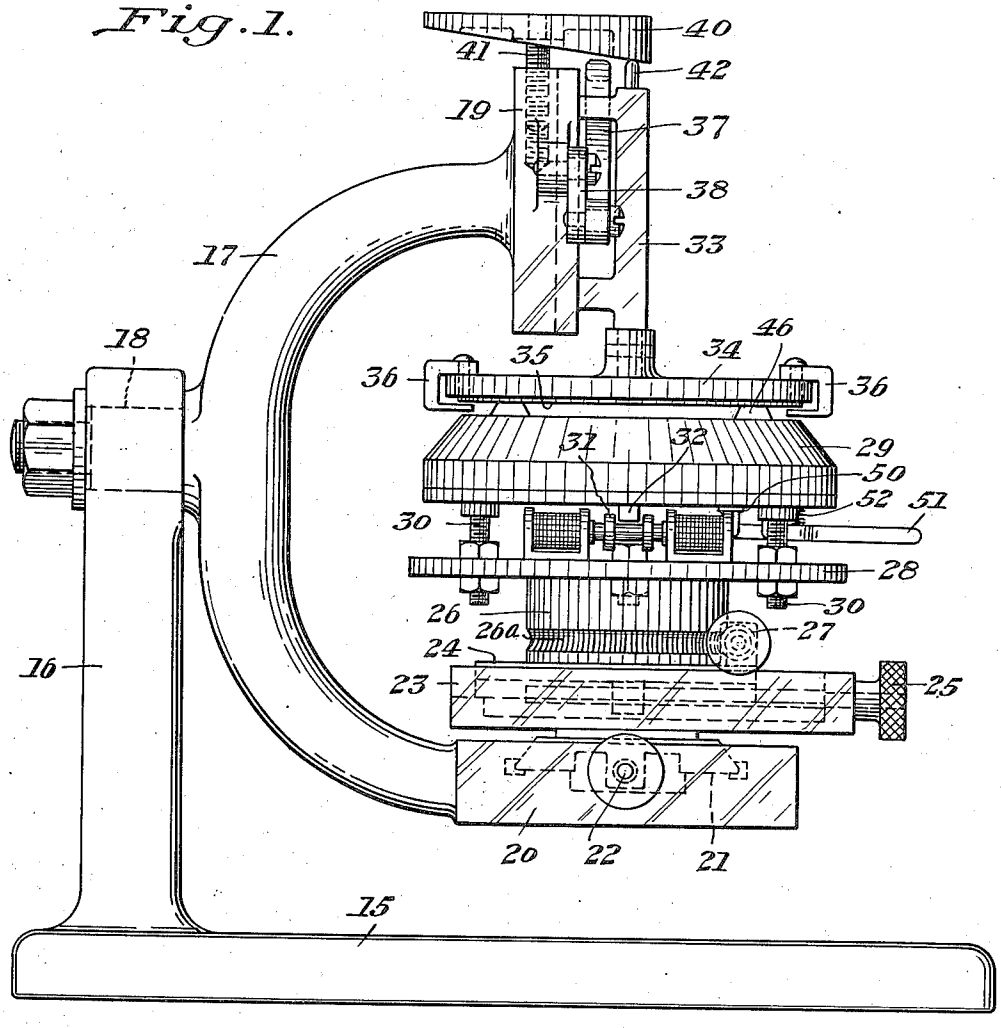
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METHOD AND APPARATUS FOR APPLYING DESIGNS AND THE ARTICLE PRODUCED THEREBY

Filed Dec. 4, 1934 4 Sheets-Sheet 1

Fig. 1.



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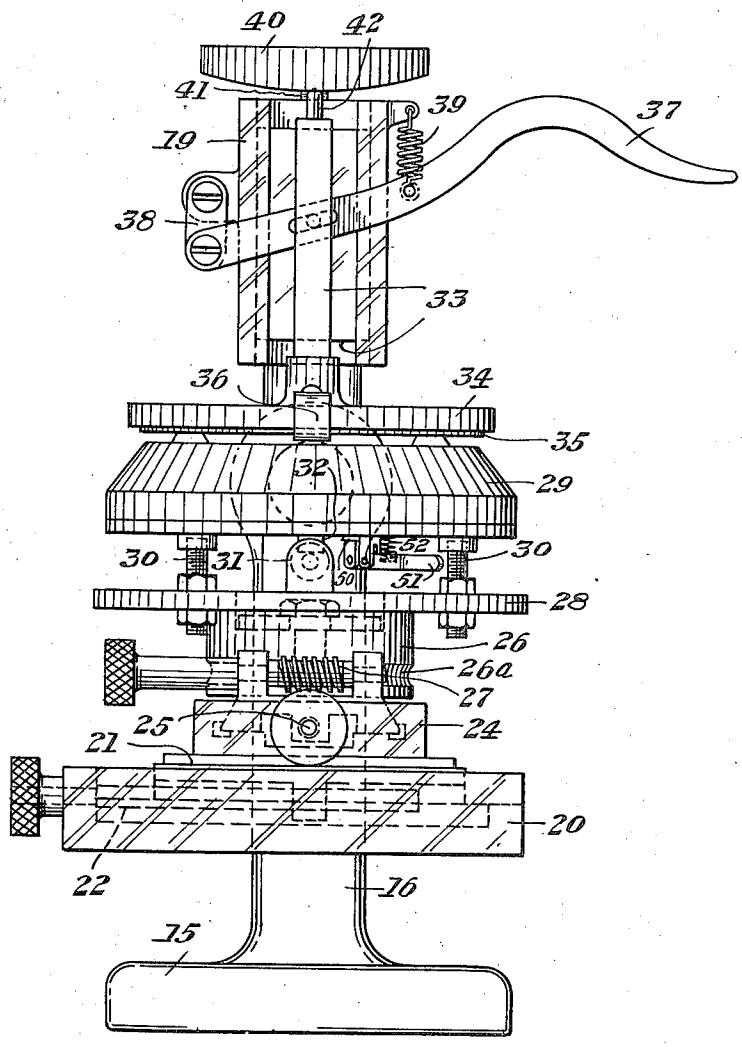
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METHOD AND APPARATUS FOR APPLYING DESIGNS AND THE ARTICLE PRODUCED THEREBY

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Fig. 2.



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METHOD AND APPARATUS FOR APPLYING DESIGNS AND THE ARTICLE PRODUCED THEREBY

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Fig. 3.

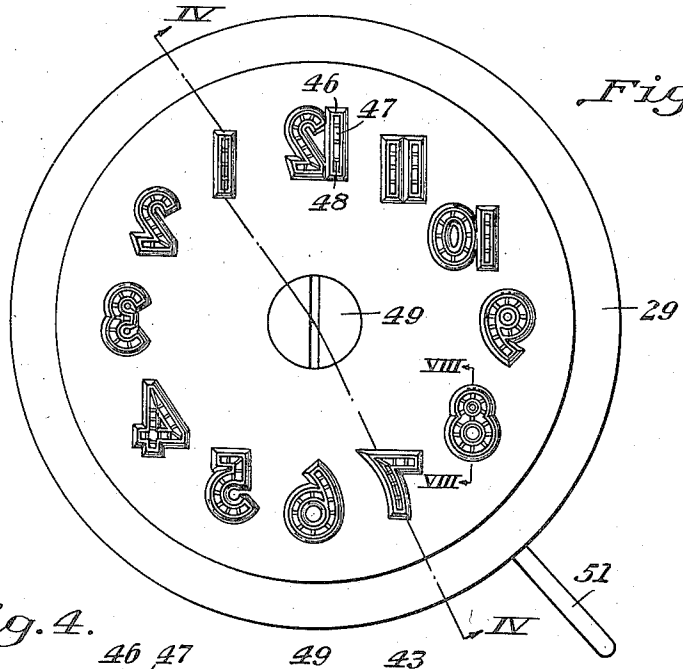


Fig. 4.

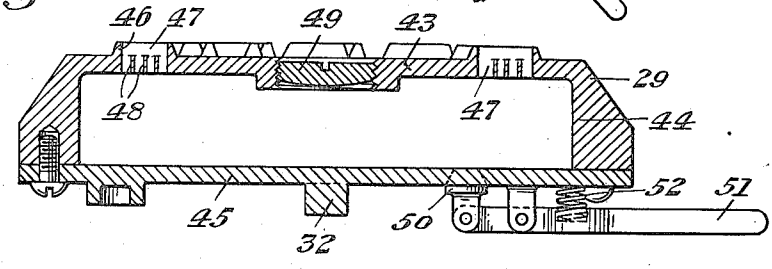


Fig. 5.

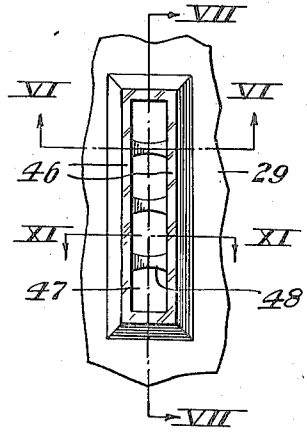


Fig. 6.

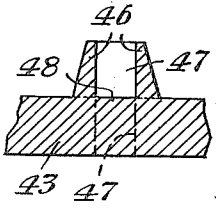
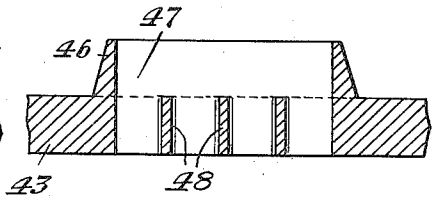


Fig. 7.



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METHOD AND APPARATUS FOR APPLYING DESIGNS AND THE ARTICLE PRODUCED THEREBY

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Fig. 8.

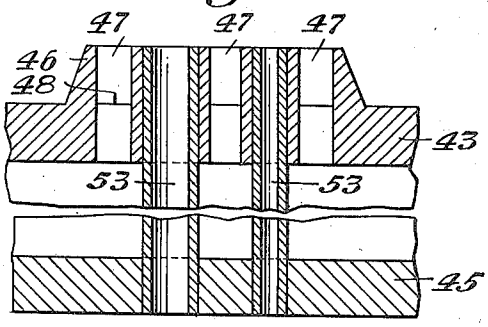


Fig. 9.

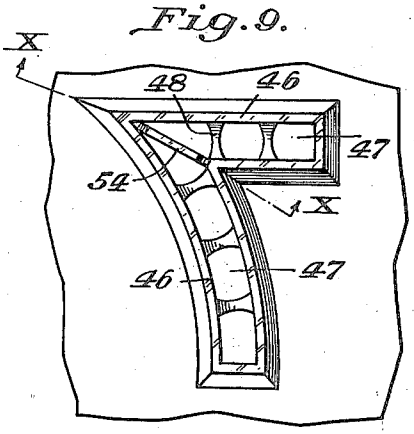


Fig. 10.

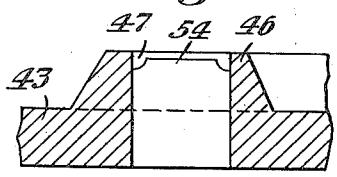


Fig. 11.

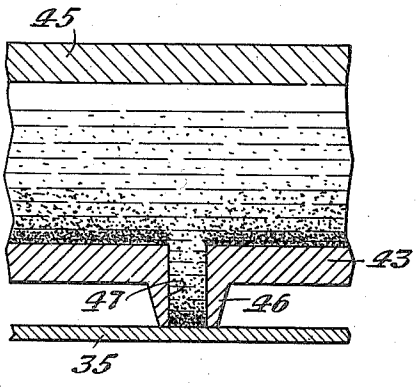


Fig. 12.

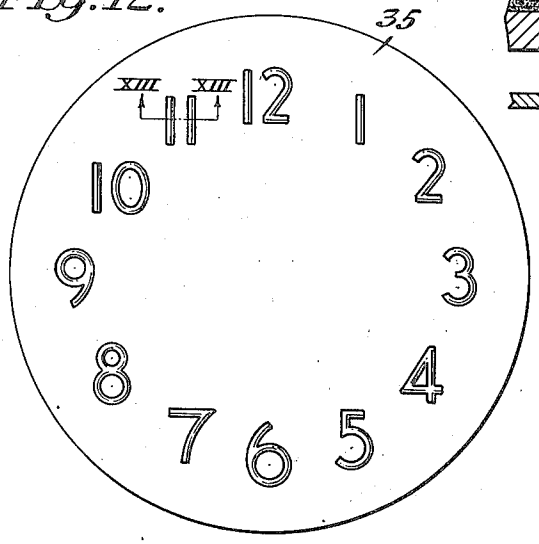
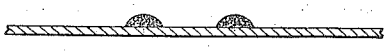


Fig. 13.



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Patented Jan. 5, 1937

2,066,642

UNITED STATES PATENT OFFICE

2,066,642

METHOD AND APPARATUS FOR APPLYING DESIGNS AND THE ARTICLE PRODUCED THEREBY

Howard L. Page, Chicago, Ill., assignor to Radium Dial Company, Pittsburgh, Pa., a corporation of Delaware

Application December 4, 1934, Serial No. 755,904

8 Claims. (Cl. 101—114)

My invention relates to the application of designs on suitable receiving surfaces. It is concerned particularly with and is here disclosed as applied to the formation of characters in the manufacture of luminous dials for clocks and the like, although not limited to such specific application.

While luminous dials for clocks and the like have been widely used heretofore, the methods used in their manufacture have been open to numerous objections.

I have invented a method and apparatus for applying designs, and the article produced thereby, specifically luminous dials, according to which such objections are largely overcome. The method and means which I employ are particularly adapted to produce a raised character formed from a crystalline material. The operators are protected, the formation of dust is prevented, there is little or no waste of material, and the amount of luminous material deposited may be readily controlled so as to produce characters in high or low relief containing more or less luminous material.

It is well known in the art of producing so called "self-luminous" characters that the luminosity of such characters depends entirely upon retaining the luminous material in its original crystalline condition. I accomplish this object by a new method, according to which the physical structure of the luminous crystal is not altered in any respect. It is known that the crystal cannot be subjected to any handling, stirring or unusual mixing without destroying its luminosity.

The method is particularly designed to place such luminous crystals in a predetermined position on a clock dial.

The material used to produce such luminous clock dials is usually zinc sulphide of a particular crystalline structure. However, other phosphorescent crystals may be substituted, and for the purpose of this invention, the term crystal will designate a phosphorescent solid having a characteristic crystalline formation, causing it to be responsive to suitable activative agents.

It is also well known in the art that the luminosity of a crystal is maintained through the use of an activating agent such as radium.

My present method affords unusual protection to the operator of the device from any presumed effect of such activating agent by enclosing the entire mixture in a lead reservoir.

In accordance with my invention, I mix the crystalline luminous material with a fluid such as an adhesive solution of a gum in which the material is insoluble. The viscosity of the solution is made sufficient to hold the solid crystals in suspension for a limited time, such as several minutes, during which time the act of forming the luminous characters is completed. The luminous material is permitted to settle out of the suspension so formed for a predetermined time through patterned openings, onto a receiving surface such as a dial for a clock or the like. The apparatus consists of a closed container having openings in its upper wall disposed in the outline of the desired characters. The suspension of the crystalline character-forming material is placed in the container and the surface on which the characters are to be formed is placed on top of the container. The container and the surface thereon are then inverted. This agitates the suspension. The crystalline material then settles through the patterned openings in the top (now bottom) wall of the container onto the receiving surface. After the desired amount of material has been deposited, the container is restored to its upright position and the receiving surface lifted therefrom with the raised characters adhering thereto. The characters thus formed are neat, accurate, and readily distinguishable at a distance so as to be very effective when composed of luminescent material.

For a more complete understanding of the invention, reference is made to the accompanying drawings in which:

Figure 1 is a side elevation of the apparatus which I employ;

Figure 2 is a front view thereof;

Figure 3 is a plan view of the top of the container for the character-forming material;

Figure 4 is a sectional view along the line IV—IV of Figure 3;

Figure 5 is a partial, plan view to enlarged scale, showing a portion of the top wall of the container;

Figure 6 is a sectional view along the line VI—VI of Figure 5;

Figure 7 is a sectional view along the line VII—VII of Figure 5;

Figure 8 is a partial, sectional view along the line VIII—VIII of Figure 4;

Figure 9 is a plan view to enlarged scale of another portion of the container top shown in Figure 3;

Figure 10 is a sectional view along the line X—X of Figure 9;

Figure 11 is a partial, sectional view along the line XI—XI of Figure 5 showing the container in the inverted depositing position;

Figure 12 is a plan view of a dial having raised characters formed in accordance with my invention; and

Figure 13 is an enlarged, partial, sectional view along the line XIII—XIII of Figure 12.

In the following description, the apparatus will be treated first, and its operation explained in describing the method contemplated herein.

Referring in particular to Figures 1 and 2, the apparatus comprises a base 15 having an upright standard 16 thereon. A yoke-shaped member 17 has a lateral projection 18 by which it is journaled in the standard 16 for rotation. The yoke 17 has two branches or ends 19 and 20. The branch 20 is in the form of a base plate having a slide 21 adjustable therein by means of a screw 22. The slide 21 carries a plate 23 having a slide 24 adjustable therein by means of a screw 25. The direction of movement of the slide 24 is at right angles to that of the slide 21.

The slide 24 carries a turret 26 having worm wheel teeth formed thereon at 26a. A worm 27 journaled on the slide 24 meshes with the worm wheel teeth to provide means for rotating the turret. The turret carries a table 28. A container 29 for the character-forming material is supported on the table 28 by leveling screws 30. A vibrator 31 on the table, operated by spaced solenoids, engages a projection 32 extending downwardly from the bottom of the container 29.

One branch 19 of the yoke 17 is provided with a vertically movable slide 33. The slide 33 carries a clamping disc 34 at its lower end which is adapted to hold a surface to be provided with characters, such as a blank dial 35, closely against the upper face of the container 29. Holders 36 on the disc 34 temporarily support the disc when disposed thereunder. The lower face of the disc has recesses (not shown) cooperating with projections extending from the rear face of the dial, to insure accurate registry thereof. The slide 33 is shiftable vertically by means of a hand lever 37 connected to the branch 19 by a link 38. A spring 39 normally holds the slide in raised position. A cam member 40 is rotatable and adjustable on the branch 19 by means of a screw 41 threaded thereinto. The cam member 40 is adapted to cooperate with a pin 42 projecting upwardly from the slide 33 to apply downward pressure to the latter.

Referring now more particularly to Figures 3 through 10, the construction of the container 29 for the character-forming material will be described. The container is preferably formed of or lined with lead and has a top wall 43, an annular side wall 44, and a bottom wall 45. The top wall is provided with character outline walls 46 between which openings 47 are formed to permit outflow of character-forming material. In the openings 47, bridging members 48 connect the opposite sides of the passage between the walls 46. These bridging members do not extend upwardly the full height of the walls 46. They thus provide sufficient support for the portions of the wall 43 within the closed loops of characters, such as the 4, 6, 8, 9 and 0, but at the same time permit the character-forming material passing through the openings 47 to unite on the surface of the dial and form a continuous character outline without breaks. A filling plug 49 is threaded into the upper wall of the container. A valve 50 is provided in the lower wall to permit any pressure which might build up in the container to be relieved. The valve is opened manually by means of a lever 51, but is normally maintained closed by a spring 52.

Pressure-equalizing passages 53 extend from the bottom wall of the container through the closed loops of characters having such portions, as shown in Figure 8. This prevents the formation of any vacuum which might be created under such portions, when the dial is separated from the container.

Because of the surface tension of some of the adhesives used, the deposited material tends to build up higher where portions of characters intersect at an acute angle, for example, the intersection of the two strokes of the "7". To prevent this, I form a partition wall 54 at such intersection, the wall being slightly less in height than the walls 46. The character-forming material deposited in the angular disposed portions of the "7" is thus not made continuous for its full depth but is continuously joined by the very thin portion over the partition. This tends to prevent any building up of the material in the angle of the character.

To operate the apparatus, it is first disposed in the position shown in Figures 1 and 2. The container 29 is charged with character-forming material in a suspension of an adhesive. A blank dial is placed face down on the top of the characters formed by the walls 46 on the top of the cup. The lever 37 is then lowered to clamp the dial against the characters and is locked in that position by the cam 40.

When the dial has been thus positioned on the characters, the yoke 17 is rotated through 180°. This agitates the suspension and provides a uniform distribution of the crystalline, character-forming material in the adhesive. Since the dial engages the characters only at the relatively sharp edges of the walls 46, a tight joint is formed which prevents leakage outside the limits of the character outlines. The suspended character-forming material immediately begins to settle out and deposit on the dial. The yoke is left in this inverted position for a predetermined period of time. The amount of luminous material deposited varies with the time during which the yoke is inverted. Higher characters require longer intervals of time. The proper interval can readily be determined by experiment. When this interval has elapsed, the yoke is restored to its initial position, and the cam 19 backed off. The spring 39 then raises the lever 37 to lift the disc 34. The dial is thus freed from the top wall of the container and when removed from the holders 36, is found to have the desired characters perfectly formed thereon as raised numerals. The drying of the semi-fluid characters by evaporation or oxidation of the adhesive, causes them to harden and adhere permanently to the dial.

The vibrator 31 is useful in case the characters have fine lines, necessitating narrow openings in the characters on the container. When the vibrator is connected to a suitable source of current, it causes the settling crystalline material to pass readily through even those openings which are quite narrow.

The valve 50 should be opened at intervals to relieve the slight pressure which seems to build up in the container. This pressure might otherwise mar the characters formed, or diminish the sharpness of their outline.

Figure 11 indicates the manner in which the deposit of crystalline, luminous material on the dial is effected. Figure 12 shows a completed dial, and Figure 13 indicates a section through the fig-

ure "11" on the latter showing that the completed deposit has a well rounded exterior which is very effective for a character of luminous material.

The invention is characterized by numerous advantages over the prior methods. I utilize the considerable specific gravity of the usual luminous compound, zinc sulphide, and the rapidity with which it is deposited by gravity from a fluid suspension, such as a gum adhesive. The agitation of the crystalline suspension by the repeated inversion of the container makes it unnecessary to provide other means for agitating the suspension. This is very important because some agitating means might result in the reduction of the crystalline zinc sulphide to a fine powder. This is highly objectionable since it is known that the luminous character of this material depends on its being preserved in the crystalline state. The time necessary for the desired thickness of character to be deposited may be also controlled by varying the viscosity of the fluid in which the material is held in suspension. There is little or no waste, since all the luminescent material is deposited directly on the dial. This economy of operation makes it possible to produce luminescent dials at relatively low cost. The luminous material is confined during the process until actually deposited on the dials and the container may easily be made of lead, or lined with lead, so that the operator is protected. The desired height of character can usually be produced within a relatively short time, viz., from 30 to 60 seconds, so that dials may be provided with luminous characters at a relatively rapid rate. The outline of the characters is continuous, even where a closed loop is involved. By equalizing the pressure inside the container with that of the atmosphere, any marring of the characters is avoided and clean, sharp figures are produced. Any vacuum which might be created within the closed loops of certain characters is relieved to prevent any breakage of the character outline or distortion of its symmetry, which might otherwise produce imperfect figures. The partitions between the character outline walls at points where different points of a character intersect at an angle prevent the formation of a hump on the character at that point.

While I have illustrated and described herein only one preferred embodiment of the invention and the method of its practice, it will be apparent that changes in the method and apparatus disclosed may be made without departing from the spirit of the invention or the scope of the appended claims.

I claim:

1. In a method of preventing blurring of deposited characters having portions at an acute angle to each other, the steps including depositing character-forming material while fairly fluid and partially segregating said portions.

2. Apparatus for applying characters on a surface comprising a container for character-forming material having patterned openings in a wall thereof, and means for vibrating the container to aid the passage of said material through said openings.

3. Apparatus for applying characters including a container for character-forming material having patterned openings in a wall thereof, means for adjusting the container about a central axis, and means for adjusting the container rectilinearly in different directions in a common plane.

4. A character-embossing device comprising a container for character-forming material, said container having spaced holes in a wall thereof outlining a character to be formed, upstanding walls on each side of said holes, also outlining the character, and partitions between said last mentioned walls partially separating portions of characters intersecting at an acute angle.

5. In a method of forming characters on a surface, the steps of depositing character-forming material thereon from a container having patterned openings in one wall thereof and vibrating said container to accelerate the deposition.

6. A stencil comprising a plate, spaced walls extending therefrom constituting a channel in the form of a character to be stenciled, and spaced transverse partitions extending between said walls.

7. The apparatus defined by claim 6, characterized by said partitions being of a depth less than the sum of the thickness of the plate and the height of said walls.

8. Apparatus for forming characters on a surface comprising a container for character-forming material having patterned openings in a wall thereof, and means for vibrating the container to cause the material to deposit on the surface through said openings.

HOWARD L. PAGE.