

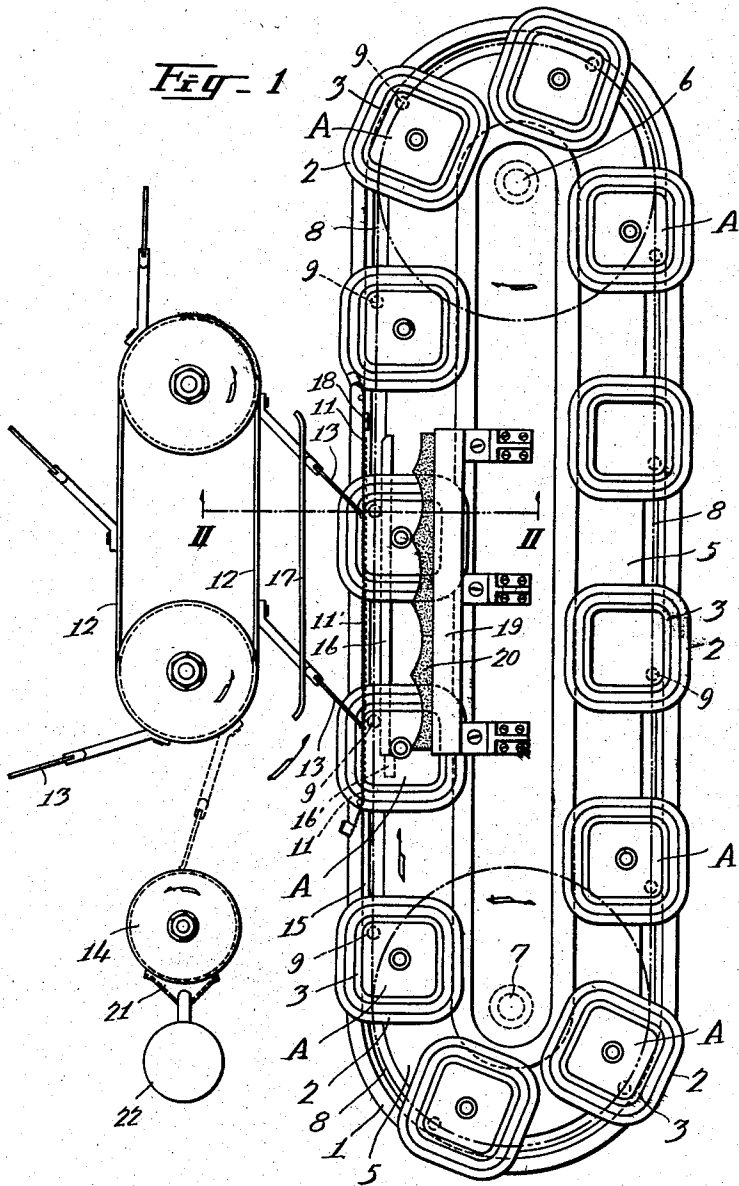
April 14, 1959

9 ICHIRO HAKOGI
APPARATUS FOR PRINTING THE CIRCUMFERENTIAL
SURFACE OF SQUARE ARTICLES SUCH AS GLASS
BOTTLES OR THE LIKE

2,881,699

Filed Aug. 10, 1955

4 Sheets-Sheet 1



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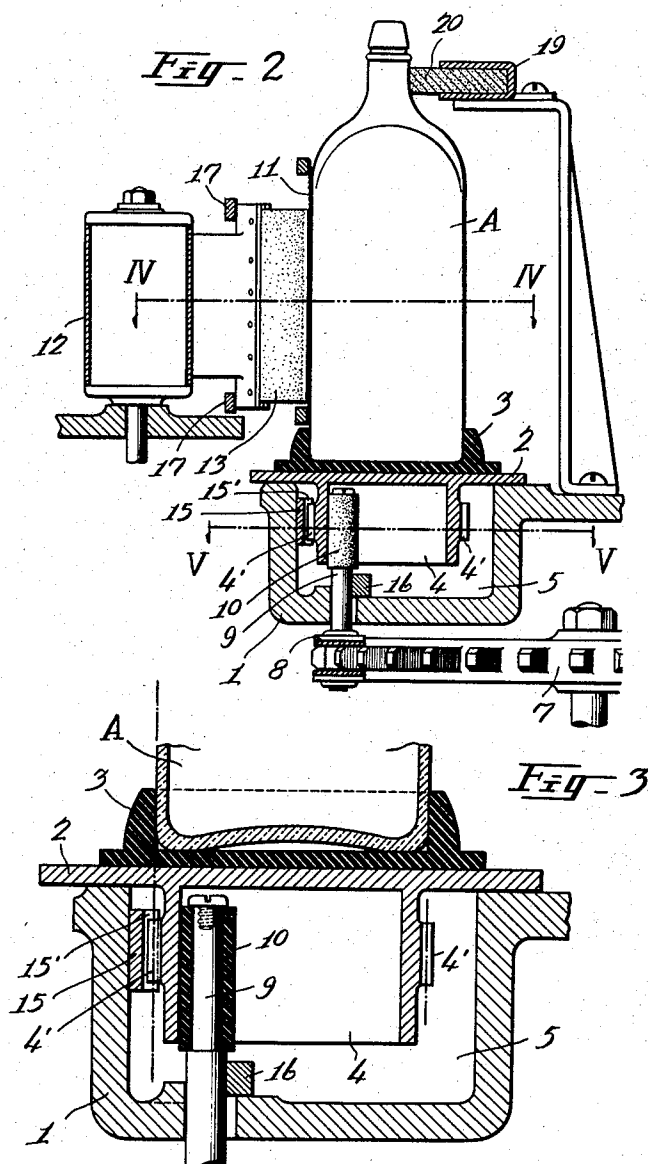
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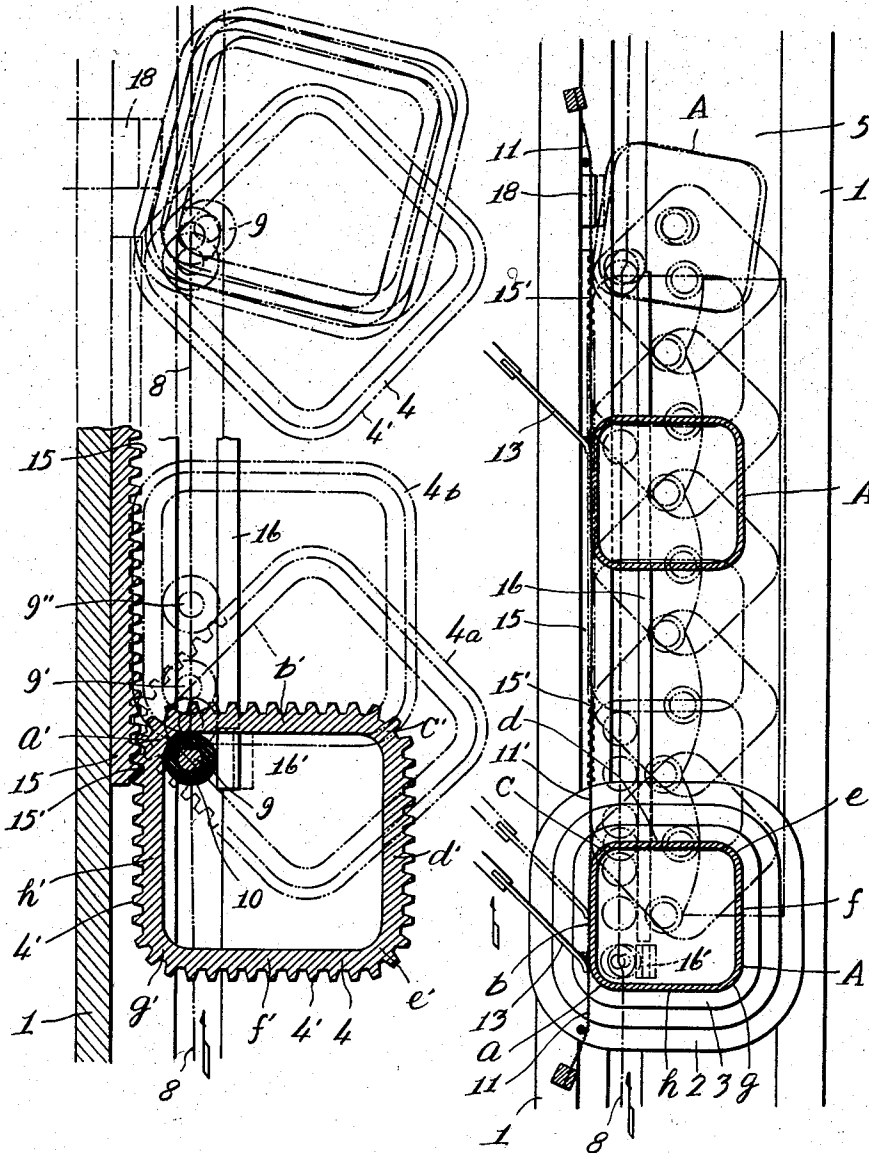
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Fig. 5

Fig. 4



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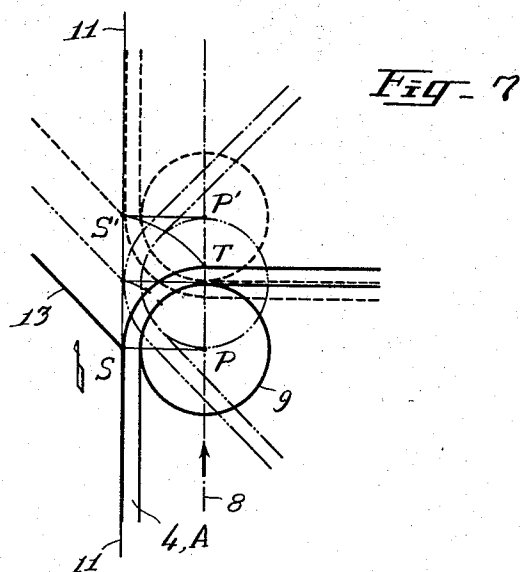
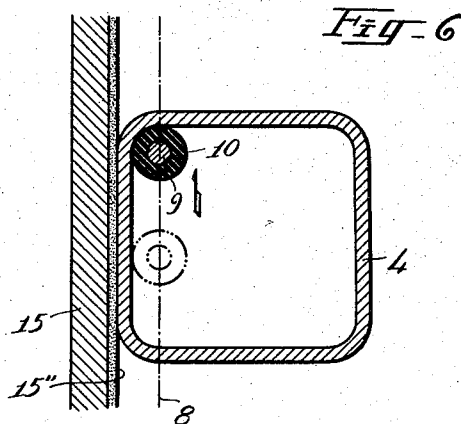
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APPARATUS FOR PRINTING THE CIRCUMFERENTIAL SURFACE OF SQUARE ARTICLES SUCH AS GLASS BOTTLES OR THE LIKE

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Application August 10, 1955, Serial No. 527,463

14 Claims. (Cl. 101—126)

This invention relates to an apparatus for marking three-dimensional objects, and more particularly marking the surface of articles having a continuous surface including flat and rounded portions. One object of this invention is to provide an apparatus for marking the circumferential surface of square or polygonal bottles or similar articles having circular arc portions in their corners. A preferred embodiment of the invention comprises a control track, a plurality of supporting plates, movable along said track and each adapted to hold one of the articles thereon in an erect position; each supporting plate has an extension with an inside guide surface and an outer control surface shaped in conformity with said articles to be printed, said control surface engaging said control track, while connecting members projecting from an endless chain travelling at a fixed speed engage said inner guide surfaces. While the articles on their respective supporting plates are moved in one direction, a stationary silk screen parallel with the control track is contacted at a designated position by the said articles from one side and by squeegees or rollers, moving at the same speed and in the same direction as said connecting members, from the other side. During this operation the supporting plates and the articles held thereon are held by said connecting members at standstill while their flat portions are in contact with the screen, and are turned in a rolling movement on the screen while the corresponding supporting plate is turned with its outer control surface in contact with the control track by the connecting member when the latter engages a rounded portion of the inner guide surface of the supporting member whereby the desired printing on the entire circumferential surface of the article is accomplished by continuous printing on the alternating flat and rounded surface portions of the article.

An embodiment of this invention is illustrated by the drawings in which Fig. 1 is a plan view of an apparatus handling square bottles with round corners, Fig. 2 a sectional side view taken along the line II—II in Fig. 1, Fig. 3 an enlarged view of a part thereof, Fig. 4 a sectional plan view taken along the line IV—IV in Fig. 2 showing the manner in which the square bottles move, Fig. 5 likewise a sectional plan view taken along the line V—V, Fig. 6 a plan view showing another example of rotating the square bottles, and Fig. 7 a diagram explaining the rotation of the moving square bottles.

In the drawings, 1 is a fixed frame and on the top surface thereof a plurality of supporting plates 2 are supported at suitable intervals for being moved in succession in one direction. On the upper side of the said plate 2 is provided a frame 3 into which is inserted the bottom part of a square bottle A so as to hold the said bottle in a fixed position and on the lower side is formed a hollow extension 4 which is similar in shape to the cross section of the square bottle and which projects into a guide channel 5 of the frame 1. Connecting members 9 protruding at suitable intervals from a chain 8 which is driven at a fixed speed by means of sprocket-wheels 6 and 7 engage and press against the inside guide surface

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of the casing 4, moving the supporting plates 2 successively in one direction. In view of their function, it is preferable that the connecting members 9 have a rotary portion and covered with an elastic body 10 such as rubber.

11 is a silk screen stationarily arranged to extend along the side of the frame 1 at a designated position and parallel with the channel 5. The square bottles A held on the supporting plates 2 are caused to come in contact with this silk screen while moving along the channel 5. On the opposite side of the said silk screen is set up a belt 12 rotating at the same velocity and in the same direction as the square bottles A. From the outer surface thereof are projecting a series of squeegees 13 spaced at intervals corresponding to the spacing of the respective square bottles. After ink is supplied to the end portions of the squeegees by contact with an ink supply drum 14, the squeegees 13 are moved in one direction rubbing against the silk screen 11. Consequently, a desired design 11' on the surface of the silk screen 11 is printed on the surface of the square bottles A by means of moving said bottles into consecutive positions opposite the squeegees and pressing them against the screen 11 while the squeegees force ink through the screen from the other side. Further, in order to print a design continuously along the entire circumferential surface of the square bottles A, it is necessary to successively rotate the bottles with their rounded corner portions rolling on the screen while the round surface portions are printed and to hold them in stationary contact with the screen while the flat portions are printed. This object is achieved by moving the connecting members 9 continuously in one direction, while the members 9 are engaged with the inner guide surface of the respective extension 4. When member 9 moves along a flat surface portion, the support 2 and the bottle A is held at standstill. When member 9 meets a round corner portion, the support 2 is turned with the outer surface of extension 4 rolling on the contact surface 15 of the channel 5 contact surface 15 and extension 4 contact each other without danger of slipping. Therefore the surface 15 is formed as a gear rack 15' and the contact surface of extension 4 is provided with gear teeth 4' to mesh with each other, in order that this operation may be made especially precise, but as shown in Fig. 6, the purpose of slip-preventing engagement can also be accomplished by covering the contact surfaces with a material 15'' having a high friction coefficient, such as rough surface rubber, this may be done along the outer control surface of the extension 4 or along the contact surface 15. In order to avoid in particular any slipping at the rounded corner portions of the square bottles A, the rolling movement of extension 4 caused by the connecting member 9 and the rolling movement of the square bottles A must be carried out in conformity with each other. In order to make the travel of the connecting member 9 and of the squeegee 13 or roller during unit time coincide with the length of the circular arc portion of the round corner, it is necessary that the contour of the outer control surface of the extension 4 is identical with the contour of the surface of the article to be printed. Further, in case of contact by means of toothed surfaces, the pitch line of the gear 4' takes the place of the control surface of extension 4 and the pitch line of rack 15' takes the place of the contact surface 15 in the guide channel.

In order to obtain a good reproduction, an intimate contact between the square bottle A and the screen 11 opposite the squeegee 13 compact during the printing operation must be effected, therefore, the connecting member 9 pressing against the inside wall or guide surface of the extension 4 is backed by means of a guide rail 16 which forces the supporting plate 2 fixed with the square bottle A held thereon forward against the silk screen 11, in a similar manner on the other side the

squeegee 13 presses against the opposite side of the silk screen 11 and is backed by means of a pressure guide 17 whereby the bottle surface, the screen and the squeegee are kept in intimate relative contact during the printing operation.

For the purpose of assuring an accurate register at the start of the printing operation, the rear end of the guide rail 16 with respect to the duration of travel is a movable portion 16', which is moved quickly in transverse direction. When the supporting plate 2 with the square bottle A held thereon is in position opposite the portion 16' so that the bottle is suddenly pressed against the design part 11' of the silk screen 11 and simultaneously the teeth 4' and 15' mesh with each other precisely.

When the square bottles A have been completely printed they must be moved out of contact with the silk screen 11 to prevent the printed part from contacting the screen again. For this purpose (Figs. 1, 4, 5) the extension 4 is pushed transversely inward by means of a guide piece 18 located at an appropriate point along the channel 2 so that the bottles are disengaged from the printing station after having been parted a little from the surface of the silk screen 11.

19 is a stationary supporting member which presses against the neck portion of the square bottle A from the back and thereby maintains the same steadfast in an erect position. It is mounted on the frame 1 and extends over the area occupied by the design part 11' of the silk screen 11. The inner side of support 19 consists of an elastic supporter 20 which is formed with a series of arc-shaped edge surfaces corresponding to the moving locus of the neck part of the bottle A according to the movement and rotation of said bottle A during the printing operation. It constantly presses evenly the neck part of the square bottle A from behind against the surface of the silk screen 11 during the printing operation, preventing the bottle from tottering and making the printing accurate. 21 is an ink storage provided at the side of an ink supply drum 14 and connected to an ink tank 22.

In operation, the chain 8 and belt 12 are moved at the same velocity in the direction of the arrows by means of a drive means (not shown). When the square bottles A are placed onto the supporting plates 2 on top of the frame 1, the said bottles A, as shown in Fig. 1, come in contact with the silk screen 11 at a designated position. At the same time, the squeegees 13 press against the silk screen from the opposite side towards the bottles. Further, by means of the movable portion 16' of the guide rail 16 forcing the connecting member 9 which is moving the supporting plate 2 in outward direction, the teeth 4' of extension 4 engage precisely the teeth 15' of the contact surface 15. At this time the connecting member 9 projecting from the chain 8 is positioned inside the corner portion a' of the extension 4 as shown by the dotted lines in Fig. 5, and the said connecting member 9 by the movement of the chain 8 presses forward against the inside of the flat guide surface b' which is located in front thereof. Consequently, the supporting plate 2 by means of the teeth 4' and 15' meshing with each other begins rolling with the round corner a' of extension 4, as shown by the lines 4a on the track 15', and further takes the position of 4b so that the flat surface b' faces the surface of the silk screen 11.

During this time the square bottle A held on the upper surface of the supporting plate 2 makes the same movement as the plate 2, and so the round corner portion a of the square bottle A as shown in Fig. 4 turns while facing the squeegee 13 which is being pressed simultaneously from the opposite side against the silk screen 11 whereby the corner portion a is printed. Further, the solid lines in Fig. 4 show the position in which printing of the flat surface b is about to begin, following completion of printing the round corner portion a. The connecting member 9 now moves to the position of 9' in

Fig. 5 and continues to move in the direction of 9' in accordance with the movement of the endless chain 8, and this movement is parallel to the flat surface b' of the extension 4. Therefore only the connecting member 9 moves forward rolling along the said surface b'. The supporting plate 2 without accompanying the forward movement of the connecting member 9 remains in its position as it is due to the engagement of the teeth 4' and 15', during which time printing continues by the squeegee 13 sliding and pressing the silk screen 11 against the flat surface b of the square bottle A in Fig. 4. Thereafter, the roller 9 moves on and upon reaching the next round corner portion c' of the extension 4, it presses forward against the flat surface d' positioned in front thereof. As above, the plate turns at the round corner portion c' and the following flat surface d' now faces the surface of the silk screen 11. During this time printing is done on the round corner portion c of the square bottle A and the flat surface d. In the same manner the supporting plate 2 is turned at the round corner portions e' and g', and by making the flat surfaces f', h' are placed against the silk screen, and the round corner portion e, flat surface f, corner portion g and flat surface h of the square bottle A are printed continuously in succession. In this manner, the desired printing can be applied to the entire circumferential surface of the square bottle A or on a part thereof by suitably setting up the position of the design 11' of the silk screen surface 11. During this operation the square bottle A is pressed in a suitable manner against the surface of the silk screen 11 by means of the roller 9 and the supporting member 19 supporting the upper part of the bottle from the back, which results in a clear printing. At the beginning of the printing operation a register is obtained with the printing surface by the transverse movement of the movable guide rail portion 16'. Simultaneously with the completion of the printing, the supporting plate 2 is pushed inward by a pusher 18 to part the square bottle A from the silk screen 11, thus preventing the printed surface from getting marred by movement thereafter. At a suitable position the finished product is removed from the supporting plate 2 by hand or automatically. Furthermore, in the rolling movement at the rounded solid corner portions of the square bottle A, as illustrated in detail in Fig. 7, the velocity of the endless chain 8, that is, of the connecting member 9, is to be identical with the velocity of the squeegee 13 or roller. When the connecting member 9 contacts closely the inside wall of the extension 4 and controls the movement and the turning of said extension 4, the length of movement P—P' of the connecting member 9 during the turning of the extension is equal to the length of movement S—S' of the squeegee 13, and the length S—T of the circular arc corner portion of the extension 4 is equal to these two distances. Consequently, by forming the extension 4 with the same shape and size as the square bottle A to be printed, there will be no slip whatsoever in printing the corner portions of the square bottle A. It should be understood that this apparatus is not limited to cross sectional square but also shape of the article to be printed can, of course, be operated to print polygonal bottles having flat and rounded surface portions.

As described hereinabove, according to this invention, cross sectional polygonal articles to be printed are held on supporting plates, said articles are moved in one direction and at a designated position are caused to come in contact with a silk screen to which is imparted a suitable design. Simultaneously on the opposite side of said screen slides and rubs a number of squeegees or rollers. A desired design can be printed successively on the entire outer circumferential surface continuously by intermittent turning of the said articles. Moreover, these operations are carried out automatically, thereby making it possible to print a multitude of articles simultaneously by arranging the articles in succession like a string of

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beads which would be mass production. This invention is also valuable in view of elimination of man power as much as possible.

What I claim is:

1. Apparatus for marking the surface of an article having a continuous surface including flat and rounded portions comprising, in combination, a stationary printing form; a control track parallel with said printing form; at least one support means movable along said track, said support means being adapted to hold said article in fixed position thereon and in contact with said printing form, said support means having an inside guide surface, and an outside control surface shaped in conformity with said surface of the particular article so that flat and rounded portions of said control surface correspond to flat and rounded portions of the article, said control surface engaging said control track; and movable means movable along said control track and relatively to said support means and including a connecting member engaging said inside guide surface of said support means for holding said outside control surface in contact with said control track and the associated surface of the article in contact with said printing form, said connecting member holding a flat surface portion of said article in stationary contact with said printing form and a corresponding flat surface portion of said outside control surface in stationary contact with said guide track while moving along a flat portion of said inside guide surface, and imparting a rolling movement to a rounded portion of said outside control surface on said control track and to an associated rounded surface portion of the article on said printing form while said connecting member moves relatively to a rounded portion of said inside guide surface.

2. An apparatus as set forth in claim 1, wherein said inside guide surface and said outside control surface of said support means are parallel with each other.

3. An apparatus as set forth in claim 1, including a movable printing member movable along said printing form in contact therewith and in the same direction as the movement of said movable means moving along said control track.

4. An apparatus as set forth in claim 1, including a movable printing member movable along said printing form in contact therewith and in the same direction as the movement of said movable means moving along said control track and at the same speed as said movable means.

5. Apparatus for marking the surface of an article having a continuous surface including flat and rounded portions comprising, in combination, a stationary printing form; a control track parallel with said printing form; at least one support means movable along said track, said support means being adapted to hold said article in fixed position thereon and in contact with said printing form, said support means having an inside guide surface, and an outside control surface shaped in conformity with said surface of the particular article so that flat and rounded portions of said control surface correspond to flat and rounded portions of the article, said control surface engaging said control track; movable means movable along said control track and relatively to said support means and including a connecting member engaging said inside guide surface of said support means for holding said outside control surface in contact with said control track and the associated surface of the article in contact with said printing form, said connecting member holding a flat surface portion of said article in stationary contact with said printing form and a corresponding flat surface portion of said outside control surface in stationary contact with said guide track while moving along a flat portion of said inside guide surface, and imparting a rolling movement to a rounded portion of said outside control surface on said control track and to an associated rounded surface portion of the article

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on said printing form while said connecting member moves relatively to a rounded portion of said inside guide surface; and stationary support means mounted along said control track opposite said stationary printing form and including a supporting edge extending substantially parallel with said control track, said supporting edge being spaced from said control track and from said support means and formed to support a portion of an article held by said support means while the article with its movable support means is moving along said control track.

6. Apparatus as set forth in claim 1, wherein said control track has a supporting surface extending perpendicular to said printing form for supporting said movable support means, said control track having a contact surface extending perpendicular to said supporting surface for engagement with said outside control surface of said support means; and wherein said support means include a plate member having a flat surface for resting on said supporting surface of said control track, said plate member carrying on one side locating means for holding a particular article in a fixed position and having a hollow extension on the opposite side facing said movable means, said hollow extension having said inside guide surface and said outside control surface and said connecting member projecting into said hollow extension.

7. Apparatus for marking the surface of articles having a continuous surface including flat and rounded portions, comprising, in combination, a stationary printing form; a control track parallel with said printing form; support means movable along said track, said support means being adapted to hold one of said articles in fixed position thereon and in contact with said printing form, said support means having an inside guide surface and an outside control surface shaped in conformity of said surface of the particular article so that flat and rounded portions of said control surface correspond to flat and rounded portions of the article, said control surface engaging said control track; slip-preventing means interposed between said control track and said outer control surface, the surface of said slip-preventing means constituting the engagement surface between said control track and said control surface; and movable means movable along said control track and relatively to said support means and including a connecting member engaging said inside guide surface of said support means for holding said outside control surface in contact with said control track and the associated surface of the article in contact with said printing form, said connecting member holding a flat surface portion of said article in stationary contact with said printing form and a corresponding flat surface portion of said outside control surface in stationary contact with said guide track while moving along a flat portion of said inside guide surface, and imparting a rolling movement to a rounded portion of said outside control surface on said control track and to an associated rounded surface portion of the article on said printing form while said connecting member moves relatively to a rounded portion of said inside guide surface.

8. An apparatus as set forth in claim 7, wherein said slip-preventing means include a gear rack mounted along said control track, and a corresponding series of gear teeth arranged along said outside control surface for mutual meshing engagement, the pitch line of said gear rack and said gear teeth constituting the engagement surface between said control track and said control surface.

9. Apparatus for marking the surface of articles having a continuous endless surface including flat and rounded portions comprising, in combination, a stationary printing form; a control track parallel with said printing form; support means movable along said track, said sup-

port means being adapted to hold one of said articles in fixed position thereon and in contact with said printing form, said support means having a hollow extension having an endless inside guide surface and an endless outside control surface shaped in conformity with said endless surface of the particular article so that flat and rounded portions of said control surface correspond to flat and rounded portions of the article, said control surface engaging said control track, the flat portions of said surfaces being parallel with each other and the rounded portions thereof being concentric with each other; and movable means movable along said control track and relatively to said support means and including a connecting member projecting into said hollow extension and engaging said endless inside guide surface of said support means for holding said outside control surface in contact with said control track and the associated surface of the article in contact with said printing form, said connecting member holding a flat surface portion of said article in stationary contact with said printing form and a corresponding flat surface portion of said outside control surface in stationary contact with said guide track while moving along a flat portion of said inside guide surface, and imparting a rolling movement to a rounded portion of said outside control surface on said control track and to an associated rounded surface portion of the article on said printing form while said connecting member moves relatively to a rounded portion of said inside guide surface.

10. Apparatus as set forth in claim 9, wherein said connecting member is pin means including a roller made of resilient material for rolling and resilient engagement with said inside guide surface.

11. Apparatus as set forth in claim 9, wherein said connecting member is pin means including a roller made of resilient material for rolling and resilient engagement with said inside guide surface; and including guide rail extending along said control track and parallel therewith and having a guide edge spaced from said control track a fixed distance corresponding to the diameter of said pin and the distance between said inside guide surface and said outer control surface so that the side of said pin remote from said guide surface is in engagement with said guide edge while the other side of said pin is simultaneously in contact with said inner guide surface, where-

by pressure contact between said outside control surface and said control track is maintained.

12. Apparatus as set forth in claim 9, wherein said connecting member is pin means including a roller made of resilient material for rolling and resilient engagement with said inside guide surface; and including a guide rail extending along said control track and parallel therewith and having a guide edge spaced from said control track a fixed distance corresponding to the diameter of said pin and the distance between said inside guide surface and said outer control surface so that the side of said pin remote from said guide surface is in engagement with said guide edge while the other side of said pin is simultaneously in contact with said inner guide surface, whereby pressure contact between said outside control surface and said control track is maintained, said guide rail extending along said control track a distance substantially equal to the length of said printing form; and a movable member at the rearward end of said guide rail relative to the direction of movement of said connecting member, said movable member being movable in transverse direction for forcing said connecting member into engagement with said inside guide surface and for forcing said outside control surface into engagement with said control track when said connecting member is in a position opposite said movable member whereby the particular article held on said support means is brought into contact with said printing form.

13. An apparatus as claimed in claim 1, wherein said stationary printing form is a silk screen, and wherein at least one movable inking device is arranged for moving along and in contact with said silk screen at points opposite the position of said connecting member.

14. An apparatus as set forth in claim 1, wherein said control track is an endless track with a portion thereof parallel with said printing form; and wherein said movable means are conveyor means movable along an endless path parallel to said tracks; and including a plurality of spaced connecting members carried by said conveyor means; and a plurality of movable support means.

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