

Nov. 24, 1964

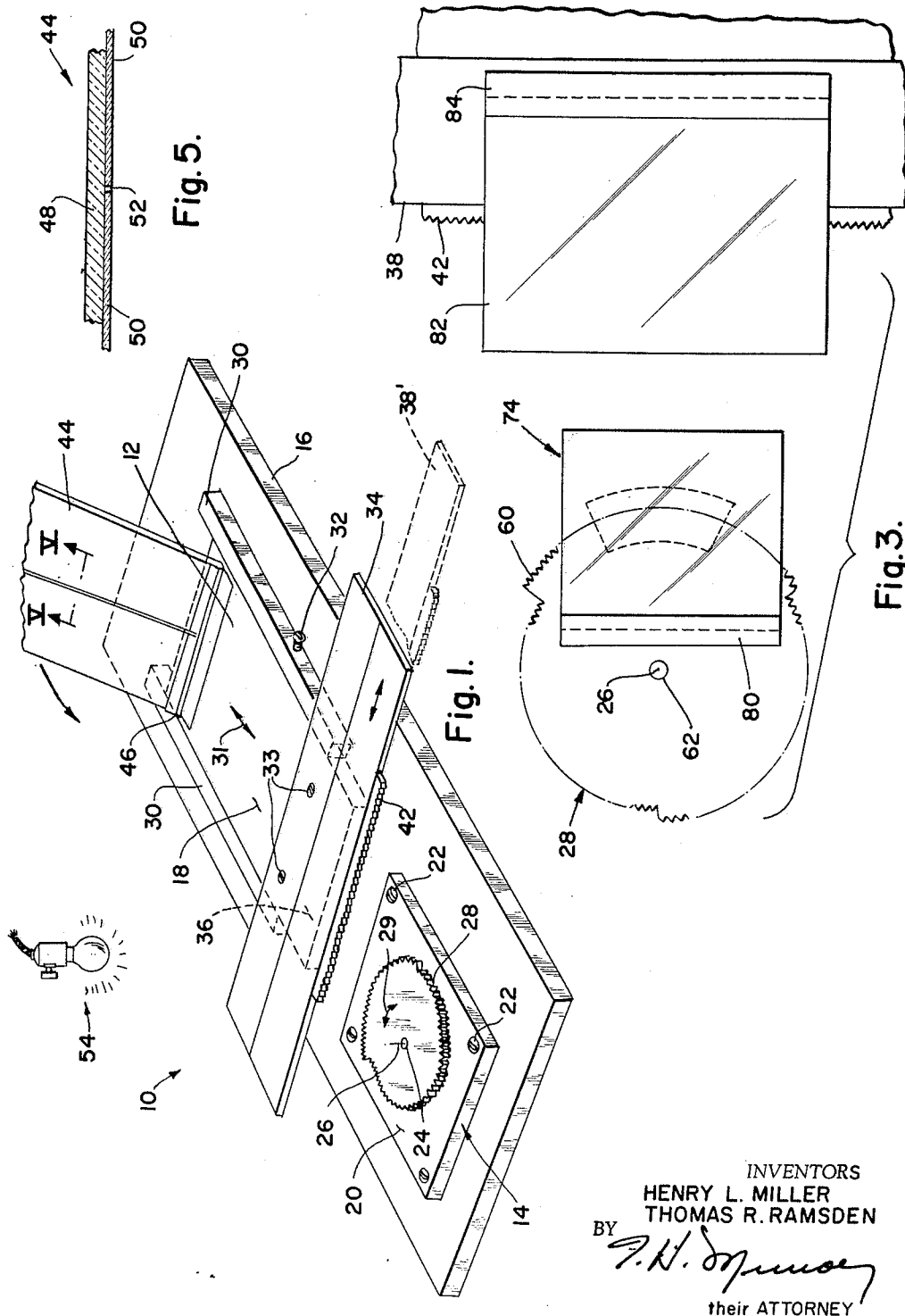
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3,158,077

METHOD AND APPARATUS FOR REPRODUCING DESIGNS

Filed May 28, 1963

3 Sheets-Sheet 1



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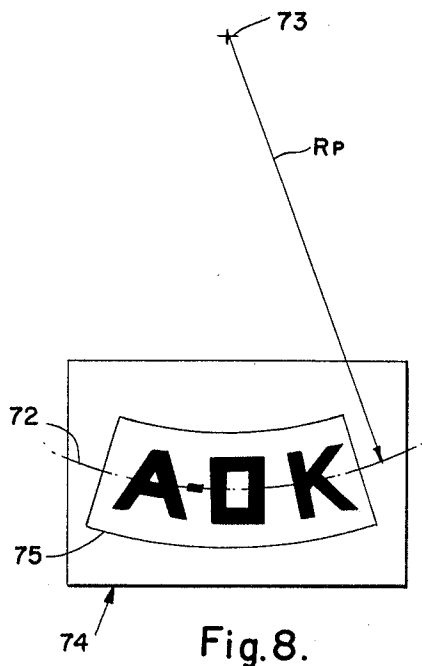
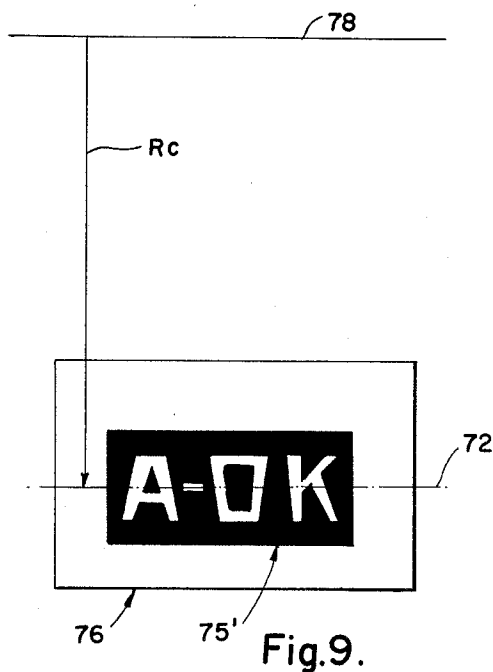
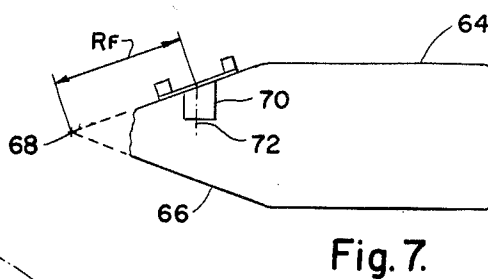
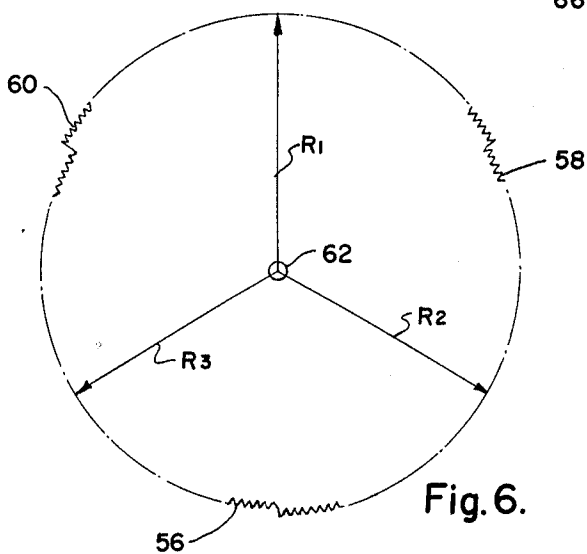
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METHOD AND APPARATUS FOR REPRODUCING DESIGNS

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3 Sheets-Sheet 3



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3,158,077

METHOD AND APPARATUS FOR REPRODUCING DESIGNS

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15 Claims. (Cl. 95—73)

The present invention relates to a method and apparatus for reproducing designs, and more particularly to a method and apparatus for photographically reproducing designs in distorted form for the preparation of decorating screens for printing on tapered surfaces.

Stencil screens are used extensively in applying letters or designs to the rounded surface of bottles and the like. The decoration of the cylindrical surface of bottles presents no problems. A decorating screen may be moved along a straight-line path while the bottle is rotated about its axis with its cylindrical surface in rolling contact with a decorating screen. Ceramic decorating material is forced through the screen by means of a squeegee to transfer the design onto the surface of the bottle.

On the other hand, decorating the tapered shoulder surface of the bottle does present problems which have been successfully solved by the prior art. Two common methods are available for decorating the tapered shoulder surface of a bottle.

The first and least preferred method, involves moving the screen bearing the desired design in an arcuate path while the bottle rotates about its central longitudinal axis. The design, on the screen, is provided in what is called "radius form," i.e., it is drawn along an arcuate path. Hence, the design is transferred to the tapered shoulder surface in undistorted form. It will be appreciated that on small bottles, for example, the arcuate path followed by the shoulder decorating screen will interfere with the straight-line path of the cylindrical surface decorating screen. On small bottles, then, two operations usually are required when this method is employed.

The second and most desirable method, involves moving the screen bearing the design along a straight-line path while the bottle is rotated about its central longitudinal axis. When this method is employed, the design must be distorted from its radius form into a straight-line or modified form whereby when the screen is moved along the straight-line path, the design will be transferred onto the tapered shoulder surface in undistorted form.

The artist may reproduce the design in straight-line or modified form by transferring reference points from the "radius form" of the drawing onto a set of coordinates. It should be obvious that this method is costly and time consuming in that first, it requires two drawings of the design and second, the transfer of reference points takes a considerable length of time.

Heretofore, design distorting apparatus have been provided for photographically reproducing a design in straight-line or modified form. In these apparatus, a negative transparency bearing a design in "radius form" is supported for movement along an arcuate path while a sensitized sheet is supported in overlying engagement with the negative transparency and for movement along a straight-line path. A slot is provided in a hood through which light is transmitted for exposing the sensitized sheet during its movement. The sensitized sheet is then developed and fixed to produce a positive transparency of the design in modified form from which a decorating screen may be made.

The prior art design distorting apparatus have certain

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disadvantages which, as will become apparent, are overcome by the present invention. One disadvantage concerns the ease with which a drive gear of one radius may be substituted for a drive gear of a different radius. This substitution has heretofore usually involved a considerable expenditure of time and effort.

Another disadvantage concerns the light sources used in exposing the sensitized sheet. As for example, one prior art apparatus employs one light source in a first position for reproducing a design in distorted form and a second light source in a second position for reproducing the design in its original radius form. Hence, in effect, two forms of the apparatus are required.

An example of a conventional apparatus employed in photographically reproducing designs in distorted form will be found in U.S. Patent No. 2,617,337.

Accordingly, the primary objects of the present invention include:

To provide a new and improved apparatus for reproducing designs in distorted form which by virtue of its simplified construction may be quickly and easily operated;

To provide apparatus for reproducing designs in distorted form in which the substitution of gears of different radii may be easily accomplished in a minimum of time and with a minimum of effort;

To provide design distorting apparatus wherein a design in radius form may be photographically modified into the desired straight-line form and vice versa, which apparatus employs a single light source, as for example, any light fixture present in the room which is of a suitable intensity;

To provide apparatus for reproducing designs in distorted form wherein the drive gear and rack bar are each removably mounted on the apparatus whereby the appropriate ones of the sheet may be easily secured thereon;

To provide apparatus for reproducing designs in distorted form which may employ a drive gear of any desired radius;

To provide apparatus for reproducing designs in distorted form which is considerably less expensive to manufacture; and

To provide a novel method for reproducing a decorating screen bearing a design in straight-line form.

These and other objects and advantages of the present invention will become apparent from the following detailed description by reference to the accompanying drawings, in which:

FIGURE 1 is an isometric view of a design distorting apparatus of the present invention;

FIG. 2 is a plan view of the apparatus of FIG. 1;

FIG. 3 is a plan view illustrating a drive gear and a rack bar employed in the present design distorting apparatus;

FIG. 4 is a cross-sectional view, taken along the line IV—IV of FIG. 2, further illustrating the present design distorting apparatus;

FIG. 5 is a cross-sectional view, taken along the line V—V of FIG. 1, illustrating the preferred construction of a cover member;

FIG. 6 is a plan view of a drive gear illustrating its construction;

FIG. 7 is a schematic illustration of a bottle with means for decorating the shoulder portion thereof;

FIG. 8 is a plan view of a positive transparency bearing a design in radius form; and

FIG. 9 is a plan view of a negative transparency bearing the design of FIG. 7 in straight-line or modified form.

According to the present invention, a design distorting apparatus is provided comprising movable and stationary plate means which are supported on a base so that their upper surfaces are substantially coplanar. The base

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includes track means between which the movable plate means is disposed. The track means serves to guide the movable plate means during its movement towards and away from the stationary plate means. The movable plate means is provided with a guide bar means which is rigidly secured thereto and which extends transversely of the track means. The stationary plate means is provided with a pin member which extends upwardly from the upper surface thereof to define a vertical axis. A cover member of substantially opaque material is pivotally secured at one end to the movable plate means and is adapted to overlie a major portion of the intervening space between the guide bar means and the pin member.

In one instance, the present invention contemplates the use of a plurality of gear means each of which is separately used and adapted to be removably mounted on the pin member for oscillatory movement about the vertical axis. Each gear means preferably includes three sets of gear teeth, each set being of a different radius whereby each gear may be used in conjunction with three designs in radius form each of whose radius length corresponds to the radius length of one set of the gear teeth.

The straight-line movement, required in the distorting process, is provided by an extrinsic rack bar means which is slideably supported on the upper surface of the movable plate means while it is engaged with the rack bar means and in meshing relation with the desired gear means.

The present invention also provides a novel method for reproducing a design in modified form, which method contemplates the constant use of an intermediate size gear means. In the practice of this method, any size decorating screen may be made from any size drawing of a design in radius form.

Reference is now directed to FIGS. 1 to 5 wherein the present design distorting apparatus is illustrated and generally indicated by the numeral 10. The apparatus 10 comprises a movable plate 12 and a stationary plate 14 supported on a base 16. The plates 12 and 14 have upper surfaces 18 and 20, respectively, which reside in a common plane.

A stationary plate 14 is secured to the base 16 by any suitable means such as a plurality of bolts 22 and includes a pin 24 extending from the upper surface 20 to define a vertical axis indicated by the dashed-dot line 26. A drive gear 28 is mounted on the pin 24 and is adapted for oscillatory movement about the vertical axis 26 as indicated by the double-headed arcuate arrow at 29.

The movable plate 12 is slideable over the base 16 and is guided in its movement by track means 30 engaged with the sides thereof and which are secured to the base 16. Hence, the movable plate 12 is free to move towards or away from the stationary plate 14 in the directions indicated by the double-headed arrow 31. A bolt 32 is threadedly engaged in one of the track means 30 and serves to clamp the movable plate 12 at the desired position.

Guide bar means 34 is secured in a fixed position to the movable plate 12 by means of bolts 33 and extends in a transverse direction with respect to the track means 30. The guide bar means 34 is positioned rearwardly of the leading edge of the movable plate 12 so that a platform 36 is provided.

Rack bar means 38 rests on the platform 36 and is freely slideable thereover. The rack bar means 38 is engaged along one edge with the guide bar means 34 and, hence, is guided thereby during a straight-line movement, which movement is in a direction which is transverse to the track means 30 as indicated by the double-headed arrow at 40. The rack bar means 38 also is shown in a phantom outline position at 38' which position is illustrative of the transverse straight-line movement.

On the leading edge of the rack bar means 38 there is provided a set of gear teeth 42 which is adapted to be

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engaged in meshing relation with the gear means 28 when the movable plate 12 is moved from a position such as illustrated in FIG. 1 to the position illustrated in FIGS. 2 and 4. It should be evident that when the rack bar means 38 is engaged with the gear means 28, movement of the rack bar means 38 also will move the gear means 28 or vice versa. It will be noted that the rack bar means 38 is, in effect, clamped between the gear means 28 and the guide bar means 34 so that positive meshing thereof with the gear means 28 is assured.

As can best be seen in FIGS. 1 and 2, a cover means 44 is provided which is pivotally mounted on the movable plate 12 by means of a hinge member 46 and so positioned whereby it may be pivoted from the raised position illustrated in FIG. 1 to the covering position illustrated in FIG. 2. The cover means 44 is adapted to overlie a major portion of the intervening space between the guide bar means 34 and the pin 24. As can be seen in FIG. 5, the cover means 44 preferably comprises a transparent support plate 48 to which a pair of substantially opaque sheets 50 are secured in spaced parallel relation whereby a slot 52 is provided therebetween through which light may be transmitted. The sheets 50 may be formed from material commonly known as red film or safety film. This material is translucent and passes only red light as for example. Hence, contrast film may be used which is not sensitive to red light. As can be seen in FIG. 2, the slot 52 extends transversely of the rack bar means 38 and guide means 28 and substantially at their point of tangency.

In FIG. 1, there is schematically illustrated a light source 54 which may comprise any suitable light fixture having a bulb with a sufficient light intensity. As will be described, the present apparatus 10 may be operated using a single light source which remains in one position.

In FIG. 6 there is illustrated one of the gear means 28 which preferably includes three sets of gear teeth 56, 58 and 60. Each set of gear teeth extends along an arc of approximately 120° and at a predetermined radial distance. As illustrated, the sets of gear teeth 56, 58 and 60 are disposed at radial distances R_1 , R_2 and R_3 , respectively, which increase in length by a predetermined amount. The gear means 28 also includes a central aperture 62 through which the pin 24 will extend when the gear means 28 is positioned on the stationary plate 14.

If desired, a plurality of the gear means 28 may be provided each of a predetermined size. In practice, the radii R_1 and R_2 would differ in length by about one-sixteenth inch. Likewise, the radii R_2 and R_3 would differ in size by about one-sixteenth inch. The desired range of radii to be covered would include from two and one-quarter inches to about eight inches, at one-sixteenth inch intervals.

Referring now to FIG. 7, a bottle 64 is illustrated having a tapered shoulder position 66 which, for all intents and purposes, comprises a cone having an apex at 68. A design 70 is illustrated having a center line indicated by the dashed-dot line 72. The position of the design 70 on the shoulder portion 66 may be determined by measuring the distance from the apex 68 to the center line 72, this distance being indicated by R_f . In the specification and claims of the present invention, the phrase "fixed radius" is defined as the distance R_f .

As hereinbefore stated, the design 70 first is drawn in radius form. A photographic copy of the drawing is made which results in a negative transparency 74 bearing a design 75 in radius form as illustrated in FIG. 8. The radius R_p of the design 75 comprises what will be termed a "predetermined radius" having a center 73. In the case where a plurality of the gear means 28 is provided, a gear will be chosen having a radius equal to the radius R_f of the bottle 64. The drawing preferably would be photographed so that its radius R_p would be equal to the radius R_f .

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By employing the apparatus 10, in a manner hereafter to be described, a positive transparency 76 may be produced bearing a design indicated at 75' in straight-line or modified form as illustrated in FIG. 9. Shown in FIG. 9 is a line 78 which comprises the locus generated by a point moving along a path which is parallel to the center line 72. The point which generates the line 78 comprises the center 73 of FIG. 8. The distance between the line 78 and the center line 72 is indicated by R_c and comprises what will be termed a "corresponding radius." In the specification and claims of the present invention, the phrase "corresponding radius" is defined as the distance R_c , i.e., a distance which corresponds in length to the radius R_p of the design 75 in radius form.

The ease of operation afforded by the simplified construction of the present apparatus 10 will now be described with reference to FIGS. 1 to 4. When it is desired to produce the positive transparency 76 bearing the design 75' in modified or distorted form, the negative transparency 74 is secured directly onto the proper sized gear means 28 by means of a strip of adhesive tape 30 which is applied along one edge thereof. The negative transparency 74 may be quickly and easily positioned on the gear means 28 since the operator may hold the gear means 28 in his hands. The negative transparency 74 preferably is positioned so that the center line 72 of the design 75 is coincident with the pitch circle, as for example, of the set of gear teeth 60; and the center 73 is coincident with the vertical axis 26. It should be evident that by sighting through the negative transparency 74, the matching of the center line 72 and the pitch circle may be easily accomplished. A sensitized sheet 82, such as contrast film, is then secured directly onto the rack bar means 38 by means of a second strip of adhesive tape 84 which is applied along one edge thereof. The sheet 82 is so positioned whereby it will extend from the rack bar means 38 to cover all of the design 75 when in the position illustrated in FIGS. 2 and 4.

The gear means 28 and rack bar means 38 are placed on the apparatus 10 in the positions illustrated in FIG. 1. Since the negative transparency 74 and the sensitized sheet 82 are each taped only along one of their edges, they may be pivoted to the raised positions illustrated in phantom outline at 74' and 82', respectively, in FIG. 4. The movable plate 12 may now be moved toward the stationary plate 14 so that the rack bar means 38 meshes with the gear means 28 (see FIGS. 2 and 4). At this point, the bolt 32 is turned down to secure the movable plate 14 in the desired position.

The sensitized sheet 82, being the first to be lowered, underlies the negative transparency 74 and both underlie the cover means 44 (see FIG. 4). The workman may now either pull the rack bar means 38 or pivot the gear means 28 so that the design 75 is on either side of the slot 52 in the cover means 44 (see FIG. 2). The light is then turned on whereupon the gear means 28 is pivoted whereby the sensitized sheet 82 and the negative transparency 74 are simultaneously moved under the slot 52 so that the sensitized sheet 82 is exposed. After this, the sensitized sheet 82 is developed and fixed to produce the positive transparency 76 of FIG. 9.

Since the design 75 in the negative transparency has a radius equal to the desired fixed radius R_f , the resulting design 75' in straight-line form in the positive transparency 76 also will have a corresponding radius equal to the desired fixed radius R_f . This is made possible by choosing the proper sized gear means 28. Hence, the positive transparency 76 may be used directly to make a decorating screen bearing a negative of the design 75'. The decorating screen preferably is made by contact printing since this method assures a clear, sharp design at a minimum of exposure time.

The term "light" as used herein is intended to cover not only the radiation within the visible spectrum but also

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ultra-violet radiation and actinic radiation which may occasionally be employed.

It should be evident by inspection of FIG. 4 that if it is desired to reproduce the negative transparency such as illustrated in FIG. 8 from the positive transparency 76, a sensitized sheet would be secured to the gear means 28 and lowered first; and the positive transparency 76 would be secured to the rack bar means 38 and lowered second. Once again, the cover means 44 would be lowered as in FIG. 4 and a similar exposure would be made. Notice, however, that the same source of light is used in both instances and that no modification to the apparatus is required.

The present invention also contemplates a novel method for reproducing a decorating screen. In this method the apparatus 10 is employed. However, only a single gear means 28 of any convenient size need be used. In this method, then, a drawing of the design in radius form is first made at any suitable scale or radius. The scale or radius at which the design is drawn would depend on the intricacy of the design. As for example, a simple design may be conveniently drawn at a small radius, however, an intricate design is most conveniently drawn at a large radius. The drawing is then photographed to reproduce the negative transparency 74 bearing the design in radius form, which radius form has a "predetermined radius" R_p . The radius R_p is equal to the radius of the gear means 28 being used in the apparatus 10. The positive transparency 76 is then produced in the manner hereinbefore described.

The positive transparency 76 bears the design 75' in straight-line form, which straight-line form has a "corresponding radius" R_c equal to the "predetermined radius" R_p . The positive transparency 76 is then photographically reproduced to provide a second positive transparency bearing the design 75' which has a corresponding radius R_c equal to the desired fixed radius R_f . The second positive transparency then is used directly in making a decorating screen bearing a negative of the design 75'. The decorating screen preferably is made by contact printing since this method assures a clear, sharp design at a minimum of exposure time.

The photographic method employed in providing the second positive transparency may take one of two forms. In the case where the corresponding radius R_c of the positive transparency 76 is smaller than the desired fixed radius, the positive transparency 76 may be enlarged to the desired size by projecting the image onto, for example, a sheet of enlargement paper. The resulting negative print may then be photographed to produce the second transparency. On the other hand, if the corresponding radius R_c of the positive transparency 76 is larger than the desired fixed radius, the positive transparency 76 may be contact printed to produce a negative print of the design. The resulting negative print then may be photographed to reduce the design 75' to the desired size and to produce the second positive transparency.

As an example of this method, let us assume that the intricacy of the drawing requires the drawing to be made in radius form at a radial length of twelve inches. Let us assume further that the gear size used in the apparatus 10 has a radius of six inches and that the position of the design on the tapered shoulder portion of the bottle corresponds to a "fixed radius" R_f of seven inches. The drawing, then, would be photographically reduced from its original twelve inch radius to a six inch radius, i.e., equal to the predetermined radius R_p of the gear means used in the apparatus 10. The negative transparency 74 would then be employed in the apparatus 10 to produce a positive transparency 76 bearing a design in straight-line form which has a corresponding radius R_c of six inches. The positive transparency 76 will then be projected in the direction of enlargement onto a sensitized sheet to produce a negative transparency of the design 75' in straight-line form which has a corre-

sponding radius R_c equal to seven inches which, of course, is equal to the desired fixed radius R_f of seven inches of the bottle. The negative transparency of the design 75' is used to make a positive transparency by contact printing in which positive transparency is used to make a decorating screen bearing a negative of the design 75' in straight-line form. It should be noted, however, that the straight-line form of the design on the decorating screen has a corresponding radius R_c of seven inches which is equal to the fixed radius R_f which corresponds to its position on the tapered shoulder portion of the bottle to be decorated.

In any event, the present method of producing a decorating screen is not limited by the size of the drawing nor is it limited, as in prior art apparatus, to the radius of the gear means.

Although the invention has been shown in connection with a specific embodiment, it will be readily apparent to those skilled in the art that various changes in form and arrangement of parts may be made to suit requirements without departing from the spirit and scope of the invention.

We claim as our invention:

1. The method of producing a stencil screen for the transfer of a design onto a conical surface and at a fixed radius comprising the steps of preparing a radius negative of said design whose radius is of a predetermined dimension; producing a straight-line positive of said design by photographically distorting said radius negative, said straight-line positive having a corresponding radius equal to said predetermined dimension; reproducing said straight-line positive photographically to produce a second straight-line positive bearing said design and having a corresponding radius equal to said fixed radius, and employing a sensitized stencil screen for contact printing said second straight-line positive to produce a stencil screen bearing a negative of said design in straight-line form having a corresponding radius equal to said fixed radius.

2. The method of producing a stencil screen for the transfer of a design onto a conical surface and at a fixed radius, comprising the steps of preparing a radius negative of said design whose radius is of a predetermined dimension which is smaller than said fixed radius; producing a straight-line positive of said design by photographically distorting said radius negative, said straight-line positive having a corresponding radius equal to said predetermined dimension; reproducing said straight-line positive of said design by enlargement to produce an enlarged second straight-line positive bearing said design and having a corresponding radius equal to said fixed radius; and employing a sensitized screen for contact printing said second straight-line positive to produce a stencil screen bearing a negative of said design in straight-line form having a corresponding radius equal to said fixed radius of said conical surface.

3. The method of producing a stencil screen for the transfer of a design onto a conical surface and at a fixed radius, comprising the steps of preparing a radius negative of said design whose radius is of a predetermined dimension which is larger than said fixed radius; producing a straight-line positive of said design by photographically distorting said radius negative, said straight-line positive having a corresponding radius equal to said predetermined dimension; reducing said straight-line positive of said design photographically to produce a second straight-line positive having a corresponding radius equal to said fixed radius, and employing a sensitized screen for contact printing said second straight-line positive to produce a stencil screen bearing a negative of said design in straight-line form having a corresponding radius which is equal to said fixed radius of said conical surface.

4. The method of producing a stencil screen for the transfer of a design onto a conical surface and at a fixed radius, comprising the steps of preparing a radius draw-

ing of said design at any suitable radius; photographing said radius drawing to prepare a radius negative of said design whose radius is equal to said fixed radius of said tapered surface; distorting said radius negative photographically to produce a straight-line positive of said design, said straight-line positive having a corresponding radius equal to said fixed radius of said conical surface; and printing said straight-line positive directly on a sensitized stencil screen to produce a straight-line negative thereon having a corresponding radius equal to said fixed radius of said conical surface.

5. In photographic reproduction apparatus, the combination comprising rack bar means supported for reciprocal straight-line movement; gear means supported for oscillatory movement about a vertical axis, said gear means being in meshing relation with said rack bar means; first sheet means secured directly onto said rack bar means; second sheet means secured directly onto said gear means; one of said sheet means being disposed in overlying relation with the other of said sheet means; the lowermost of said sheet means comprising a sensitized sheet; and substantially opaque cover means disposed above both of said sheet means and including a slot through which light is transmitted for the exposure of said sensitized sheet.

6. In photographic reproduction apparatus, the combination comprising rack bar means supported for reciprocal straight-line movement; gear means supported for oscillatory movement about a vertical axis, said gear means being in meshing relation with said rack bar means; first sheet means of sensitized material secured directly onto said rack bar means and extending over said gear means; second sheet means secured directly onto said gear means and extending in overlying relation with a major portion of said first sheet means, said second sheet means comprising a radius negative of a design, and substantially opaque cover means disposed in overlying relation with said second sheet means and including a slot through which light is transmitted for exposing said first sheet means.

7. In photographic reproduction apparatus, the combination comprising rack bar means supported for reciprocal straight-line movement; gear means supported for oscillatory movement about a vertical axis, said gear means being in meshing relation with said rack bar means; first sheet means secured directly onto said rack bar means and extending over said gear means, said first sheet means comprising a straight-line positive of a design; second sheet means of sensitized material secured directly onto said gear means and extending beneath said first sheet means; said first sheet means extending over a major portion of said second sheet means; and substantially opaque cover means disposed in overlying relation with said first sheet means and including a slot through which light is transmitted for exposing said second sheet means.

8. In photographic reproduction apparatus, the combination comprising a base, first and second plate means supported on said base and having coplanar upper surfaces, guide bar means secured to the upper surface of said first plate means and extending transversely thereof; extrinsic rack bar means resting on said first plate means and engaged along one edge with said guide bar means, said rack bar means being freely slideable in parallel engaged relation with said guide bar means; pin means extending from the upper surface of said second plate means providing a vertical axis, gear means removably mounted on said pin means for oscillatory movement about said vertical axis, the position of one of said plate means being adjustable with respect to the other of said plate means whereby said rack bar means and said gear means are in meshing relation, and means for guiding the movement of said movable one of said plate means.

9. In photographic reproduction apparatus, the combination comprising a base, first and second plate means supported on said base and having coplanar upper sur-

faces, guide bar means secured to the upper surface of said first plate means and extending transversely thereof; extrinsic rack bar means resting on said first plate means and engaged along one edge with said guide bar means, said rack bar means being freely slideable in parallel engaged relation with said guide bar means; pin means extending from the upper surface of said second plate means providing a vertical axis, gear means removably mounted on said pin means for oscillatory movement about said vertical axis, the position of one of said plate means being adjustable with respect to the other of said plate means whereby said rack bar means and said gear means are in meshing relation, track means for guiding the movement of the movable one of said plate means, a first sheet carried by said gear means for arcuate movement therewith, a second sheet carried by said rack bar means for straight-line movement therewith, one of said sheets being disposed in overlying relation with the other said sheet, and substantially opaque cover means disposed above said gear means and said rack bar means and including a slot through which light is transmitted.

10. In photographic reproduction apparatus, the combination comprising a base, first plate means supported by said base and slideable thereover, guide bar means rigidly secured to said first plate means and extending transversely thereof, rack bar means freely slideable on said first plate means and engaged along one of its edges with said guide bar means for reciprocal linear movement, second plate means rigidly secured to said base and having an upper surface which is coplanar with the upper surface of said first plate means, pin means extending from said second plate means for providing a vertical axis, gear means removably mounted on said pin means for oscillatory movement about said vertical axis, and means guiding the movement of said first plate means toward and away from said second plate means whereby said rack bar means and said gear means may be placed in meshing relation.

11. In photographic reproduction apparatus, the combination comprising a base, stationary and movable plate means supported by said base and having coplanar upper surfaces, track means guiding the movement of said movable plate means toward and away from said stationary plate means while maintaining the coplanar relation of said upper surfaces, guide bar means secured to one of said plate means and extending transversely of said track means, a rack bar resting on said one of said plate means and engaged along one edge with said guide bar means, said rack bar means being freely slideable in parallel engaged relation with said guide bar means, pin means in the upper surface of the other of said plate means providing a vertical axis, and gear means remov-

ably mounted on said pin means for oscillatory movement about said vertical axis, the position of said movable plate means with respect to said stationary plate means being adjustable whereby said rack bar and said gear means are in meshing relation.

12. In photographic reproduction apparatus comprising a base plate, carrier means resting on said base plate and slideable thereover, track means on said base plate for guiding said carrier means during its movement, transverse guide means secured to said carrier means and extending transversely of said track means, gear means removably mounted on said base plate for oscillatory movement about a fixed vertical axis disposed in the path of said carrier means, a rack bar engageable along one side with said transverse guide means and slideable thereon, said rack bar being movable into meshing relation with said gear means by movement of said carrier plate means whereby gear means of any desired radius may be used, and cover means disposed above said gear means and said rack bar, said cover means comprising a substantially opaque sheet including a slot extending transversely of the rack bar and said gear means substantially at their point of tangency.

13. Photographic reproduction apparatus comprising a base plate, a carrier plate on said base plate, guide means on said base plate for guiding said carrier plate during movement thereof, a guide bar rigidly secured to said carrier plate and extending transversely of said guide means, gear means removably mounted on a pin on said base plate for oscillatory movement about a vertical axis defined by said pin, a rack bar engageable along one side with said guide bar and guided thereby for reciprocal movement thereof, said rack bar being movable into meshing relation with gear means by movement of said carrier plate whereby gear means of any desired radius may be used, and cover means providing a slot extending transversely of said rack bar through which light is transmitted, said cover means being disposed above said gear means and said rack bar.

14. The combination of claim 6 wherein said cover means is pivotally mounted on said first plate means whereby it may be pivoted away from said rack bar means and said gear means.

15. The combination of claim 6 including means for pivotally securing said first sheet means along one of its edges and means for pivotally securing said second sheet means along one of its edges which is spaced from and substantially parallel with the secured edge of said first sheet means whereby each said sheet means may be positioned to overlie the other said sheet means.

No references cited.