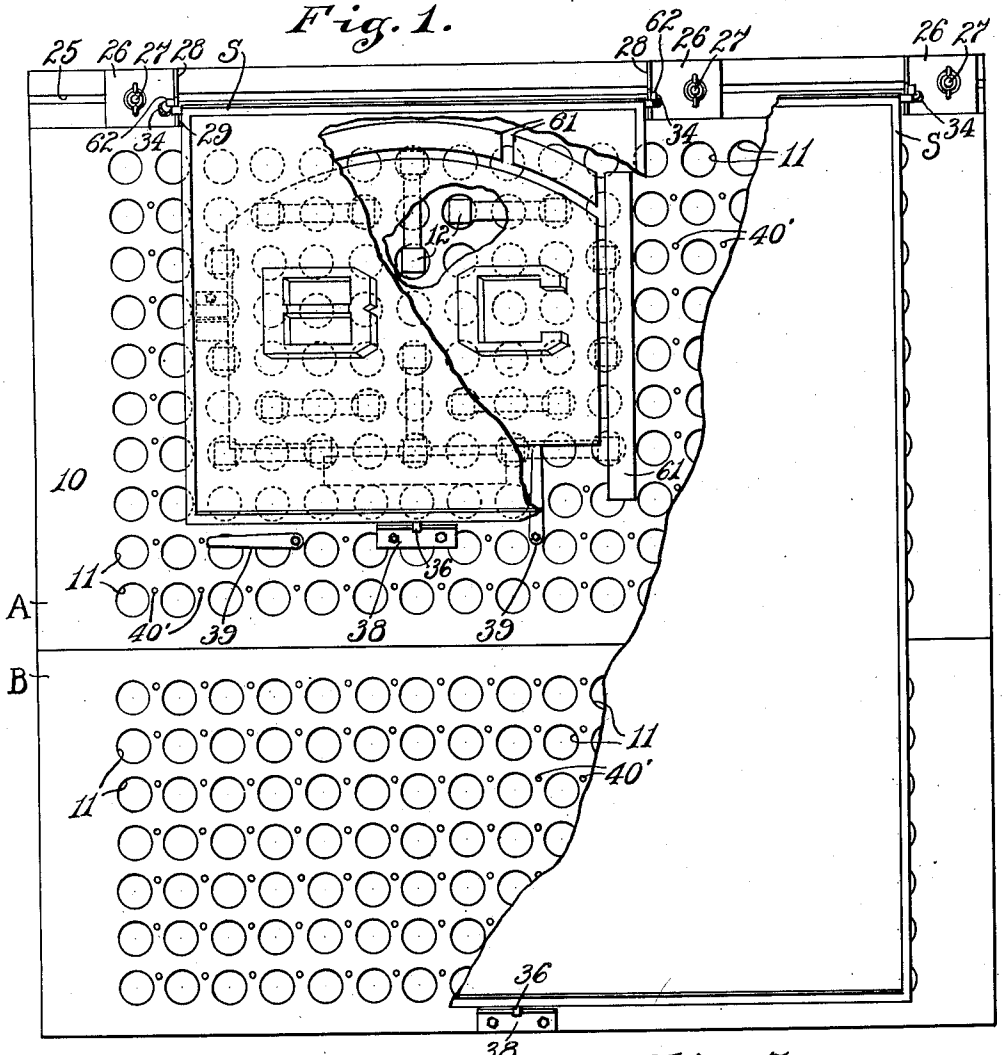


Fig. 2.

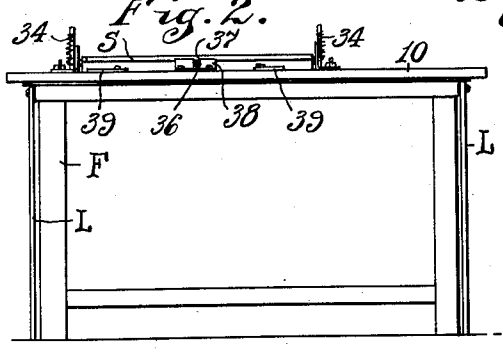
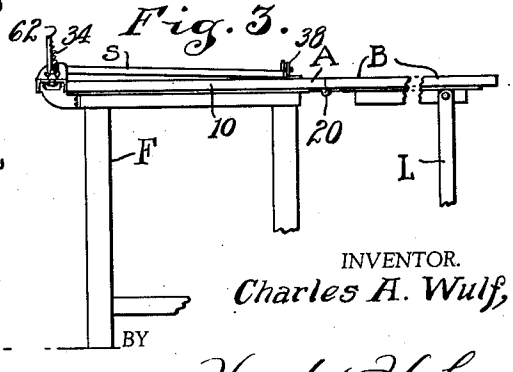


Fig. 3.



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Filed Feb. 1, 1934 2 Sheets-Sheet 2

Fig. 4.

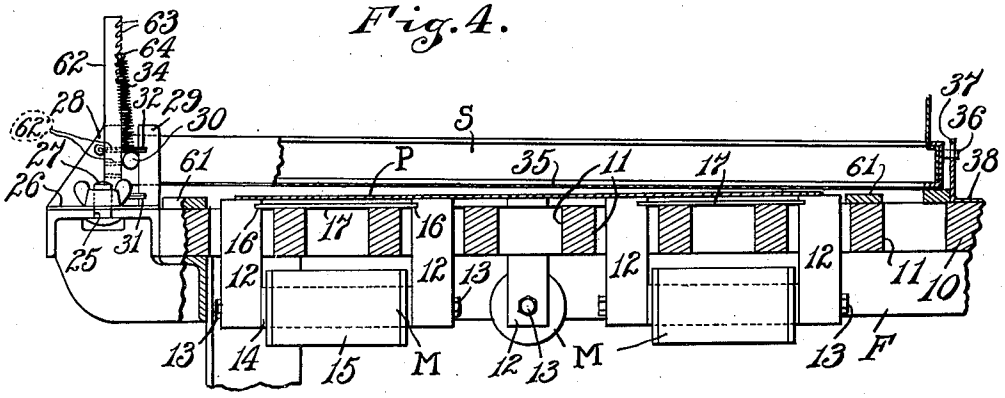


Fig. 5.

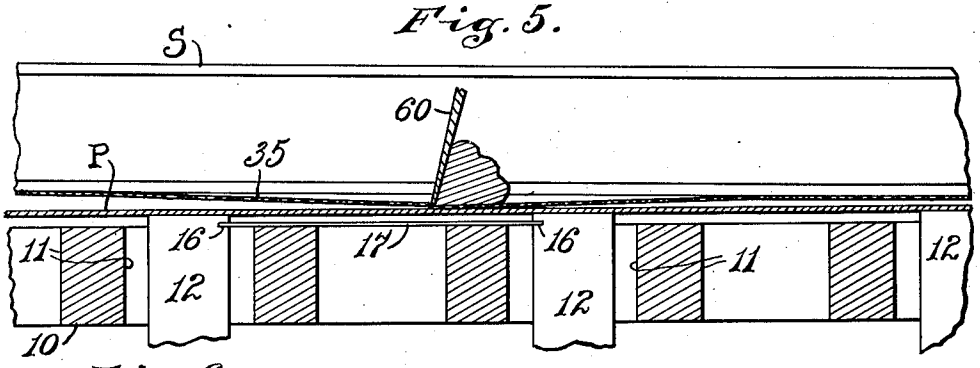


Fig. 6.

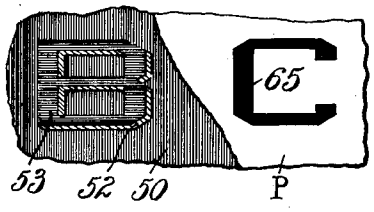


Fig. 7.

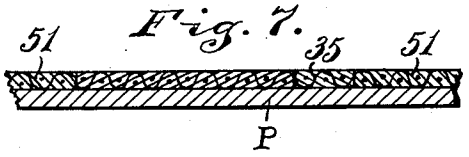


Fig. 9.

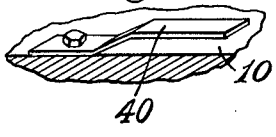
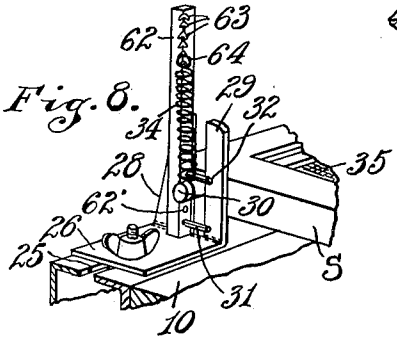


Fig. 8.



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Patented Dec. 15, 1936 2,064,284

UNITED STATES PATENT OFFICE

2,064,284

PROCESS OF PIGMENTING SURFACES AND APPARATUS THEREFOR

Charles A. Wulf, Indianapolis, Ind., assignor to The Ceramic Process Company, Beaver Falls, Pa., a corporation of Pennsylvania

Application February 1, 1934, Serial No. 709,312

7 Claims. (Cl. 101—126)

My present application relates to a method of pigmenting surfaces and apparatus therefor, and more particularly to a method of, and apparatus for, producing multi-color designs upon porcelain enamel, and similar surfaces.

While the method and apparatus have been produced primarily for the application of multi-colored pigments to enameled sheet metal surfaces in such manner and form that the resultant multi-color design may be rendered permanent by a single firing operation, it will be readily understood that the invention is by no means limited thereto.

The accompanying drawings illustrate my invention.

Fig. 1 is a plan of an apparatus embodying my invention;

Fig. 2 is an end elevation on a smaller scale;

Fig. 3 is a side elevation on the scale of Fig. 2;

Fig. 4 is a fragmentary vertical section on the scale of Fig. 1;

Fig. 5 is a fragmentary vertical section illustrating the reaction of the pigment screen during application of the pigment;

Fig. 6 is a diagram illustrating various stages of the method;

Fig. 7 is a diagrammatic vertical section of the screen fabric at various stages;

Fig. 8 is a fragmentary perspective of one corner of the pigment screen frame and adjacent parts, and

Fig. 9 is a perspective of one of the spring gauge fingers.

In the drawings 10 indicates a table top provided with a multiplicity of perforations 11, any one of which is adapted to receive a pole 12 of an electromagnet M. The pole pieces 12 of magnets M are preferably detachably connected by bolts 13 to the ends of a spacer 14 upon which the energizing coil 15 is mounted. Spacers 14 may be provided in various lengths such that poles 12 may be properly spaced to project through any desired pair of table perforations 11 and each pole, near its outer end, is transversely notched at 16 to receive one end of a lock strip 17 which, projecting into two of such notches and lying upon the upper surface of the table, as illustrated in Fig. 4, serves to retain the magnet in operative position with the upper ends of all of the magnets in a common horizontal plane.

By this arrangement any desired arrangement of magnet poles may be provided so as to provide sufficient magnetic force at properly spaced points to insure a holding of the pigment receiving plate P perfectly flat for the reception of the pigments.

Plates P, if of material which has been fire-treated to provide an enameled face, are unavoidably warped by the fire treatment, but the above-described magnetic holding table, when the magnets are properly placed, insures flatness of the plate during the periods of subsequent pigment application.

For convenience in operating upon plates P of widely varying sizes, the table 10 may be conveniently formed in two sections A and B (Figs. 1 and 3) connected by hinge 20, with the section A as the permanent top of the frame F and the section B supportable, in the plane of section A, by a leg L.

Along the rear edge of section A of the table top 10 I provide a guideway 25 upon which are slidably mounted two plates 26, 26 which may be held in any desired position of relative spacing by the clamping bolts 27, 27. Each of these plates is provided with a pair of spaced upwardly-extending fingers 28, 29, between which may be received one of a pair of pins 30 carried by screen frame S. Adjacent the finger 28 there is secured to each plate 26 an upstanding post 62, each of which is formed with a plurality of perforations 62' for selectively receiving stop pins 31 and 32 projectible across the space between the fingers 28 and 29 to limit the vertical movement of the pins 30 in both directions. As shown, said posts 62 are rectangular in cross section, and one corner of each post is provided with a plurality of vertically spaced kerfs or notches 63 adjacent its uper end. A loop 64 at the upper end of each of a pair of coiled springs 34 is adapted to be selectively received in any one of said kerfs 63. The lower ends of said springs 34 are, as shown, connected to the pins 30 so that, when said loops 64 are hung in said kerfs 63, the rearward end of the frame S will be resiliently supported above the table surface; the equilibrium elevation of said end above the table surface being variable by selection of the kerfs 63 in which said loops 64 are engaged.

The frame S is conveniently formed of channelled bars in order to be rigid, and secured to its under face is a fine mesh screen 35, the mesh of which is sufficiently fine, as is well known in this art, to retain the pigment except when the pigment is forcibly pressed therethrough. This screen may be made of bolting cloth, or other similar material but I have found that the best

results are attainable by using a very fine copper screen which may be firmly held, in stretched condition, over the frame by soldering to the frame.

The edge of the frame S opposite that which carries the pins 30, is provided with a centering pin 36 adapted to rest in a notch 37 formed in the upstanding arm of a centering bracket 38 which may be secured to the upper face of the table at any desired position. Pin 36 supports the screen a few thousandths of an inch above plate P so that the screen may be contacted with the plate only by pressure exerted by the squeegee 60, to be described.

In addition to the perforations 11 table 10 is provided, conveniently, with a large number of perforations 40' which may be threaded to receive fastening screws for retaining the centering bracket 38 or for retaining in place gauge fingers 39 or 40.

The gauge fingers 39 and 40 are positioned to accurately position the plate P relative to the pattern produced on the screen 35 and finger 40 is conveniently made in the form of a leaf spring anchored at one end.

Screen frames S of various sizes appropriate to the various articles which are to be manipulated may be provided and the springs 34 are proportioned and adjusted to be capable of sustaining the weight of the rear end of a selected frame and super-imposed pigment.

A screen of appropriate size will have superimposed upon its fabric 35 a desired pattern and those portions of the fabric forming the general background for the pattern, indicated at 50 (Fig. 6) will be filled with a filler 51 (Fig. 7) so as to be impervious to the pigment which is to be used. This filler 51 is conveniently a water-insoluble glue.

The pattern portion of the screen is then filled with a filler 52, which is impervious to pigment. The filler 52 is of such character as to be soluble in a reagent in which filler 51 is insoluble, whether or not the filler 52 has been exposed to light. This filler 52 also is of such character that when a portion thereof is exposed to light the exposed or unexposed portion, one or the other, becomes insoluble in a reagent in which the other portion is soluble, and as to which the filler 51 is insoluble.

Those portions of the screen which are permeated by the filler 52 are then exposed to a patterned light and then subjected to the selected reagent which is capable of dissolving either the exposed or unexposed portion, thus rendering the selected portions 53 of the screen permeable to the pigment. The plate P is closely surrounded by strips 61 (Figs. 1 and 4), and the free end of screen S swung down to the position shown in Fig. 4. In this position that portion of the screen immediately above plate P lies entirely free from the plate and, because of the elevation of the frame produced by springs 34, inclines slightly upwardly away from the operator. A sufficient quantity of pigment having been placed upon the screen, across its width, at the elevated end of the screen, the operator presses the screen down by means of a squeegee 60 and sweeps the pigment toward him, the squeegee acting to depress the screen upon the upper face of plate P and propel the pigment through the open portions 53 of the screen, the pigment coalescing on the under face of the screen immediately in advance of the squeegee.

As the squeegee is moved toward the operator across the screen the springs 34 act to raise the screen promptly from the surface of plate P immediately adjacent the squeegee as indicated in Fig. 5, both the lowering of the screen into contact with the upper surface of the plate and the raising of the screen from contact with the surface of the plate being progressive, immediately adjacent the squeegee, as indicated in Fig. 5, as the squeegee is drawn toward the operator. The blocking strips 61, and the support of screen S, are of such character that except as the screen is forcibly depressed from its normal plane, no portion thereof may contact the upper surface of plate P.

This operation results in depositing upon the upper surface of plate P the pigment in desired pattern as indicated at 65 (Fig. 6). After the screen has served its purpose in the desired permeable pattern the permeable portions are filled with filler 51. The remaining portions of filler 52 are then dissolved and the screen again used in the manner described. The several permeable portions of the screen should be accurately formed so that adjacent pigments will have edge contact but will not overlap.

By a proper sequence of fillers and light treatments the screen may be used to apply any desired color patterns of pigments to the plates P, whereupon the screen may be subjected to a solvent which will remove all filler therefrom and again become available for another set of operations.

The fabric 35 may be prepared by any well known, or other, method so as to be pigment-permeable in a desired pattern. However, in order that satisfactory results may be attained, it is important that the several parts may be accurately registered so that pigments of different colors, applied for simultaneous firing, shall not overlap because such overlapping generally results in defects.

Of course, it is to be understood that, following any firing, any plate P may receive additional pigmentation preliminary to another firing.

In order to prevent creeping of the screen relative to the plate P (hereby tending to blur the deposited pigment) the screen frame may either be held back against bracket 38, so as to pivot on that bracket, or fingers 28 and 29 may be slightly curved to approximate an arc of an average radius of screen swing.

It will be noted (Fig. 5) that the screen inclines upwardly immediately in front of the squeegee so that the pigment is not only forced through the screen but is permitted to coalesce over the underface of the screen before contact with the plate P so that the pigment is applied as an even coating on the plate. It will also be noted that the screen is also stripped vertically away from the plate and applied pigment immediately to the rear of the squeegee thus insuring clear pigment boundaries on the plate.

By the time the squeegee has progressed across the patterned fabric the fabric has been lifted entirely free from the plate by the springs 34. As the fabric is lifted from the plate the pigment clings both to the plate and to the fabric and consequently the fabric must be lifted from the plate considerably more than the thickness of deposited pigment before the viscosity of the pigment permits the fabric to be separated from the pigment.

Therefore, if the screen frame were fixed ver-

tically during the pigment application, and inherent flexibility of the fabric depended upon to cause withdrawal of the fabric immediately following pigment application to the plate, the fabric would have to be initially spaced a relatively considerable distance above the plate and would have to be so severely stretched during each pigment application that it would soon acquire a permanent sag which would render it unfit for further use.

In my device, however, the lowest position of the fabric, with frame S fully depressed, may be actually in contact with plate P yet, as the squeegee progresses toward the operator the passed-over portions of the fabric are promptly raised free from the pigment adhering to the plate and it is never necessary to substantially stress the fabric so as to stretch it. Each pigment design is allowed to dry before the application of another pigment and by using appropriate pigments any desired combination and pattern of different colors may be successively applied to plates P, each color being accurately placed relative to, but not overlapping, adjacent colors, so that a single firing will serve to fix the color pattern upon the plate without blurring.

By providing the multiplicity of pole-receiving perforations in the table, and the multiplicity of magnetic poles, said poles may be readily selectively positioned, in accordance with any particular color design, so that adequate anchoring and straightening of plates P may be attained without requiring contact of any pole with any color-receiving portion of the plates. As a consequence the plates may be reversed, for application of pigments to both faces without delay for intermediate drying.

I claim as my invention:

1. In combination, a table, a laterally distortable stenciling screen, means on said table and cooperable with said screen to guide one edge of said screen in a path substantially perpendicular to the surface of said table, means normally resiliently biasing said edge of said screen progressively away from the plane of said table, and means supporting the other end of the screen spaced from the table a distance slightly greater than the thickness of material to be stenciled but within the vertical distortion range of the patterned portion of the stencil.

2. In combination, a table, a stenciling screen, a pair of brackets independently slidably mounted on said table for adjustment laterally across the surface of said table, and means carried by each of said brackets and cooperable with an edge of said screen to lift said screen edge normally resiliently away from the plane of said table.

3. In combination, a table, a stenciling screen, a pair of relatively movable brackets mounted on said table, each of said brackets being formed with a slot extending substantially perpendicular to the surface of said table, pins carried by opposite sides of said screen adjacent one end thereof and receivable in said slots, and spring means carried by each of said brackets and cooperable with said screen to bias said one end thereof normally away from the plane of said table surface.

4. In combination, a table, a stenciling screen, a pair of brackets adjustably mounted on said table, each of said brackets being formed with a slot extending substantially perpendicular to the surface of said table, and open at the free end of its bracket, pins carried by opposite sides of said screen adjacent one end thereof and receivable in said slots, an upstanding post carried by each of said brackets, stop means adjustably and removably carried by one of said posts and adapted to be positioned in the path of movement of one of said pins, and springs connecting each of said pins with one of said posts and normally resiliently supporting said one screen end out of contact with said table surface.

5. The method of applying pigment in a pattern to a receiving surface, which comprises arranging a screen stencil over said surface, supplying pigment to said stencil, progressively forcing the pigment through the stencil beginning at one edge thereof and progressing toward the opposite edge, and simultaneously and progressively tilting the stencil as a whole to raise its beginning edge progressively from the surface of application, whereby portions of the stencil through which pigment has been forced are progressively and increasingly raised from the application surface during progressive stencil penetration by the pigment.

6. The method of applying pigment in a pattern to a receiving surface which comprises arranging a laterally distortable screen stencil over said surface and spaced therefrom a distance not greater than the distortion range, supplying pigment to said stencil, forcing said pigment through the stencil beginning at one edge of the stencil and progressing in a narrow zone toward the opposite edge of the stencil, and simultaneously and progressively tilting the stencil as a whole to raise its beginning edge progressively from the surface of application, whereby portions of the stencil through which pigment has been forced are progressively and increasingly raised from the application surface during progressive stencil penetration by the pigment.

7. In combination, a table, means by which a pigment-receiving article may be held upon said table, a laterally-flexible stenciling screen positioned over the article-receiving portion of said table, means for supporting the finishing edge of said screen spaced from said article within the flexibility-range of said screen, and vertically-yielding means normally supporting the opposite edge of said screen in substantially greater spaced relation to said article and capable of progressively tilting the screen as a whole, whereby vertical pressure applied to said screen upon lines substantially paralleling said two edges may produce line contact of screen with article and the yielding-supported edge of the screen will be progressively and increasingly raised as said pressure line approaches the first-mentioned screen edge.

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