March 9, 1965 L. W. FREEMAN 3,172,355

APPARATUS FOR PRINTING ON TWO SURFACES OF AN ARTICLE

Filed Jan. 7, 1963 3 Sheets-Sheet 1

FIG. 4

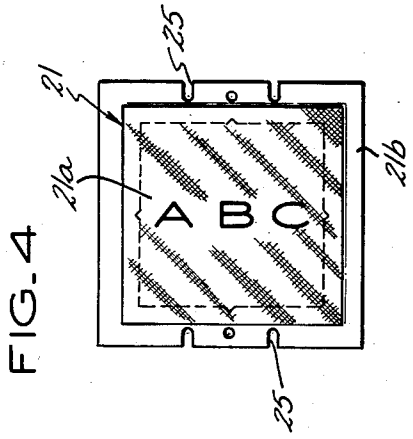


FIG. 1

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FIG. 2

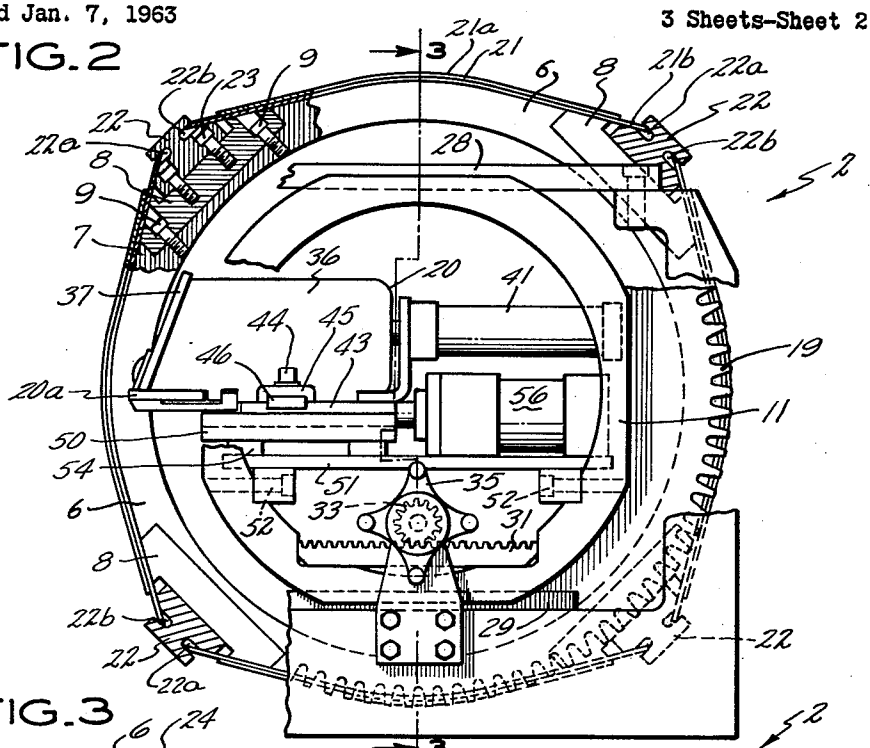
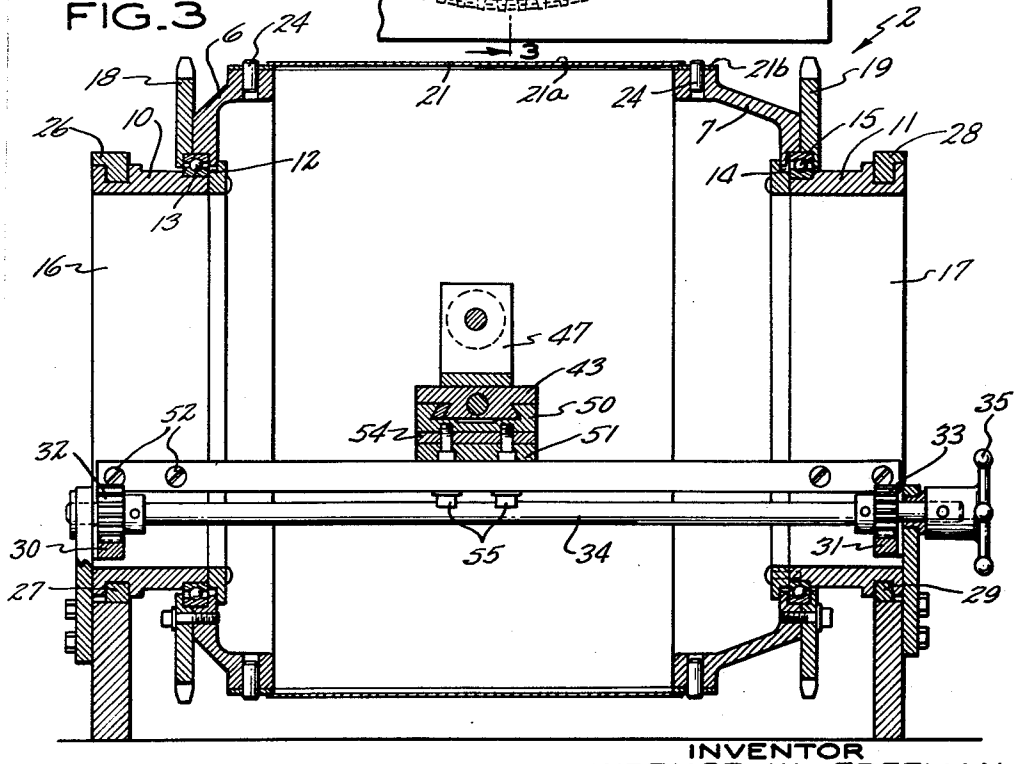


FIG. 3



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APPARATUS FOR PRINTING ON TWO SURFACES OF AN ARTICLE

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FIG. 5

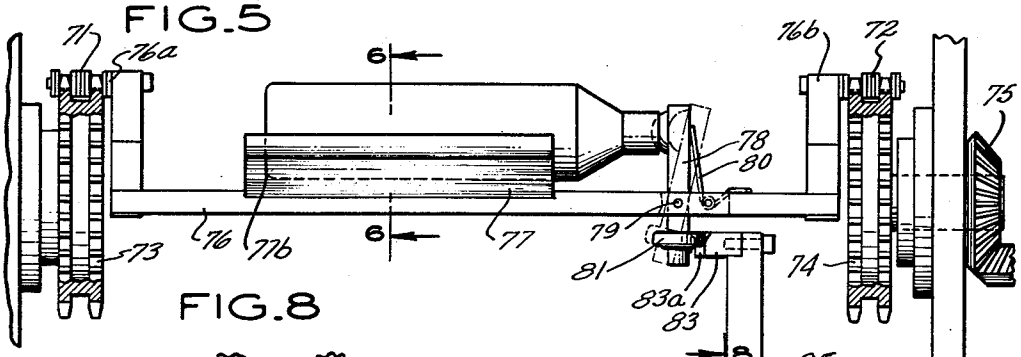
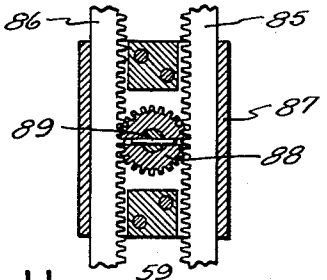


FIG. 8



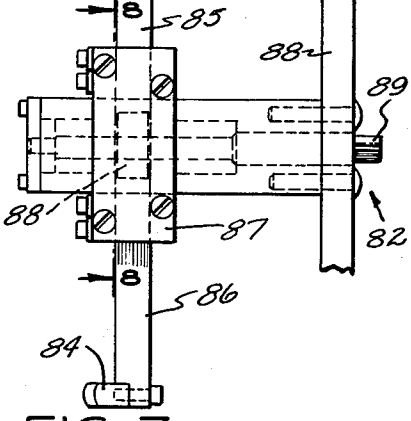


FIG. 7

FIG. 11

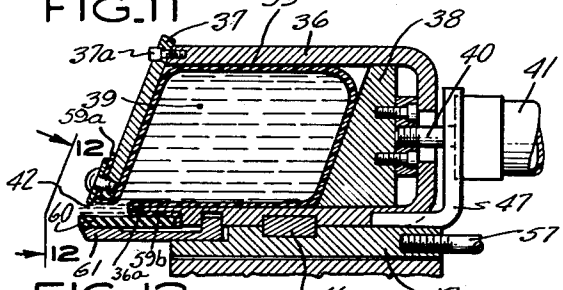
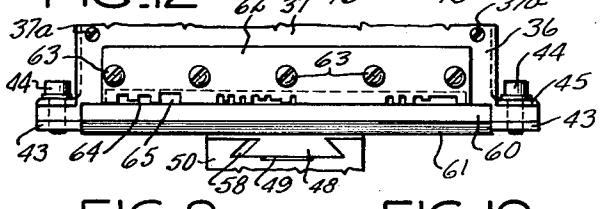


FIG. 12



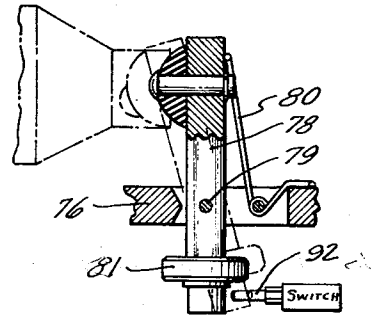


FIG. 9

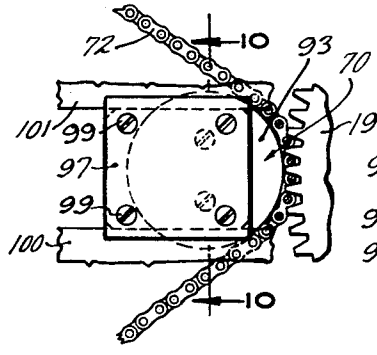


FIG. 10

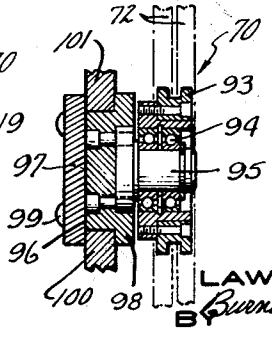
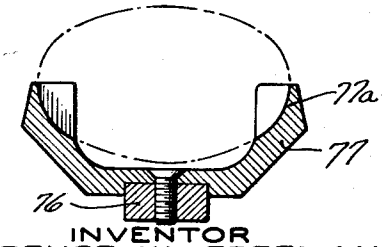


FIG. 6



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United States Patent Office

3,172,355
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3,172,355

APPARATUS FOR PRINTING ON TWO SURFACES OF AN ARTICLE

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Filed Jan. 7, 1963, Ser. No. 249,879
27 Claims. (Cl. 101—119)

This invention pertains to mechanisms for handling and forming indicia on articles. Specifically it relates to a silk screen printing mechanism including two, rotatable silk screen printing devices and associated conveying means by means of which a plurality of articles may be consecutively fed through the apparatus and be automatically printed on two diametrically opposite surfaces.

Modern, high speed, automatic printing operations impose exacting requirements on printing apparatus. Printing mechanisms, in order to be effectively competitive in the present market, must be capable of high speed accurate printing operations with minimum structural complexity. It has become increasingly desirable for mechanisms to be capable of handling non-circular articles such as conventional, blow molded plastic bottles having a generally oval shaped cross section and to be capable of printing indicia on oppositely disposed arcuate surfaces of such articles.

Printing mechanisms heretofore developed have been characterized by substantial disadvantages, foremost among which has been undue structural complexity. Particular difficulty has been involved with rotatable drum types of silk screen printing mechanisms in effecting the distribution of ink upon peripherally carried silk screen surfaces. Ink distributors in such mechanisms are normally located within the drum interior. Heretofore such distributors have either undesirably engaged screen supporting frame members during the rotation of the printing drums or have been mounted for cyclic reciprocation toward and away from the printing portions of the silk screens. As will be appreciated, contact between the distributor and frame members entails severe wear of the distributing member with the likelihood of damage or failure occurring. Cyclic reciprocation of the distributor involves the complexity associated with cycling control means.

Additional disadvantages involved with prior art, rotatable drum types of silk screen mechanisms pertain to the correlating of the operation of mechanisms for conveying articles toward and away from the printing drums with the operation of the drums themselves.

Other problems have related to a general inability to obtain access to ink distributing members while silk screen drums are rotating so as to effect suitable apparatus adjustment or corrections.

Further problems associated with prior art printing structures have involved the handling of articles on conveyors adapted to feed such articles toward and away from printing mechanisms and in providing reliable yet structurally simple mechanisms for changing the position of articles after they have been printed on one surface so as to be suitably and accurately registered to receive indicia on another surface.

Yet another difficulty of prior art structures has involved the distribution of ink on silk screen printing surfaces. In general, prior art distributors have effected a uniform distribution of ink across a silk screen pattern. Such a uniform distribution has not taken into account the varying requirements of printing patterns along the axis of the distribution outlet such that excessive accumulation of unused ink has tended to occur in localized pattern areas having minimum ink demands.

In recognition of the need for an improved article handling and indicia forming system, it is an object of this

invention to provide such a system which is particularly adapted to silk screen printing techniques and by means of which the aforenoted prior art disadvantages, may be substantially obviated.

It is a particular object of the invention to provide a rotatable drum type of silk screen printing unit, including an internally disposed ink distributing member which remains stationary throughout a continuous, multiple article printing operation and yet which does not engage frame or silk screen supporting members of the printing drum while the drum is rotating.

Yet another object of the invention is to provide such an indicia forming apparatus which affords continuous access to the ink distributing member while a printing plate bearing drum is rotating.

A further object of the invention is to provide such a mechanism, including an ink distributor which is adapted to distribute printing ink in accordance with localized printing requirements of a printing pattern.

An additional object of the invention is to provide a piston and cylinder assembly type of ink distributing structure which is uniquely configured such that the assembly may be positioned in close proximity to silk screen printing surfaces to effect the transfer of ink to silk screen surfaces without having other portions of the assembly engage the silk screen surfaces or frame members of a screen supporting drum.

It is also an object of the invention to provide a printing mechanism which enables the forming of indicia on two separate surfaces of an article in an automatic and expeditious fashion with a minimum of structural complexity. In accomplishing this objective, means are also provided for forming indicia on articles of non-circular cross-sections such as generally oval shaped bottles.

A still further object of the invention is to provide a mechanism for rigidly supporting articles such as oval shaped bottles on an endless conveyor so as to effect tangential, indicia forming contact between the articles and a rotary printing surface.

It is an additional object of the invention to provide article handling mechanisms including multiple, endless conveyor flights and having devices for effecting the simultaneous release of articles from multiple flights and the simultaneous release of articles from article holders on one flight and the simultaneous placing of article holders on another flight in a condition to receive articles released from the one flight.

Still another object of the invention is to provide an article handling mechanism including article holders uniquely adapted for use with endless conveyors and which effect automatic and accurate positioning of articles for multiple indicia forming operations. Uniquely combined with such holders is a device for detecting the absence of articles to be printed.

In partially accomplishing the objects of this invention there is provided an indicia forming mechanism including a pair of annular rims, which rims are coaxial and spaced along their common axis. A plurality of frame members extend between and are connected to these annular rims. Means are provided for rotatably supporting the interconnected annular rims and for rotating the interconnected rims about their common axis. A plurality of indicia forming plates extend between the rims with each such plate having a portion thereof curved in an arc having a radius extending from the common axis of the rims. Support means are provided for each indicia forming plate, which support means have portions extending tangentially away from each end of the curved portions of the indicia forming plates supported thereby. Fluid distributing means are positioned between the rims and within the path of rotation traversed by the frame members. The fluid distributing means is positioned so

as to engage the curved portions of the indicia forming plates yet be spaced from the tangentially extending portions of the support means as the annular rims are rotated about their common axis.

The fluid distributing means desirably comprises a piston and cylinder assembly including a sloping cylinder head extending from an elongate fluid outlet. The sloping cylinder head facilitates the positioning of the assembly in close proximity to the indicia forming plates without causing structural interference between the assembly and frame components of the mechanism during the rotation of the annular rims. It is also desirable that the cylinder be provided with a unique distributing member adjacent its outlet so as to control the expulsion of fluid from the assembly in accordance with the varying demands of a pattern along the axis of the elongate cylinder outlet.

With respect to the forming of indicia on two surfaces of an article, there is contemplated an apparatus which includes first indicia forming means associated with first article conveying means adapted to convey articles toward and away from the first indicia forming means. Second indicia forming means are provided which are spaced from the first indicia forming means. Second article conveying means are included which are adapted to convey articles toward and away from the second indicia forming means. The first article conveying means has a first horizontal flight extending away from the first indicia forming means while the second article conveying means has a second horizontal flight leading to the second indicia forming means and disposed beneath and in spaced relation with the first horizontal flight. Means are provided for releasing articles from the first horizontal flight which have been printed on one surface so that they may fall by gravity onto the second horizontal flight to be carried to the second indicia forming means to receive indicia on a second surface.

Also envisioned as important features of the invention is a unique article holder particularly adapted for use with an endless conveyor where an article is to be transferred from one conveyor flight to another to effect accurate registered printing on multiple article surfaces. Each such article holder has a concave portion to support an article side, an abutment to engage one article end, and a pivoted jaw adapted to resiliently engage the other article end. A cam follower is carried by the pivoted jaw and is adapted to engage stationary abutment type cams to effect the pivoting of the jaw from article engaging to article receiving positions.

In order to effect tangential indicia forming contact between endless conveyor carried articles and printing surfaces carried by the periphery of a rotatable printing drum, the article holders are rigidly attached to their associated endless conveyors so as to support articles with their median planes extending from their longitudinal axis radially to arcuate article surfaces to receive indicia and are perpendicular to the portions of the endless conveyors which they intersect. Holders thus mounted may be carried around suitably diametered rollers located adjacent rotatable printing drums to effect tangential indicia forming contact between the article surfaces to be printed and indicia forming means carried by the drum. Desirably, each endless conveyor is of the sprocket chain type and is engaged with toothed peripheral portions of its associated printing drum so as to effect rotation of the drum which is positively coordinated with the speed of the conveyor.

In describing the invention reference will be made to preferred embodiments of the mechanism as illustrated in the accompanying drawings. In these drawings:

FIG. 1 is a schematic, side elevational view of a complete mechanism including two rotatable, silk screen printing units, each having an associated endless conveyor. The conveyors and silk screen printing units are interrelated so as to effect the automatic forming of indicia on two surfaces of each article passing through the mechanism;

FIG. 2 is a transverse, partially sectioned and broken away view of one of the two silk screen mechanisms shown in FIG. 1;

FIG. 3 is a sectional view of the silk screen printing mechanism of FIG. 2 taken along the section line **3—3**;

FIG. 4 is a plan view of a representative silk screen and silk screen frame adapted to be mounted upon the FIG. 2 mechanism;

FIG. 5 is an enlarged representation of a portion of FIG. 1 apparatus illustrating an article holder and a mechanism for changing the holder from article holding to article receiving conditions;

FIG. 6 is a sectional view of an article holder portion shown in FIG. 5 as taken along the section line **6—6**.

FIG. 7 is a fragmentary, partially sectional view of a pivoted jaw component of the article holder illustrated in FIG. 5;

FIG. 8 is a fragmentary, sectional view of an adjustment portion of a pivoted jaw actuating mechanism shown in the FIG. 5 illustration as viewed along the section line **8—8**;

FIG. 9 is a fragmentary, and enlarged view of the manner in which the endless chain conveyors of the FIG. 1 mechanism are employed to effect the coordinated rotation of the silk screen printing drums shown in FIG. 1;

FIG. 10 is a fragmentary, sectional view of the FIG. 9 apparatus as viewed along the section line **10—10**;

FIG. 11 is an enlarged and sectioned view of the ink distributor assembly incorporated in each silk screen printing mechanism of the FIG. 1 apparatus; and

FIG. 12 is a fragmentary, end view of the ink distributor assembly shown in FIG. 11 as viewed along the view line **12—12**.

FIG. 1 schematically illustrates an overall mechanism for accomplishing automatic silk screen printing on oppositely disposed, arcuate faces of articles such as plastic bottles having a generally oval shaped cross-section.

As shown in FIG. 1, the mechanism includes a first, rotary drum type printing unit **1** adapted to print one article face and a second, rotary drum type of silk screen printing unit **2** adapted to print a second article face. As shown in FIG. 1, silk screen printing units **1** and **2** are preferably both laterally and vertically spaced from each other.

A first endless conveyor **3** schematically illustrated in phantom line in FIG. 1, conveys articles to the first printing unit **1** along an upper, horizontally disposed flight *3a* and carries articles which have been printed on one face away from the printing unit **1** along a lower horizontal flight *3b*. A second endless conveyor **4**, shown schematically in dotted line, is associated with the second rotary screen printing unit **2**. Endless conveyor **4** is positioned beneath endless conveyor **3** and includes an upper horizontal flight *4a* positioned beneath the lower horizontal flight *3b* of conveyor **3**, which upper flight *4a* is adapted to convey articles toward printing unit **2** to receive printed indicia on a second face. Conveyor **4** includes a lower horizontal conveyor flight *4b* for transporting articles generally away from printing unit **2**.

In FIG. 1 printing unit **1** and the conveyor **3** are shown schematically with the supporting frame merely being indicated in phantom lines. The additional structural detail shown in connection with the conveyor **4**, the printing unit **2** and the frame and structure associated with these components provides clarification of details of the system to be described hereinafter.

At the transfer station indicated in FIG. 1, conventional article transfer means may be provided for loading articles to be printed upon the conveyor **3**. Conveying means such as an endless conveyor **5** disposed beneath the flight *4b* may be employed to transport articles which have been printed on two separate faces away from the printing mechanism. Endless conveyor **5** may be pro-

vided with a plurality of cradle type, article receiving holders 5*a*.

In operation of the mechanism shown in FIG. 1, unprinted articles are carried from horizontal flight 3*a* to the printing unit 1. At this unit, such articles are supported on the conveyor 3 so that a first surface to receive indicia is moved in tangential, indicia forming contact with a silk screen carried by the rotary printing unit. The article with one surface printed is then carried away from the printing unit 1 and, as it moves along the lower flight 3*b*, is discharged from the conveyor 3 so that it falls by gravity on to the upper flight 4*a* of the conveyor 4. As shown in FIG. 1, flights 3*b* and 4*a* are relatively closely spaced. Because of this close spacing, there is little or no possibility of article reorientation occuring as the article falls by gravity from the conveyor flight 3*b* onto the conveyor flight 4*a*. Thus, in making the transfer from the flight 3*b* the flight 4*a*, an article is repositioned in relation to its supporting conveyor so that the unprinted article face which was disposed inwardly on conveyor 3 is disposed outwardly on the conveyor 4. The article is then carried by the conveyor 4 to the second silk screen, rotary printing unit 2 where the second article face is printed in the same manner in which the first face was printed by the printing unit 1.

Rotary printing unit 1 and rotary printing unit 2 are substantially identical rotary silk screen printing units arranged in oppositely oriented relationship, as shown in FIG. 1, so as to rotate in opposite directions.

In describing the structure of each rotary printing unit, the rotary unit 2 shown in full line in FIG. 1 will be referred to as typifying the structure of both printing units.

FIGS. 2 and 3 disclose the structural details of the rotary printing unit 2. FIG. 2 provides a partially sectioned, end elevational view of the printer unit 2. FIG. 3 provides a sectional, fragmentary, side elevational view of the unit 2.

As shown in FIG. 3, the rotary printing unit 2 includes a first, generally annular rim 6 disposed on one side of the printing unit and a second, generally annular rim 7 disposed on the other side of the unit. Rims 6 and 7 are coaxial and spaced along the axis of rotation of the printing unit, which axis of rotation is the common axis of the rims 6 and 7. A plurality of mounting members 8 shown in FIG. 2 may be fastened to rim members 6 and 7 by conventional fastening means such as threaded bolts 9. Rim 6 is rotatably supported by an annular, i.e. cylindrical section, type of support member 10 while annular rim 7 is similarly supported by an annular, cylindrical section type support member 11. Rim 6 includes a central aperture 12, of circular, cross section, through which the support member 10 projects. Support member 10 is journaled in aperture 12 by means of a conventional roller bearing assembly 13. Rim 7 includes a similar, centrally disposed circular aperture 14. Annular support member 11 is journaled in aperture 14 by means of a conventional roller bearing assembly 15.

Annular support member 10 includes a central opening 16 which, in cooperation with aperture 12, affords direct access to the printing unit interior, even while the unit is rotating. Similarly, support member 11 includes a central opening 17 affording direct access to the printing unit interior, while the unit is rotating.

The printing unit 2 is rotated by interengagement of the conveyor 4 with sprocket toothed rims 18 and 19 mounted respectively on annular rims 6 and 7 in a manner to be hereinafter described. The sprocket toothed rim 18 and 19 shown in FIGS. 2 and 3 are not illustrated in FIG. 1 in order to simplify the illustration of the overall system.

An ink distributing assembly 20 is positioned between the rims 6 and 7 and within the path of rotation traversed by the frame members 8.

Printing unit 2 supports a plurality of indicia forming assemblies 21 which extends between the rims 6 and 7. As shown in FIG. 4, a representative assembly 21 includes a generally rectangular, silk screen surface, printing place 21*a* mounted on a rectangular supporting frame 21*b* fabricated of resilient metal or other material. Referring to FIG. 2, it will be seen that each printing assembly 21 is mounted so as to have an intermediate portion curved in an arc having a radius extending from the axis of rotation of the printing unit. End portions of the silk screen printing surface 21*a* extend tangentially away from the intermediate curved portion. Similarly, the frame 21*b*, which supports the silk screen plate 21*a*, has a mid portion, i. e. the mid portions of its slides, which are curved in an arc conforming generally to the arc of the mid portion of the plate 21*a* while its end portions extend tangentially away therefrom.

Silk screen and frame assemblies are supported on the printing unit 2 in the manner shown in FIGS. 2 and 3. The slides of each frame 21*b* are supported by portions of the rims 6 and 7, which rims are shaped to conform to the curved and tangentially extending configuration desired for the screen and plate assembly. Each end of the silk screen and frame assembly 21 is secured by a holding member 22. Holding members 22 are attached to mounting members 8 by conventional fastening means such as threaded fasteners 23. One side of each holder 22 includes a slot 22*a* extending along the length of the end of a silk screen frame 21 and is adapted to receive and retain this frame end. Another slot 22*b* other side of the holder 22 and is adapted to receive and retain the end of the tangentially extending end portion of another, adjacent silk screen frame.

As will be appreciated, the holding members 22, in being connected to mounting member 8 on rims 6 and 7 and extending along the length of the end of the screen frames 21, may also be considered to be frame members extending transversely between the interconnected rims 6 and 7.

As will be appreciated, each frame and silk screen assembly 21 may be mounted upon the periphery of the printing unit 2 merely by flexing the mid portion of the assembly to allow its outer ends to slip into the slots of a pair of adjacent assembly holders 22. When the assembly is released, the resilience of the frame 21*b* will effectively draw the frame into snug engagement with the rims 6 and 7 and cause the frame ends to extend into locked position within the slots 22*a* and 22*b* of adjacent holders 22. Accurate registration of the assembly 21 on the printing unit 2 may be assured by means of registration pins 24 carried by the rims 6 and 7 adopted to engage registration notches 25 formed on the sides of frame 21b.

In order to accommodate to particular article requirements, it may be necessary to adjust the position of each printing unit toward and away from its associated conveyor. One such mechanism for adjusting the position of a printing unit transversely of its axis of rotation is shown in FIGS. 2 and 3. This adjusting mechanism includes a pair of frame mounted rails 26 and 27 adapted to slideably support upper and lower flattened peripheral surfaces of the annular support member 16 and a pair of frame supported rail members 28 and 29 adapted to slideably support upper and lower flattened, peripheral surfaces of the annular support member 11. A horizontally aligned toothed rack 30 is mounted on the annular support member 10 while another horizontally aligned toothed rack 31 is mounted on the annular support member 11. A pinion assembly including a first pinion gear 32 meshingly engaged with the toothed rack 30 and a second pinion gear 33 meshingly engaged with the toothed rack 31 is mounted upon an actuating rod 34 which is journaled in the frame assembly and provided with a manually operated turning handle 35. When the handle 35 is rotated so as to rotate the pinion gears 32 and 33, the printing unit 2 is caused to move along the axis of the racks 30 and 31 so as to be displaced transversely of the axis of rotation of

the rims 6 and 7. In this manner the position of each printing unit in relation to its associated conveyor may be expeditiously and effectively adjusted to obtain the desired contact between conveyor carried articles and the silk screen printing surfaces.

When each ink distributor assembly is positioned in operative position, as shown in FIGS. 1 and 2, the ink distributing end 20*a* of each assembly is positioned so as to engage the curved portions of the silk screens 21*a* rotatably carried by the rims 6 and 7 past this distributing end 20*a*. The distributor 20 is positioned and configured so as to be spaced from tangentially extending portions of the silk screen 21*a* and the silk screen frames 21*b* as well as the mounting members 8 and the frame members 22 while these components are rotated past the ink distributing end 20*a* of the distributor assembly 20.

The structural details of the ink distributing assembly 20 are shown in FIGS. 2, 3, 11, and 12.

As shown in FIG. 2, each assembly 20 includes a cylinder 36 which defines an ink reservoir. The forward head 37 of the cylinder 36 extends away from the outlet end 20*a* of the assembly and slopes away from silk screens surfaces operably engaged with the distributor and toward the piston end of the assembly. The sloping of the head 37 toward the piston end of the assembly 20 enables the assembly to be positioned with the outlet end 20*a* in close proximity to silk screen surfaces 21*a* without the upper portion of the assembly 20 engaging the frame members 8 or other portions of the printing unit while it is in operation.

As shown in FIG. 11, each assembly further includes a piston 38 disposed within the cylinder 36 and adapted to expel printing ink 39 therefrom. In order to prevent the forming of a dead space within the cylinder 36 the leading, i.e. ink expelling, face of the piston 38 may be sloped to be parallel to the head end 37 of the assembly 20 as shown in FIG. 11.

The piston 38 is connected to a piston rod 40, which extends from an actuating piston housed within an actuating cylinder 41. The piston within the cylinder 41 may be pneumatically or hydraulically actuated under the influence of conventional control means to provide the desired biasing force on the ink expelling piston 38, so as to maintain a desired rate of expulsion of printing ink through a generally elongate outlet 42 at the leading end 20*a* of the cylinder 36.

Cylinder 36 is mounted upon a base member 43 by means of threaded fasteners 44 passing through wing portions 45 of the cylinder 36 into the base member 43. Accurate registration of the cylinder 36 in relation to the base 43 may be secured by a registration key 46, which as shown in FIG. 11, extends into mating and oppositely facing slots in the base of the cylinder 36 and the upper surface of the base member 43. Actuating cylinder 41 is also rigidly secured to the base member 43 by means of a bracket 47.

During certain operating conditions, as for example, when an article is missing during a printing operation or for purposes of maintenance and adjustment, it may be desirable to retract the assembly 20 away from its operative position to the position shown in FIG. 2. For this reason, the base 43 includes a dove-tail type key 48 integrally formed on the base 43, as shown in FIG. 12. Key 48 is slideably positioned within an appropriately configured key way 49 formed in a stationary base member 50. Base member 50 may be intermediately supported by a bracket assembly 51 which is attached by the threaded fasteners 52 to the rims 6 and 7. Base 50 may be appropriately elevated on the bracket assembly 51 by means of spacers 54. Threaded fasteners 55 are provided for joining the bracket assembly 51, the spacers 54 and the base 50.

Movement of the assembly 20 along the stationary base 50 is effected by an actuating piston and cylinder assembly 56 rigidly mounted upon the bracket 51 as shown in FIG. 2. A piston rod 57 extends from a piston contained within the cylinder of the assembly 56 and is attached at one end to the slideable member 43 as shown in FIG. 11. The application of fluid to the piston within the assembly 56 to control the extension and retraction of the assembly 20 is controlled by conventional control mechanisms, not illustrated.

Smooth sliding movement of the assembly 20 may be facilitated by providing friction easing or resilient packing 58 between the key 48 and the key way 49 in the general fashion shown in FIG. 12.

In order to facilitate the replenishing of ink within the interior of the cylinder 36, the head 37 is made selectviely detachable from the cylinder 36 by means of threaded fastener 37*a* so that a supply of ink 39 contained in a flexible liner 59 may be positioned within the cylinder interior. As shown in FIG. 11, one end 59*a* of the liner may be tucked around and secured to the end of the removable head 37, which lies adjacent the outlet 42. Another end 59*b* of the liner 59 may be tucked around and secured to an edge portion 36*a* of the cylinder 36 which also lies adjacent the ink outlet 42. The end 59*b* of the liner may be tucked between a conventional squeeze 60 which is supported on the cylinder 36 so as to project beneath the outlet 42 by means of a supporting plate 61. As shown in FIG. 11, supporting plate 61 is mounted between the base 43 and the lower surface of cylinder 36.

A comb-like, ink distributing member 62 is mounted on the cylinder head 37 so as to extend across the outlet 42 and control the expulsion of ink from the outlet in accordance with varying ink requirements of the printing pattern along the elongate axis of the outlet 42. Distributor 62 is secured to the cylinder head 37 by conventional threaded fasteners 63. As shown in FIG. 12, distributor member 62 includes a plurality of separately defined, outlets having different sizes conforming to the printing requirements of appropriate areas of printing patterns on the silk screens 21*a*. For example, as shown in FIG. 12, the opening 64 is of a substantially smaller size than the adjacent opening 65. The different widths and depths of openings in the distributor 62 effectively control the expulsion of ink in accordance with localized ink demands so as to prevent localized ink accumulations which would occur with uniform ink distribution where printing patterns have varying ink requirements along the axis of the ink outlet 42.

The structural details of the conveyors 3 and 4, including spaced article holders carried thereon, are shown in FIGS. 1 and 5 through 10.

Conveyors 3 and 4 are each substantially identical but are disposed in oppositely facing directions as shown in FIG. 1. With this arangement the lower, horizontal flight 3*b* of the upper conveyor 3 and the upper horizontal flight 4*a* of the lower conveyor 4 travel in the same direction. As will be appreciated, conventional drive means for these endless conveyors, not illustrated, effect the driving of the conveyors at the same linear rate so that the flights 3*b* and 4*a* move concurrently. In order to properly correlate the rate of linear movement of the conveyors 3 and 4, it is desirable for these units to be driven by a common drive mechanism.

As conveyors 3 and 4 are substantially identical, it will be necessary to describe the structural details of only one conveyor. For this purpose conveyor 4 has been selected.

Conveyor 4 is supported on a pair of upper, horizontally spaced, sprocket wheel assemblies 66 and 67 and a pair of lower, horizontally spaced, sprocket wheel assemblies 68 and 69. Upper flight 4*a* extends across sprocket wheel assemblies 66 and 67 while lower horizontal flight 4*b* extends across the lower sprocket wheel assemblies 68 and 69.

Additional support means in the form of an idler roll assembly 70 are provided. Idler roll assembly 70 is disposed adjacent the printing unit 2. Idler roll assembly 70 is effective to cause the conveyor 4 to traverse an arcu-

ate path adjacent the outer periphery of printing unit 2.

As shown in FIG. 5, conveyor 4 includes a conventional, double sprocket chain 71 mounted on one side of the conveyor and another conventional, double sprocket chain 72 mounted on the other side of the conveyor 4. As is further shown in FIG. 5, each sprocket wheel assembly includes a conventional, double toothed sprocket wheel 73 adapted to meshingly engage with double sprocket chain 71 and another double toothed sprocket wheel 74 adapted to meshingly engage the double sprocket chain 72. As illustrated, each double toothed, sprocket wheel is journaled in frame portions of the apparatus. At least one sprocket wheel is provided with driving means such as the beveled gear arrangement 75 schematically illustrated in FIG. 5. Beveled gear 75 is adapted to be actuated by the conventional drive means previously noted.

Double sprocket chains 71 and 72 are interconnected by a plurality of spaced article holder assemblies. Each such assembly comprises a generally U-shaped bracket 76 as shown in FIG. 5, which is rigidly attached at one end 76*a* to the sprocket chain 71 and is rigidly attached at the other end 76*b* to the sprocket chain 72. With this rigid mounting arrangement, it will be appreciated that the bracket 76 is not free to pivot relative to the portions of the sprocket chain to which it is attached.

Each bracket member 76 carries an article holding structure. Each such structure includes an article cradle 77 mounted on the horizontal portion of the U-shaped bracket 76 as shown in FIG. 5. Each cradle 77 includes a generally concave portion 77*a* as shown in the cross-sectional view of FIG. 6. Concave portion 77a is adapted to support an article side such that the article is disposed with its longitudinal axis extending horizontally and perpendicular to the conveyor chains 71 and 72. An end portion 77*b* of each cradle 77 provides an abutment for engaging and supporting one article end. The other article end is engaged by a pivoted jaw 78 as shown in FIGS. 5 and 7. Each pivoted jaw 78 is pivotally mounted at pivot axis 79 on the bracket 76 supporting the cradle 77. A conventional resilient spring 80 is mounted upon the bracket 76 so as to resiliently and yielding urge the pivoted jaw 78 to its article engaging position.

With the article holder arrangement described, positive and accurate support for articles is provided so as to insure accurate registration for printing purposes. The concave portion 77*a* of the cradle allows an article to naturally assume an orientation so that the surfaces to be printed face upwardly and downwardly. The abutment 77*b*, in cooperation with the pivoted jaw 78 properly position the article along the axis of the bracket 76. As is apparent, each article is thus supported with its median plane extending radially from its longitudinal axis to the outwardly facing surface to be printed and perpendicular to the portions of the conveyor chains 71 and 72 which it intersects.

The manner in which articles are released from the conveyors and the manner in which article holders are placed in article receiving position are illustrated in FIGS. 1, 5 and 8.

As shown in FIG. 5, each pivoted jaw 78 carries an enlargement 81 which functions as a cam follower. Enlargement 81 is positioned beneath the bracket 76, as shown.

A cam assembly 82 is provided for simultaneously effecting the pivoting jaws 78 of article holders moving along the upper and lower flights 4*a* and 4*b* of the conveyor 4. Cam assembly 82 includes a horizontally extending abutment bar 83 which provides a cam surface disposed in the travel path of the followers 81 of pivotable jaws 78 as they move along the upper flight 4*a*. This cam surface comprises the left side of the bar 83, as shown in FIG. 5, which side has sloped, camming end portion 83*a*. A bar 84 provides a similar cam surface disposed in the travel path of jaw followers 81 as the article holders move along the lower flight 4*b* of the conveyor 4.

Abutment bar 83 is supported upon a toothed rack 85 while abutment bar 84 is supported upon a toothed rack 86, as shown in FIG. 1. Toothed racks 85 and 86 extend toward each other and pass slideably through a mounting bracket assembly 87. As shown in FIG. 5, bracket 87 is mounted upon a frame portion 88.

Toothed racks 85 and 86 extend in parallel but spaced relationship through the bracket assembly 87 so as to meshingly engage opposite sides of a pinion 88 journaled within the bracket assembly 87, in the manner shown in FIG. 8. Pinion gear 88 is mounted upon a rotatable shaft 89 by means of which it may be rotated to effect concurrent movement of the abutment bars 83 and 84 toward and away from their respectively associated conveyor flights. This simultaneous adjustment arrangement materially facilitates adjusting operations and insures correct positioning of the camming abutments on both upper and lower flights of the conveyor.

If it should become necessary to adjust the apparatus to accommodate to articles of different sizes, it may be necessary to substitute article holder assemblies of new dimensions. In this event, the racks 85 and 86 may be simultaneously actuated by rotation of pinion gear 88 so as to position the abutment bars 83 and 84 in accordance with the position of the followers 81 in the new assemblies.

The pivoted jaw carried, cam follower and the stationary abutment cam arrangement heretofore described provides a particularly reliable but structurally simple transfer mechanism. As article holders move along the upper flight 4*a*, the cam follower portion 81 of the pivoted jaw 78 of each holder engages the camming surface of the abutment 83 so as to cause the jaw 78 to pivot away from solid line article engaging position into the phantom line, article receiving, position shown in FIG. 5. The holders are thus placed in condition to receive articles dropped from article holders carried along the lower flight 3*b* of the upper conveyor 3. Similarly, article carrying holders moving away from the printing unit 2 along the lower flight 4*b* are caused to discharge articles which have been printed on both faces into the conveyor 5 through the cooperation between the camming abutment bar 84 and the followers 81 of the pivoted jaws 78 of the article holder assemblies. As will be appreciated, the speed of the conveyor 5 and the positioning of article holding cradles 5*a* are so related to the speed of the conveyor 4 and the spacing of the article holding assemblies carried on the conveyor 4 so as to insure the coordinated alignment of the holders carried by the conveyor 4 and the cradles carried by the conveyor 5. In this manner, articles released from the article holding assemblies as they move along the lower flight 4*b* drop freely by gravity into cradles 5 aligned immediately therebeneath, as shown in FIG. 1.

Conveyor 3 is provided with a somewhat similar article holder actuating assembly 90 substantially identical to assembly 82 and including an upper camming abutment bar 90*a* mounted upon a toothed rack 90*b* to lie in the path of followers 81 of article holders moving along flight 3*a*. The mechanism further includes a lower camming abutment bar 90*c* mounted on a tooth rack 90*d* and positioned in the travel path of cam followers 81 moving along the flight 3*b*. Assembly 90 is secured to the mechanism frame by a bracket assembly 91 corresponding to assembly 87. A pinion, not shown, is included in assembly 91 to engage racks 90*b* and 90*d* to effect the adjusting of the positions of bars 90*a* and 90*c*.

As heretofore noted, flights 3*b* and 4*a* travel in parallel alignment and at the same linear speed. Article holding assemblies carried on these two conveyors are equally spaced and coordinated in position so that an article holder on the lower flight 3*b* is always aligned with an article holder on the upper conveyor flight 4*a*. As will be apparent, article holder assemblies carried along the flight 3*b* face downwardly to facilitate the discharge of

articles, while article holding assemblies moving along the flight 4*a* face upwardly to facilitate the reception of articles dropped by gravity from conveyor flight 3*b*.

Camming bars 90*c* and 83 are positioned so as to effect the concurrent or simultaneous actuation of article holders moving along the flights 3*b* and 4*a*. In this manner, when a pivoted jaw 78 of an article holder moving along flight 3*b* is pivoted out of article engaging position, the pivoted jaw 78 of a holder moving on conveyor flight 4*a* in alignment with the holder moving along the conveyor flight 3*b* is caused to pivot to an open or article receiving position. In this manner, when an article is released from a holder as it moves along the conveyor flight 3*b*, it may drop by gravity into an article holder moving along the flight 4*a* which has been appropriately disposed to receive the article.

In a manner analogous to that in which abutment bar 83 places holders moving along flight 49 in article receiving condition, the abutment bar 90*a* places holders moving along the flight 39 in such a condition. In this article receiving condition, holders may receive articles at the transfer station from any suitable supply mechanism.

As shown in FIG. 1, camming bars 90*a* and 83 terminate in intermediate portions of their respectively associated flights so as to allow pivoted jaws 78 of the article holders to return to article engaging position while article holders move along the flights 3*a* and 4*a*. Thus, articles received by the conveyor flight 4*a* from the conveyor flight 3*b* and articles received by the flight 3*a* from the transfer mechanism are securely positioned and locked in place before moving into inclined portions of the conveyors. As will be appreciated, the returning of the pivoted jaws 78 to article engaging position completes the registration of articles to insure their proper positioning to receive indicia.

In certain instances due, for example, to failures in the feeding operation at the transfer station, a bottle may not be present in an article holder being supplied to a printing unit. As will be appreciated, when articles are not present in printing position adjacent a printing unit, the ink supplied to the printing screens will not be utilized, such that an undesired accumulation of ink will result. In order to prevent such an accumulation, a missing article control mechanism may be incorporated with each of the conveyors 3 and 4 of the system as shown in FIG. 7. Each such mechanism includes a conventional microswitch having an actuating, pivotable member 92. If an article should not be present in an article holder, the pivoted jaw 78 would swing to the inclined phantom line position shown in FIG. 7 so as to engage and trip the microswitch member 92 as it moved past this control device. The actuation of the switch 92, through means of conventional control mechanisms, serves to supply actuating fluid to the assembly 56 to effect the retraction of the ink distributing assembly 20. Through the operation of conventional control means not described, the assembly 20 would return to its operable position to effect the printing of articles carried by subsequent holders.

FIGS. 1, 9 and 10 illustrate the unique printing unit drive structure featured in this invention.

The idler roll assembly 70 of the drive structure includes a frame mounted and adjustable idler roll 93 which supports the curving portion of each double sprocket chain adjacent a printing unit. Each idler roll 93 is mounted by a conventional roller bearing assembly 94 on a stub axle 95 extending from a slideable bracket 96. As shown in FIG. 10, each bracket 96 includes a clamping plate 97 which is secured to a base 98 by conventional threaded fasteners 99. The position of the idler roll supporting bracket 96 may be adjusted along frame rail portions 100 and 101 so as to obtain the proper tautness in the conveyor chains.

As shown in FIG. 10, idler roll 93 lacks sprocket teeth which would normally project into the openings of the sprocket chains such as the illustrated chain 72. Accordingly, the idler roll may be positioned in close proximity to a printing unit such as the unit 2, so as to cause each sprocket chain to meshingly engage a sprocket toothed rim carried by the printing unit 2. As each rim is of the single toothed, rather than double toothed variety, each rim would engage only one row of sprockets in each chain. In the preferred arrangement, the inside row of sprockets in each double sprocket chain engages a toothed rim of a printing unit. As shown in FIG. 9, for example, the sprocket chain 72 passes around the periphery of idler roll 93 in meshing and driving engagement with the toothed sprocket rim 19. As will be appreciated, the chain 71 would similarly meshingly and drivingly engage the tooth sprocket rim 18.

As will be appreciated, a printing unit arrangement of the type described exists in connection with the conveyor 4 and the printing unit 2 as well as in connection with the first printing unit 1 and the upper conveyor 3.

Each idler roll 93 has a diameter so as to cause its supported endless conveyor chain to traverse an arcuate path adjacent its associated printing unit and cause arcuate article surfaces which are to receive indicia to move through an arcuate path substantially coplanar with these surfaces. Idler roll 93 is positioned relative to the travel path of the curved portions of the silk screen 21*a* so as to cause articles carried by the article holders on the conveyors to substantially, tangentially engage the curved portions of the silk screen 21*a* as the articles are moved by holders around the idler rollers 93. In this manner silk screen printing on article surfaces is effected without resorting to complex article holder movements which have heretofore often been found necessary to achieve tangential indicia forming contact between arcuate article surfaces and printing plates.

In the preferred and illustrated embodiment, an article is supported in a cradle 77 so as to permit the outwardly facing article face to be printed to lie in the same plane as the pitch of the conveyor chain as it passes over the idler rolls 93. As shown in FIG. 2, the silk screen printing surfaces 21*a* are supported on the printing units so as to lie substantially in the same plane as the pitch of the teeth of the toothed rim of the sprocket rims 18 and 19 so as to tangentially engage the article faces during the printing operation.

With the intermeshed conveyor and printing drum arrangement the conveyor chain effects the rotation of the printing unit such that the linear speed of the tangentially engaged portions of printing screens and article surfaces to be printed are the same so that conventional, silk screen printing may be accomplished.

If desired, suitable means not shown may be provided for inflating articles such as plastic, blow molded bottles during the printing operation to provide interior support for the printing surfaces in a manner well-known in the art.

In describing the over-all invention, and the details of operating components of the various mechanisms, the advantages of the invention have been demonstrated. In summary, these advantages include a structurally simple yet highly reliable apparatus for effecting the printing on two oppositely disposed faces of articles having a noncircular cross-section. A unique rotary printing unit is provided which affords continuous access to the unit interior so as to enable manipulation or adjustment of interior components, such as an ink distributor, while the printer is in operation. The rotary printer is particularly characterized by a unique arrangement of printing surfaces and supporting structures where supporting structures extend tangentially away from arcuately curved portions of the printing surfaces so that an ink distributor contacts only the curved printing surfaces during the rotation of the printing unit. In this manner, the ink distributor contacts only the printing surfaces during the

rotation of the printing unit, even though the distributor remains stationary throughout the printing operation.

The ink distributor featured in the invention is unique in that it distributes ink in accordance with the varying requirements of a printing pattern and is configured so as to facilitate its disposition within a rotary printing unit so as to allow an ink distributing portion to lie adjacent printing surfaces without the remainder of the distributor engaging portions of the unit during its rotation.

The article holders featured in the application are characterized by structural simplicity and yet obtain a uniquely accurate degree of article registration. The holders are particularly adapted for use with the article transfer mechanism featured in this application, which lacks the complexity of prior art structures but provides an effective mechanism for releasing articles from multiple conveyor flights and effecting the transfer of articles between superposed horizontal flights.

The devices incorporated in the printing mechanism of this invention for detecting the absence of articles in article holders constitute a unique utilization of an article holding component to effect the actuation of the retraction of the ink distributor out of its operable position.

A further characterizing advantage of the invention resides in the manner in which articles are carried on endless chains so as to be immovable with respect to the portions of the chains to which they are attached, yet effect tangential indicia forming contact between articles carried thereby and rotating printing surfaces.

Yet another advantage of the invention involves the manner in which endless conveyors associated with rotatable printing units themselves effect the rotation of the printing units so as to positively coordinate the operation of the conveyors with their associated printers.

The invention has been described with reference to preferred embodiments of the over-all mechanism and its various components. However, those skilled in the art may well recognize certain additions, deletions, modifications or substitutions in the disclosed mechanisms which would lie well within the purview of the invention as defined in the appended claims.

I claim:

1. An indicia forming mechanism comprising:
- a pair of interconnected annular rims, said rims being coaxial and spaced along their common axis;
- means for rotatably supporting said interconnected annular rims;
- means for rotating said interconnected rims about their common axis;
- a plurality of indicia forming plates, each said indicia forming plate having at least a portion thereof curved in an arc having a radius extending from said comomn axis and having other portions extending tangentially from the ends of said curved portion;
- support means for said indicia forming plates, said support means being carried by said rims and having portions supporting said other portions of said indicia forming plates which extend tangentially away from said curved, indicia forming plate portions;
- fluid distributing means disposed between said rims and being adapted to be positioned so as to engage the curved portions of said indicia forming plates and, while so positioned, to be spaced from said portions of said support means which support the tangentially extending portions of said indicia forming plates as said annular rims are rotated about their common axis.

2. A mechanism as described in claim 1 where at least one of said annular rims provides a central, circularly shaped aperture to afford access to said fluid distributing means while said annular rims are rotating.

3. A mechanism as described in claim 2 wherein said means for supporting said annular rims comprises:
- a nonrotatable, annular support member journaled in the central aperture of each of said annular rims, each said annular support member affording access to said fluid distributing means through the central aperture of the annular rim supported thereby by way of an opening formed in said support member and aligned with said central aperture.

4. A mechanism as described in claim 1 including means for adjusting the position of said mechanism transversely of the axis of rotation of said annular rims, said adjusting means including:
- rail means supporting said support members for slideable movement transverse to said axis;
- at least one rack fixed to said annular support member; and
- at least one rotatable pinion mounted with its axis stationary in relation to said support members and in engagement with said rack whereby, when said pinion is rotated, said mechanism is displaced transversely of said axis of rotation of said annular rims along the longitudinal axis of said rack.

5. A mechanism as described in claim 1 wherein said fluid distributing means comprises:
- a cylinder providing a reservoir of fluid, said cylinder including at one end
  - an elongate outlet facing the travel path of said indicia forming plates and extending parallel with the common axis of said rims, and
  - a cylinder head, sloping away from said outlet and inclined toward the other end of said cylinder; and
- a piston adapted to expel fluid through said outlet.

6. A mechanism as described in claim 5 wherein said piston has a fluid expelling face parallel to said sloping head of said cylinder.

7. A mechanism as described in claim 5 wherein said cylinder includes a flexible cylinder liner adapted to contain a supply of fluid, said liner having an outlet at said cylinder outlet, with said piston being adapted to compress said liner to expel fluid therefrom.

8. A mechanism as described in claim 5 and including a fluid distributing member positioned at said elongate outlet of said cylinder, said distributing member having a plurality of differently sized openings adapted to control the expulsion of fluid in response to the different requirements of an indicia pattern along the length of said outlet.

9. A mechanism as described in claim 1:
- wherein each said indicia forming plate comprises a printing screen, said screen being disposed with its mid portion curved in said arc and havng its end portons extending tangentially away therefrom, and
- wherein said support means comprises a rectangular screen frame for each printing screen, each said frame being disposed with its mid portion curved in said arc and having its end portions extending tangentially away therefrom,
- said mechanism further including a plurality of holding members extending between said annular rims, each said holding member including one slot on one side adapted to receive and retain the extermity of a tangentially extending end portion of one frame and a second slot on the other side adapted to receive and retain the extremity of a tangentially extending end portion of another frame.

10. An ink distributor for a printing mechanism, said ink distributor comprising:
- a cylinder defining an ink reservoir,
- a piston contained within said cylinder and adapted to pressurize ink contained therewithin;
- a cylinder head detachably connected to said cylinder,
- squeegee means connected to said cylinder means;
- said squeegee means extending transversely past an elongate edge of said cylinder head in spaced relation therewith so as to define an elongate ink outlet communicating with the interior of said cylinder;

an ink distributing member detachably connected to said cylinder head and projecting transversely of, and at least partially across, said elongate ink outlet, and

a plurality of notches formed on said ink distributing member and having open ends generally facing said squeegee means;

at least some of said open ended notches being of different sizes so as to restrict the flow of pressurized ink through said elongate ink outlet to differing degrees along said outlet in accordance with differing ink requirements of a printing pattern.

11. An apparatus as described in claim 10 wherein said cylinder head slopes away from said elongate ink outlet, generally toward the end of said cylinder containing said piston, and wherein said piston includes an ink expelling face which is sloped so as to be generally parallel to said sloping cylinder head.

12. An apparatus as described in claim 11 including a flexible liner contained within said cylinder and adapted to hold a supply of ink, said flexible liner having an outlet adjacent said ink distributing member with said piston being adapted to compress said liner to effect the expulsion of ink therefrom.

13. An article handling mechanism comprising:

a plurality of horizontally disposed and superposed, endless conveyor flights,

at least one article holder carried by each of said flights,

first article holder actuating means associated with one of said flights and adapted to cause a said holder to release an article so that it may fall by gravity away from said one flight,

second article holder actuating means associated with another second flight located beneath said one flight and adapted to actuate an article holder carried by said other of said flights to place it in an article receiving position,

said first article holder actuating means and said second article holding actuating means being adapted to simultaneously effect the releasing of an article from a holder carried by said one flight and the placing of an article holder carried by said other flight in an article receiving condition whereby an article released from said one fllight may fall by gravity into said holder carried by said other flight.

14. An article handling mechanism as described in claim 13 wherein,

each said article holder includes

a concave portion for supporting an article side,

an abutment for engaging and supporting one article end, and

a pivoted jaw adapted to resiliently engage and hold another end of said article, and

said article holder actuating means includes

a cam follower carried by each pivoted jaw, and

abutment means providing cam means disposed in the travel path of said cam followers and adapted to engage said followers and cause said jaws to pivot away from article engaging position and into article receiving position.

15. An article handling apparatus comprising:

an endless conveyor having an upper horizontal flight and a lower horizontal flight;

a plurality of article holders carried by said endless conveyor, each said holder including a pivotable, article engaging jaw,

article holder actuating means disposed between said upper and lower conveyor flights, said article holder actuating means including,

a first abutment means providing a cam surface positioned in the travel path of the pivoted jaws carried by said article holders as they move along said upper conveyor flight, and

second abutment means providing a cam surface disposed in the travel path of pivoted jaws of article holders as they are moved along said lower flight,

said cam surfaces each being adapted to engage said pivoted jaws and pivot said jaws out of article engaging position and into article receiving position.

16. An apparatus as described in claim 15:

wherein said first abutment is carried by a rack mounted for reciprocation toward and away from said upper flight,

wherein said second abutment is carried by a rack mounted for reciprocation toward and away from said lower flight,

said apparatus further including a pinion disposed between and engaging said first and second racks and adapted to simultaneously move said abutments toward or away from said upper and lower flights.

17. A printing mechanism including:

rotatable, indicia forming means;

endless conveyor means for transporting articles toward and away from said indicia forming means;

a plurality of article holders mounted on said endless conveyor means, each said article holder being rigidly attached to a portion of said endless conveyor and adapted to support an article such a median plane of the article extending from the longitudinal axis of said article radially to an arcuate article surface to receive indicia is perpendicular to the portion of said conveyor means which it intersects;

said articles being carried in said holders so that said surfaces to receive indicia face outwardly;

roller means disposed adjacent said indicia forming means with said endless conveyor means passing around said roller means;

said roller means having such a diameter as to support said endless conveyor means to cause it to traverse an arcuate path adjacent said indicia forming means and cause the arcuate article surface to receive indicia to move through an arcuate path substantially coplanar therewith;

said roller means and said indicia forming means being positioned so as to cause articles carried by said article holders to substantially tangentially engage indicia forming surface means of said indicia forming means as said articles are carried by said holders around said roller means,

said endless conveyor means being moved at a speed related to the rate of rotation of said indicia forming means so as to cause the surfaces of articles to receive indicia traveling around said roller means to move at the same linear rate as the indicia forming surface means with which they are engaged.

18. An apparatus as described in claim 17 wherein said endless conveyor means engages the periphery of said rotatable indicia forming means to effect the rotation thereof.

19. An apparatus as described in claim 18 wherein said endless conveyor means comprises sprocket chain means and wherein said sprocket chain means meshingly engages sprocket teeth means formed on the periphery of said indicia forming means.

20. A printing mechanism as described in claim 19 wherein said indicia forming surface means comprises a plurality of silk screen printing surfaces.

21. A screen printing mechanism comprising:

a pair of interconnected annular rims, said rims being coaxial and spaced along their common axis;

means for rotatably supporting said interconnected annular rims including a nonrotatable, annular support member journaled in a central circular aperture of each of said annular rims;

means for rotating said interconnected rims about their common axis;

a plurality of printing plates, each comprising a printing screen, each said screen being disposed with its mid-

portion curved in an arc having a radius extending from said common axis and having its end portions extending tangentially away therefrom;

support means for each of said printing plates, each said support means comprising a rectangular screen frame, each said frame being disposed with its mid-portion curved in said arc and having its end portions extending tangentially away therefrom;

ink distributing means positioned between said rims and being adapted to be positioned so as to engage the curved portions of said printing screen and, while so positioned, to be spaced from said tangentially extending portions of said screens and said screen frames as the annular rims are rotated about their common axis, said ink distributing means including

a cylinder providing a reservoir of ink, said cylinder including at one end

an elongate outlet facing the travel path of said screens and extending parallel with the common axis of said rims, and

a cylinder head, sloping away from said outlet and inclined toward the other end of said cylinder; and

a piston adapted to expel ink through said outlet;

each said annular support member affording access to said ink distributing member through the central aperture of the annular rim supported thereby by way of an opening formed in said support member and aligned with said central aperture.

22. An apparatus for consecutively forming indicia on two arcuate portions of an article, said apparatus comprising:

first indicia forming means,

first article conveying means adapted to convey articles toward and away from said first indicia forming means,

second indicia forming means spaced from said first indicia forming means,

second article conveying means adapted to convey articles toward and away from said second indicia forming means,

said first article conveying means having a first portion wherein articles are transported away from said first indicia forming means,

said second article conveying means having a second portion wherein articles are transported toward said second indicia forming means, with said second portion being disposed beneath and in spaced relation with said first portion of said first article conveying means,

means for releasing articles from said first portion which have been printed on one arcuate portion so that they may fall by gravity onto said second portion to be carried by said second article conveying means to said second indicia forming means to receive indicia on a second arcuate portion.

23. An apparatus as described in claim 22 wherein said first and second indicia forming means each comprises:

a pair of interconnected annular rims, said rims being coaxial and spaced along their common axis;

means for rotatably supporting said interconnected annular rims;

means for rotating said interconnected rims about their common axis;

a plurality of indicia forming plates, each said indicia forming plate having at least a portion thereof curved in an arc having a radius extending from said common axis and having other portions extending tangentially from the ends of said curved portion;

support means for each of said indicia forming plates, said support means being carried by said rims and having portions supporting said other portions of said indicia forming plates which extend tangentially away from said curved, indicia forming plate portions;

fluid distributing means disposed between said rims and being adapted to be positioned so as to engage the curved portions of said indicia forming plates and, while so positioned, to be spaced from said portions of said support means which support the tangentially extending portions of said indicia forming plates as said annular rims are rotated about their common axis.

24. An apparatus as described in claim 23:

wherein said first and said second article conveying means each comprises:

endless conveyor means for transporting articles toward and away from said first and second indicia forming means respectively; and

a plurality of article holders mounted on each of said endless conveyor means, each said article holder being rigidly attached to a portion of said endless conveyor means and adapted to support an article such a median plane of the article extending from the longitudinal axis of said article radially to an arcuate article surface to receive indicia is perpendicular to the portion of said endless conveyor means which it intersects;

said articles being carried in said holders so that said surfaces to receive indicia face outwardly;

and wherein said apparatus further includes roller means disclosed adjacent each said indicia forming means with each said endless conveyor means passing around said roller means;

each said roller means having such a diameter as to support a said endless conveyor means to cause it to traverse an arcuate path adjacent its associated indicia forming means and cause the arcuate article surface to receive indicia to move through an arcuate path substantially coplanar therewith;

each said roller means and its associated indicia forming means being positioned so as to cause articles carried by said article holders to substantially tangentially engage said indicia forming plates as said articles are carried by said holders around said roller means,

each said endless conveyor means being moved at a speed related to the rate of rotation of its associated indicia forming means so as to cause the surfaces of articles to receive indicia traveling around said roller means to move at the same linear rate as the indicia forming plates with which they are engaged.

25. An apparatus as described in claim 24 wherein said endless conveyor means comprises sprocket chain means and wherein said sprocket chain means meshingly engages sprocket teeth means formed on the periphery of said indicia forming means to effect the rotation thereof.

26. An apparatus as described in claim 25:

wherein each said printing plate comprises a printing screen disposed with its mid portion curved in said arc and having its end portions extending tangentially away therefrom; and

wherein said support means comprises a rectangular screen frame for each printing screen, with each such frame being disposed with its mid portion curved in said arc and having its end portions extending tangentially away therefrom.

27. An apparatus as described in claim 26 including means for retracting the fluid distributing means of each of said indicia forming means away from engagement with the curved portions of the indicia forming plate carried thereby in response to the absence of articles to receive indicia, said means including:

a pivotable, article holding jaw member adapted to pivot to a particular position in the absence of an article in a holder,

an actuating member positioned in the travel path of said jaw members when they are pivoted to said particular positions, and

fluid actuated means for effecting the retraction of said fluid distributing means, said retraction being effected in response to engagement between a pivoted jaw member and said actuating member.

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