

July 7, 1964

C. H. DERRICKSON

3,139,824

SILK SCREEN PRINTING APPARATUS

Filed April 18, 1962

3 Sheets-Sheet 1

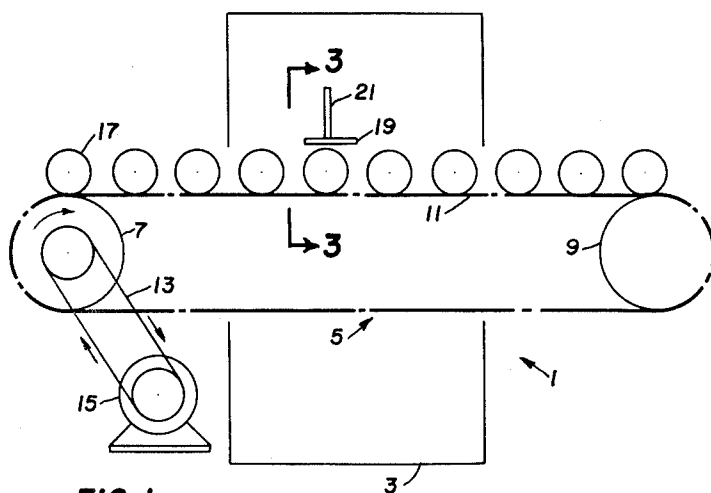


FIG. 1

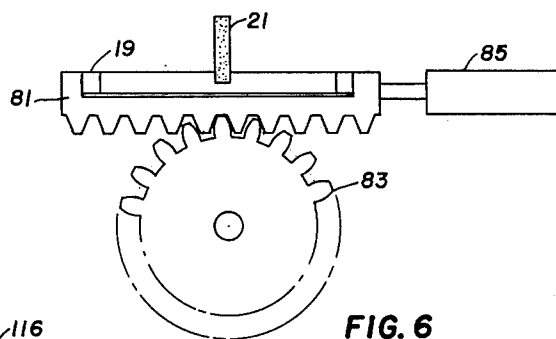


FIG. 6

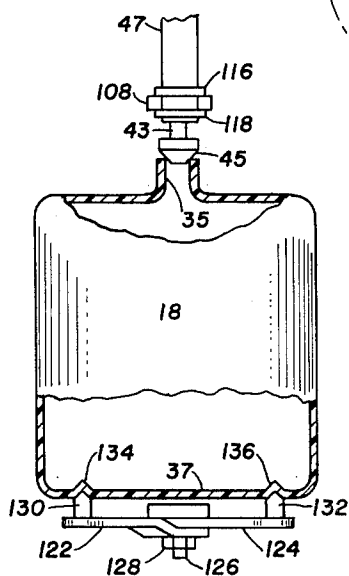


FIG. 10

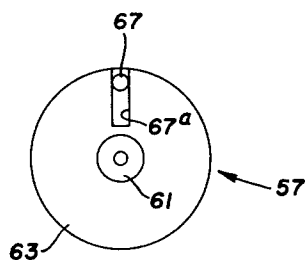


FIG. 4^a

INVENTOR.
CHARLES H. DERRICKSON

BY

Neal J. Moseley
ATTORNEY.

July 7, 1964

C. H. DERRICKSON

3,139,824

SILK SCREEN PRINTING APPARATUS

Filed April 18, 1962

3 Sheets-Sheet 2

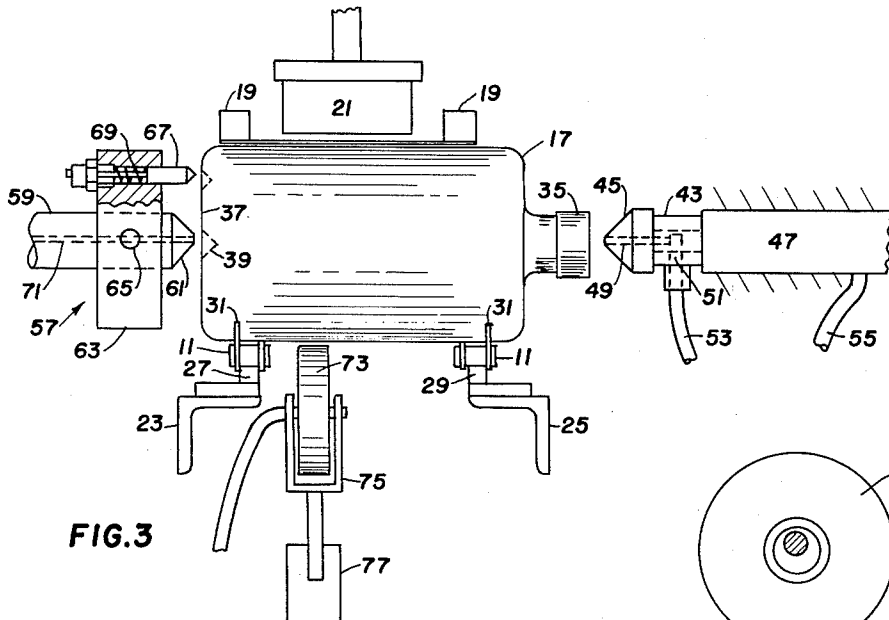


FIG. 3

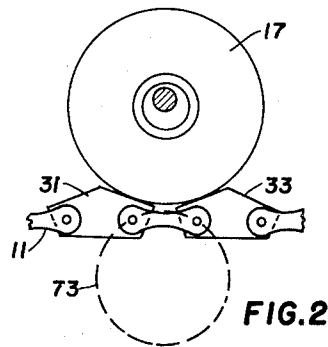


FIG. 2

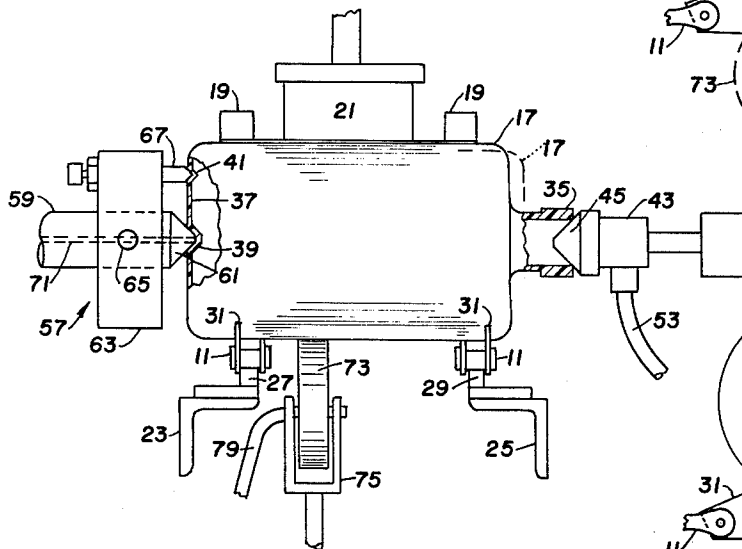


FIG. 4

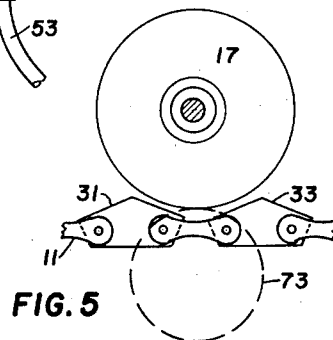


FIG. 5

INVENTOR.
CHARLES H. DERRICKSON

BY

Herb J. Mosely
ATTORNEY.

July 7, 1964

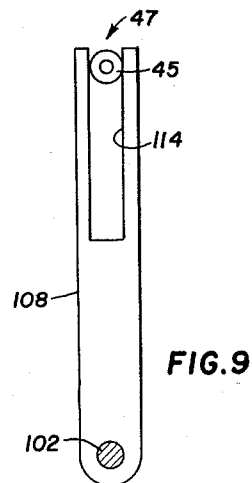
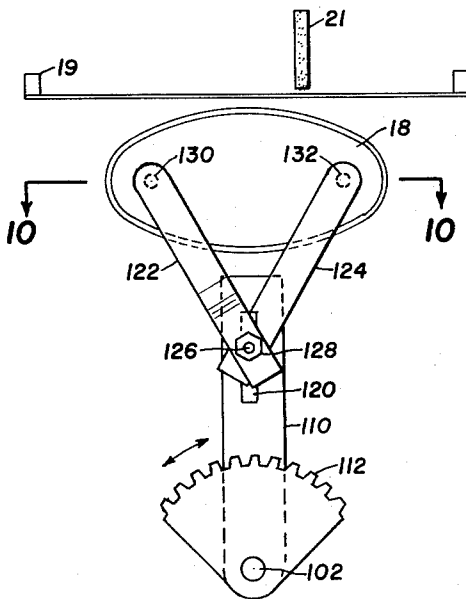
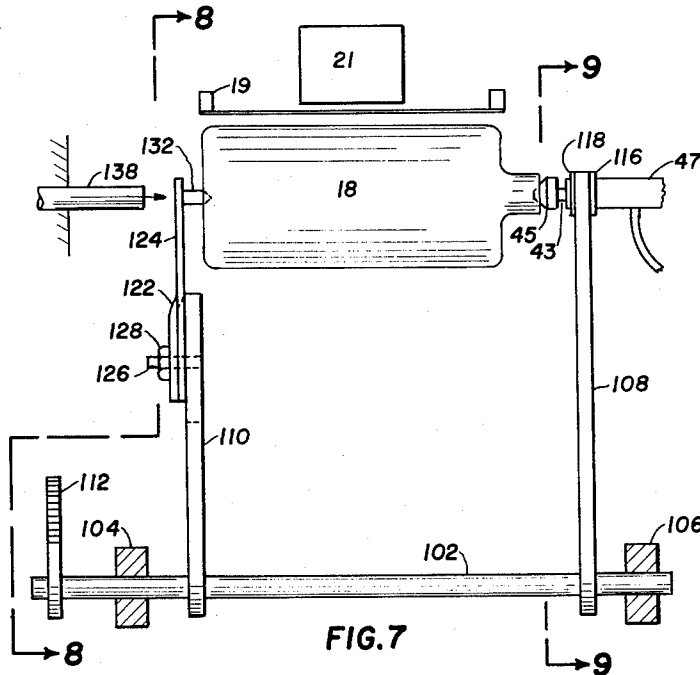
C. H. DERRICKSON

3,139,824

SILK SCREEN PRINTING APPARATUS

Filed April 18, 1962

3 Sheets-Sheet 3



INVENTOR.
CHARLES H. DERRICKSON
BY
Herb J. Moseley
ATTORNEY.

1

2

3,139,824

SILK SCREEN PRINTING APPARATUS

Charles H. Derrickson, Chicago, Ill., assignor to The American Screen Process Equipment Co., Chicago, Ill., a corporation of Illinois

Filed Apr. 18, 1962, Ser. No. 188,306

14 Claims. (Cl. 101-124)

This invention relates to new and useful improvement in silk screen printing machines and more particularly to a silk screen printing apparatus, for printing cylindrical, conical or oval shaped bottles and having an improved supporting means for holding and rotating the bottles during printing.

The silk screen printing apparatus is extensively used in the printing of designs and labels on bottles and other containers. With the rapid development in recent years of the use of plastic bottles and containers, particularly blow-molded bottles, there has developed a great need for a silk screen printing machine which can handle bottles at a relatively high rate of speed. While many types of silk screen printing machines are manufactured in the United States and many types of machines are imported from foreign countries, still there is no machine which is versatile enough to handle bottles of different sizes at a relatively high rate of speed.

Smith et al. U.S. Patent 2,009,008 discloses a silk screen printing apparatus for printing on the sides or necks of bottles such as milk bottles. The Smith et al. apparatus has a pair of supporting members which support the bottle and rotate it in contact with a silk screen stencil. One of supporting members is a generally concave shaped nose piece which fits into and supports the neck opening of the bottle. The other supporting member is a base member which is slightly recessed to receive the base of the bottle. This apparatus has the disadvantage that it cannot handle different size bottles without changing the size of the supporting members. Furthermore, the supporting member for the base is located at a position where it can bear against and cut into the silk screen stencil. The Smith et al. apparatus however, is typical of silk screen printing apparatus in use in the United States and the present invention represents an improvement over such apparatus.

Cone, U.S. Patent 2,132,818 discloses an apparatus which includes some improved features over the Smith et al. apparatus. The Cone printing apparatus includes the additional feature of a detent located adjacent the periphery of the supporting member of the base of the bottle which registers with a depression in the base of the bottle to effect a proper registration of the bottle for the location of printing at a predetermined desired position.

More recent U.S. patents such as Groce 2,553,089 disclose silk screen printing machines in which the bottle or container is held in an inclined position so that print may be placed on either the side or neck of the bottle. In substantially all silk screen printing machines which are designed for printing bottles or containers the bottle or container is held by a suitable support in contact with the silk screen stencil. The bottle is then rotated and the stencil is moved at the same linear speed so that there is no slippage between the surface being printed and the stencil. This arrangement is usually accomplished by supporting the stencil on a rack which engages a pinion gear which rotates the bottle. The size of the rack and pinion gears is selected so that movement of the stencil causes the bottle to rotate at the same linear surface speed thus effecting the desired printing on the surface of the bottle or container without slippage which would result in smearing of the printing.

The prior art printing apparatus, however, is subject

to the disadvantage that it cannot handle bottles of different sizes and cannot handle oval shaped bottles conveniently.

It is therefore one object of this invention to provide a new and improved silk screen apparatus having a rotatable supporting means for lifting cylindrical, conical, or oval shaped bottles into contact with a silk screen stencil and rotating or moving said bottle in coordination with the movement of the stencil to print on the peripheral surface of the bottle.

Another object of this invention is to provide a new and improved silk screen printing apparatus having a supporting means which is adapted for supporting cylindrical bottles of different size for movement in contact with a silk screen stencil.

Still another object of this invention is to provide an improved silk screen printing apparatus having a rotary supporting means for supporting oval shaped bottles in contact with a silk screen stencil and moving said bottles in coordination with the movement of the stencil.

Still another object of this invention is to provide an improved silk screen printing apparatus having an adjustable supporting means for supporting oval bottles of various sizes in contact with a silk screen stencil for printing on the peripheral surface of the bottle.

A feature of this invention is the provision of the silk screen printing apparatus having a rotary supporting means for bottles including a pair of conically shaped movable supporting members, one of which is engageable with the opening of the bottle and the other of which is engageable with a depression in the center of the base of the bottle.

Another feature of this invention is the provision of improved silk screen printing apparatus having a supporting means for bottles being printed comprising a movable member having a conical base engageable with the opening of the bottle and a second supporting member comprising a rotatable chuck having a conical base engageable with a central depression in the base of each bottle and a detent positioned for engagement with a second depression on each bottle for registering said bottle for location of printing thereon.

Still another feature of this invention is the provision of new and improved silk screen printing apparatus having a supporting means comprising a movable member having a conical face engageable with the opening of the bottle and a pair of adjustable movable arms with conically shaped members thereon engageable with recesses in the base of an oval shaped bottle to be printed, said supporting member and adjustably movable arms being supported on a rotatable shaft in a distance such that the rotation of the shaft will move the bottle about the radius of curvature of the surface being printed in coordination with the stencil.

Still another feature of this invention is the provision of a bottle or container shaped to fit the supporting members of the novel printing apparatus of this invention.

Other objects and features of this invention will become apparent from time to time throughout the specification and claims as hereinafter related.

In the accompanying drawings, to be taken as a part of the specification, there are clearly and fully illustrated two preferred embodiments of this invention, in which drawings,

FIGURE 1 is a diagrammatic view of the silk screen printing apparatus in which the subject invention can be used,

FIGURE 2 is a detail view showing the bottle supported on the conveyor in the silk screen printing apparatus of FIGURE 1,

FIGURE 3 is a detail view looking along the line 3-3 of FIGURE 1 and showing a bottle supported on the con-

veyor prior to engagement with the rotatable bottle supporting means,

FIGURE 4 is a view substantially identical to FIGURE 3 showing the bottle supporting means in engagement with the bottle and ready for printing of the surface of the bottle,

FIGURE 4* is an end view of a modification of the bottle supporting means showing a radially adjustable detent,

FIGURE 5 is a detail view of the conveyor and bottle substantially the same as FIGURE 2 but showing the bottle lifted from the conveyor by the rotatable supporting means as in FIGURE 4,

FIGURE 6 is a detail view, partially diagrammatic, showing the gear arrangement whereby movement of the silk screen stencil causes the bottle to be rotated in contact therewith,

FIGURE 7 is a view similar to FIGURES 3 and 4 showing an alternate embodiment of the invention having a supporting means for lifting and moving an oval shaped bottle,

FIGURE 8 is an end view of the embodiment of the supporting means shown in FIGURE 7 and illustrating the adjustable supporting arms for supporting oval shaped bottles of varying size,

FIGURE 9 is a view taken on the line 9—9 of FIGURE 7, and

FIGURE 10 is a view taken on the line 10—10 of FIGURE 8.

Summary of the Invention

This invention comprises a new and improved silk screen printing apparatus for printing cylindrical or oval bottles having a movable silk screen stencil and squeegee means associated therewith, conveyor means for moving bottles into position adjacent the stencil for printing, and rotary supporting means for lifting individual bottles into contact with the stencil and rotating or otherwise moving the bottle in coordination with movement of the stencil to print on the peripheral surface of the bottle. The invention is more particularly concerned with an improvement in the bottle supporting means which comprises a first supporting member having a movable member with a conical face engageable with the opening of the bottle and a second supporting member comprising a rotatable chuck engageable with a depression in the center of the base of each bottle and a detent positioned radially outward therefrom engageable with a second depression on each bottle to align the bottle for printing and to cause the bottle to be rotated upon rotation of the supporting chuck. The supporting means is arranged with the conical supporting portions positioned above the center line of each bottle a predetermined distance such that engagement with opposite ends of the bottle will cause the bottle to be lifted into engagement with the silk screen stencil. In an alternate embodiment of the invention the supporting means is constructed to provide for printing of oval shaped bottles. In this embodiment of the invention the conical shaped supporting member engageable with the opening of the bottle is supported on an arm extending radially outward from a rotatable shaft and the supporting means at the base of the bottle comprises a pair of adjustable arms supported on a supporting arm extending outwardly from said rotatable shaft. The adjustable arms each have a conical member engageable with a recess, preferably on the major axis of the bottle being supported. The supporting means is constructed so that the bottle is supported for rotation about the rotatable shaft at a distance corresponding to the radius of curvature of the portion of the peripheral surface of the bottle which is to be printed. In both embodiments of the invention the conical shaped supporting member for the opening of the bottle and for the base permits use of the apparatus for printing bottles of various sizes. This supporting arrangement has a further advantage over the

prior art support for the base of the bottle in that it does not rub against the silk screen stencil and tend to cut it.

Description of Printing Apparatus and Support

Referring now to the drawings by numerals of reference and more particularly to FIGURES 1 to 6, there is shown a preferred embodiment of the invention for use in the printing of cylindrical bottles. In FIGURE 1 there is shown diagrammatically the overall silk screen printing apparatus 1 comprising supporting base 3 on which there is supported conveyor means 5. Conveyor means 5 comprises sprocket wheels 7 and 9 respectively on which is supported conveyor chain 11. Sprocket wheel 7 is driven by drive belt 13 and motor 15 or any other suitable driving means. Bottles 17 are fed by any suitable means, manual, automatic, or semi-automatic, to conveyor belt 11 and are moved by the conveyor past silk screen stencil 19 and squeegee 21 where the bottles are lifted, printed and discharged back to the conveyor. At the end of the conveyor the bottles are discharged either to a suitable container for storage, if the ink used in printing is fast drying, or to a suitable dryer if the ink is of a slow drying type. A dryer which is particularly useful in drying printed bottles from the silk screen printer is shown in detail in Green and Derrickson patent application Serial No. 167,725 filed January 22, 1962.

In FIGURES 2 to 6 inclusive the details of the supporting mechanism for bottles being printed in this apparatus are shown. Supporting structure 3 of silk screen printer 1 includes supporting members 23 and 25, preferably angle irons, extending in the same direction as conveyor belt 11 in FIGURE 1 (and shown in FIGURES 3 and 4). Supporting members 23 and 25 include runners or rail members 27 and 29 on which conveyor chain 11 rides. In FIGURES 2 and 5 there are shown detail side views of conveyor chain 11 with bottles 17 supported thereon. Conveyor chain 11 includes links 31 and 33 which are of polygonal shape and form a V-shaped supporting surface for opposite ends of bottles 17. In FIGURE 2 bottle 17 is shown at rest on conveyor links 31 and 33 while in FIGURE 5 the bottle is shown in position to which it is lifted by the rotary supporting means during the printing operation. Bottle 17 which rests on conveyor links 31 and 33 is preferably a soft flexible plastic bottle, although the apparatus is adaptable for use with glass or other rigid bottles. Bottle 17 has a necked opening 35 at one end and a base 37 at the opposite end having a recess 39 of circular cross section, preferably a conical recess, located at the center thereof. Base 37 also includes a second recess 41 located preferably adjacent the periphery of the base and which is used for registering the position of the bottle at the start of the printing operation in a manner to be subsequently described.

The apparatus includes an improved supporting arrangement for the bottle during the printing operation which comprises movable supporting member 43 having a conical face 45 positioned for engagement with opening 35 of bottle 17. Member 43 is supported in and actuated by cylinder 47 which is arranged for operation by compressed air or other compressed gas. Air cylinder 47 is shown diagrammatically since air motors of this type are well known in the art. Supporting member 43 is provided with internal passages 49 and 51 connected to air hose 53 which is in turn connected to a source of compressed air or other source of compressed gas (not shown). Air cylinder 47 is similarly connected by air hose 55 to a compressed air or other compressed gas source.

At the base end of bottle 17 there is positioned a second supporting means comprising a rotatable chuck 57 consisting of shaft 59 having conical face 61 engageable with the central (conical) recess 39 in bottle 17. A cylindrical collar 63 is supported on shaft 59 and held in position by a suitable retaining means such as set screw 65. Collar 63 supports a movable detent 67 which

5

is urged by spring 69 toward engagement with recess 31 adjacent the periphery of base 37 of bottle 17. Shaft 59 is provided with a longitudinally extending passageway 71 for introduction of compressed air or other compressed gas for freeing bottle 17 from engagement with conical face 61 at the end of the printing operation. The supporting members at opposite ends of bottle 17 are arranged with conical faces 45 and 61 respectively positioned for engagement with the open end 35 and recess 39 of bottle 17. These members are positioned with the longitudinal center line of conical faces 45 and 61 a small predetermined distance above the center line of bottle 17 so that engagement of conical faces 45 and 61 with opening 35 and recess 39 will cause bottle 17 to be lifted from conveyor 11 as shown in FIGURES 4 and 5.

Positioned between supporting members 23 and 25 below conveyor chain 11 is drive wheel 73 which is arranged for engagement with bottle 17 to rotate the same until detent 67 engages recess 41. Drive wheel 73 is supported in forked frame 75 which is arranged for actuation by any suitable actuating means, shown diagrammatically as 77. Actuating means 77 may be a compressed air cylinder, solenoid, mechanical actuator or the like. Drive wheel 73 is actuated by any suitable actuating means such as flexible drive shaft 79 which is connected to any suitable power source (not shown) such as the motor 15 which drives conveyor chain 11.

Since the supporting arrangement shown and described in FIGURES 2 to 5 is suitable for use with almost any of the silk screen printing machines available commercially the connection of the apparatus in a particular machine is not shown in detail. It is desirable, however, to illustrate the usual arrangement for actuation of the silk screen and rotary support for the bottle 17 which is being printed. In FIGURE 6 the actuating arrangement is shown at least partially in diagrammatic form. Silk screen 19 is secured to or supported on rack 81 which is engaged by pinion gear 83. Rack 81 is arranged for actuation by any suitable actuating mechanism 85 which may be a compressed air cylinder, solenoid, or mechanical actuating means operated by motor 15 or any other suitable power source. Shaft 59 of supporting member 57 is secured to pinion gear 83 for rotation thereby. From this arrangement it is seen that lateral movement of silk screen stencil 19 by actuating means 85 causes rack 81 to turn pinion gear 83 and rotate shaft 59, thus causing the bottle to be rotated by supporting member 57 for movement with the silk screen stencil for printing.

Operation

Bottles 17 are preferably spaced on conveyor belt 11 a sufficient distance so that a bottle can be picked up in the printing section of the apparatus, printed and dropped back on the conveyor before the next bottle is picked up for printing. Alternatively, the conveyor belt 11 may be arranged for intermittent movement and bottles 17 picked up, printed and returned to the conveyor at the same point on the conveyor belt. In such an intermittent operation the bottles can be placed more closely together on the conveyor belt. When conveyor belt 11 moves a bottle 17 into position for printing, the bottle and the bottle supporting and rotating means are positioned substantially as shown in FIGURE 3. Supporting member 43 is retracted into air motor 47 as shown in FIGURE 3 and bottle 17 is spaced on conveyor belt 11 intermediate the conical supporting face 45 of supporting member 43 and the conical supporting face 61 of chuck 57. The bottle is not necessarily positioned with registration recess 41 aligned with detent 67 although the bottle is subsequently moved into alignment during the pickup and printing operation. As was previously noted, bottle 17 is usually of a flexible plastic which has been blow-molded or otherwise formed into the desired bottle shape with central recess 39 and peripheral recess 31 in the base thereof. While the apparatus is primarily designed for use with

6

molded plastic bottles it can be used with other rigid or semi-rigid containers which have the necessary openings and/or recesses as shown in the bottle for engagement by the container supporting means. When bottle 17 is moved by conveyor 11 into position for printing, a suitable actuating means (not shown) causes compressed air (or other compressed gas) to be supplied to lines 53 and 55 for actuation of supporting member 43. The supply of compressed gas to compressed air motor 47 causes member 43 to move to the left as shown in FIGURE 4.

Members 33 upon moving outward from compressed air motor 47 engages opening 35 on bottle 17 with conical face 45 entering and contacting said opening. Movement of member 33 against opening 35 causes bottle 17 to be moved to the left (as shown in FIGURES 3 and 4) from the dotted position to the full line position in FIGURE 4. Movement of bottle 17 by member 43 causes depression 39 in the center of the base of bottle 17 to be engaged by conical face 61 of chuck 57. As is shown in FIGURE 2, the center line of conical members 45 and 61 is the same and is located a slight predetermined distance above the center line of bottle 17 to cause same to be lifted from conveyor belt 11. In the preferred form of the invention this lifting movement brings the bottle into contact with the stencil. In other forms of the invention the bottle may be merely lifted clear of the conveyor belt and contacted with the stencil by further movement of the supporting means or by movement of the stencil toward the bottle. In FIGURE 4 member 43 is shown in its fully actuated position with conical face 45 engaging opening 35 and conical face 61 of chuck 57 engaging recess 39 in the base of bottle 17. In this view bottle 17 has moved from the dotted position to the full line position and has been lifted from conveyor chain 11 into engagement with silk screen stencil 19. When member 43 is in engagement with necked opening 35 as shown in FIGURE 4 line 53 supplies compressed air (or other compressed gas) to the interior of bottle 17 to provide a slight gas pressure within the bottle to resist deformation of the bottle during printing and thus causes the bottle to maintain a tight, relatively unyielding contact with stencil 19. When member 43 engages conical face 45 with neck opening 35 and moves bottle 17 to effect engagement between conical recess 39 and conical face 61 of chuck 57 the registration recess 41 may or may not be in position for engagement by detent 67. To cause bottle 17 to be turned to effect engagement between detent 67 and recess 41 actuating wheel or roller 73 is moved upward by an actuating mechanism 77 and is rotated in contact with the outer surface of bottle 17 as shown in FIGURES 4 and 5. When roller 73 is rotated against bottle 17 the bottle is rotated until detent 67 registers with recess 41 in base 37 of the bottle. When the bottle is turned to a position where conical face 45 is tightly engaged in neck opening 35, conical face 61 is tightly positioned in recess 39, and detent 67 is positioned in registration recess 41 the mechanism is ready for printing the bottle.

With the bottle located in position as shown in FIGURE 4 silk screen stencil 19 and rack 81 are moved by actuating mechanism 85, shown in FIGURE 6. Movement of stencil 19 and rack 81 causes pinion gear 83 to rotate, which in turn causes shaft 59 to rotate supporting chuck 57. The rotation of chuck 57 causes bottle 17 to rotate in contact with silk screen stencil 19 with the result that bottle 17 is printed by ink which is forced through the silk screen stencil by squeegee 21. Upon completion of rotation of bottle 17 and movement of silk screen stencil 19 through its entire stenciling movement compressed air (or other compressed gas) is cut off at lines 53 and 55, permitting member 43 to retract into air motor 47 from the position in FIGURE 4 to the position shown in FIGURE 3. Simultaneously compressed air is supplied through passageway 71 in shaft 59 to effect movement of bottle 17 away from supporting face 61 and detent 67 so that the bottle is returned to conveyor chain 11 in sub-

stantially the same position as is shown in FIGURES 2 and 3. Simultaneously with the release with the bottle 17 for the return to conveyor belt 11, silk screen stencil 19 and rack 81 are moved back to their respective initial positions in preparation for another printing operation.

From the description of assembly and operation of the supporting and rotating means for a silk screen printing machine shown in FIGURES 1 to 6 it is seen that the apparatus used in this invention is independent of size of the bottle being printed. The conical face 45 of supporting member 43 is of a sufficient size to handle bottles ranging from a fraction of one inch up to several inches in diameter (although the bottles in any given run must be of the same size). Similarly the conical face 61 of the chuck 57 will fit a recess of the same conical shape in the base of any bottle regardless of size. If the apparatus is to be used on bottles which vary in size to a very large extent the modified support shown in FIG. 4^a can be used. In that modification detent 67 is positioned in a radially extending slot 67^a on collar 63 so that detent 67 can be adjusted inwardly and outwardly from shaft 59. Nevertheless, the apparatus as shown is operative to handle bottles of considerable variation in size even without adjustment of the position of the detent radially from the shaft. When the apparatus is used for printing bottles of different size it is necessary to either substitute a different pinion gear 83 (having a gear ratio relative to rack 81 providing movement of silk screen stencil 19 at the same linear rate as the periphery of bottle 17 being rotated) or use an adjustable gear arrangement in place of pinion gear 83 so that the movement of rack 81 relative to pinion gear 83 can be adjusted to correspond to the desired rate of movement relative to the rotation of any given bottle being printed.

Apparatus for Printing Oval Shaped Bottles

The printing of bottles having a true oval or elliptical cross section would be extremely difficult and would require a complex cam arrangement to rotate the bottle at a uniform surface speed relative to movement of the silk screen stencil. However, practically all molded bottles of so-called oval cross section are actually of a shape known as pseudo-ellipse which is constructed from several different circular curves of substantially different radii. If an oval bottle is actually constructed in the shape of a pseudo-ellipse having extended surface portions of circular cross sections the bottle can be printed easily on a silk screen printing machine by supporting the bottle on a rotatable arm which rotates the bottle about an axis having the same radius as the radius of curvature of the surface being printed. Such a printing operation is substantially identical to the printing of a hypothetical cylinder of larger diameter, with the surface being printed corresponding to a segment of such a cylindrical surface. Silk screen printing machines have been constructed and are in commercial use to a limited extent which will support an oval shaped bottle in the manner just described and rotate the bottle around an axis located at the center of curvature of the surface being printed. However, printing machines of this type have required specially tooled supporting bases of an oval shape for receiving the base of the bottle being printed to hold the same rigidly during movement of the bottle for printing. This has caused machines of this type to be very expensive and has caused such machines to be non-versatile in that bottles of different sizes and curvatures cannot be printed due to the requirement of a different support for each bottle and a different radius of curvature for rotation of the bottle.

In FIGURES 7 to 10 there is shown a modification of the apparatus shown and described in FIGURES 1 to 6 which is adapted for use in the silk screen printing of bottles of oval cross section.

In FIGURES 7 to 10, parts which have the same structure as in the other figures are given the same reference

numerals while parts having a different structure or different function are given new reference numerals.

In FIGURES 7, 8, 9 and 10 there is shown a modification of the bottle supporting and rotating means which is especially adapted for printing of oval shaped bottles. In FIGURE 7 bottle 18 is shown in position after being lifted from the conveyor by the bottle supporting means. The supporting mechanism for bottle 18 comprises supporting shaft 102 which is supported in bearings 104 and 106. Shaft 102 is provided with laterally extending arms 108 and 110 which are secured on the shaft for rotation therewith. At one end of shaft 102 is provided a radial gear 112 for rotating the shaft and arms 108 and 110. Arm 108 is provided with a longitudinally extending slot 114 (see FIG. 9) in which is supported air motor 47 and movable supporting member 43 having conical face 45. Air motor 47 is secured in slot 114 by retaining nuts 116 and 118 which provide for adjustable positioning of the air motor at varying radial distances from shaft 102.

Laterally extending arm 110 is provided with slot 120 in which are adjustably secured a pair of adjustably movable arms 122 and 124 secured in position by locking pin 126 and nut 128. Adjustably movable arms 122 and 124 are provided with conically shaped supporting members 130 and 132 respectively, which are engageable with conical recesses 134 and 136 in the base of bottle 18. Recesses 134 and 136 are preferably spaced equi-distant from the center of the base of bottle 18 along the major axis thereof. While recesses 134 and 136 are shown as being conically shaped and are preferably that shape, other depressions of circular cross section into which conical supporting members 130 and 132 can be inserted may be used. Since the introduction of compressed air through supporting members 130 and 132 for ejecting bottle 18 at the end of the printing cycle is somewhat impractical, this embodiment of the printing apparatus is provided with a separate air jet 138 positioned adjacent to silk screen stencil 19 for ejecting bottle 18 from the bottle supporting means at the end of a printing cycle.

Operation

In this embodiment of the invention the links on conveyor chain 11 are spaced to receive an oval bottle 18 and hold the same accurately for pickup by the bottle supporting and rotating means adjacent to the silk screen stencil. Bottle 18 has a necked opening 35 at one end and base 37 at the opposite end provided with recesses 134 and 136 which are preferably located equi-distant from the center axis of the base. The bottle is positioned to be engaged by conical face 45 of supporting member 43 at neck opening 35 and on the base 47 by conical shaped supporting members 130 and 132 fitting into recesses 134 and 136.

When bottle 18 reaches the point of pickup for the printing operation air motor 47 is actuated to move member 43 to engage conical face 45 with opening 35 and move bottle 18 until depressions 134 and 136 are engaged by supporting and conical shaped members 130 and 132. At this point of pickup arms 110 and 108 are rotated to a position so that when bottle 18 is picked up, rotation of shaft 102 will move arms 108 and 110 to lift bottle 18 away from conveyor chain 11 into engagement with silk screen stencil 19.

As shaft 102 rotates and moves arms 108 and 110 bottle 18 is engaged with silk screen stencil 19 and is moved in contact therewith so that squeegee 21 forces ink through the stencil and prints the desired words and/or design on the bottle. The rotation of shaft 102 is accomplished by movement of radial gear 112 which is substituted for pinion gear 83 in FIGURE 6 for actuation by rack 81 which is secured to silk screen stencil 19. At the completion of the stenciling operation the compressed air is cut off to air motor 47 and member 43 retracts to allow bottle 18 to be redeposited upon conveyor chain

11. Simultaneously with the retraction of member 43 compressed air is applied through jet 138 to move bottle 18 away from supporting members 130 and 132.

From the foregoing description of the modification of the apparatus shown in FIGURES 7 to 10 and the operation thereof it is apparent that this apparatus is applicable to the printing of bottles of various size and curvature. The arms 108 and 110 can be adjusted longitudinally of shaft 102 to accommodate bottles of large or smaller size. Likewise, supporting members 43, 122 and 124 can be adjusted in their respective supporting slots in arms 108 and 110 for different radial distances from shaft 102. Supporting arms 122 and 124 can be adjusted about supporting pin 126 to align conical supporting members 130 and 132 with depressions 134 and 136 of varying distance in bottles of different sizes. As in the apparatus shown and described in FIGURES 1 to 6, the apparatus in FIGURES 7 to 10 may require the substitution of different size radial gears 112 for the printing of bottles of different size or curvatures. When the size of the bottle is changed the same gear can be used if the surface to be printed has the same radius of curvature. However, if the bottle of different size has a different radius of curvature, then the supporting members on arms 108 and 110 must be adjusted to the new radius of curvature and a different gear 112 must be substituted on shaft 102 so that the gear will provide a movement in conjunction with the movement of silk screen stencil 19 which permits no slippage between bottle 18 and stencil 19.

While I have described my invention fully and completely with emphasis on two preferred embodiments of the invention I wish it to be understood that within the scope of appended claims this invention may be practiced otherwise than as specifically described herein.

The invention in which a preferred embodiment or privilege is described is as follows:

1. In a silk screen printing apparatus for printing bottles comprising a movable silk screen stencil and squeegee means associated therewith, means for supporting bottles in position adjacent the stencil for printing, and rotary supporting means for lifting individual bottles into contact with said stencil and moving each bottle in coordination with movement of said stencil to print on the peripheral surface of the bottle, each of said bottles having an opening at one end and a base at the opposite end having first and second depressions spaced along a diameter of the bottle; the improvement in said rotary supporting means which comprises first and second supporting members engageable with opposite ends of a bottle positioned therebetween, said first supporting member comprising a movable member having a conical face engageable with the opening of the bottle, said second supporting member comprising a rotatable chuck having first and second supporting points engageable with said first and second depressions in said bottle, and said first and second supporting members being operable to engage opposite ends of a bottle positioned therebetween and to lift said bottle away from said first named supporting means and upon rotation of said chuck to rotate said bottle.

2. In a silk screen printing apparatus for printing bottles comprising a movable silk screen stencil and squeegee means associated therewith, means for supporting bottles in position adjacent the stencil for printing, and rotary supporting means for lifting individual bottles into contact with said stencil and rotating each bottle in coordination with movement of said stencil to print on the peripheral surface of the bottle, each of said bottles having an opening at one end and a base at the opposite end having a first depression of circular cross section positioned on the center line of the bottle and a second depression adjacent to the periphery of the base; the improvement in said rotary supporting means which comprises first and second supporting members engageable with opposite ends of a bottle when positioned there-

between, said first supporting member comprising a movable member having a conical face engageable with the opening of the bottle, said second supporting member comprising a rotatable chuck having a conical face engageable with the central depression in each bottle and a detent positioned for alignment with said second depression on each bottle, said supporting members being positioned above the center line of each bottle, when positioned therebetween, a predetermined distance such that engagement of said conical faces with the opposite ends of the bottle will lift the same away from said first-named supporting means toward engagement with said silk screen and rotation of said chuck will move said detent to rotate the bottle.

3. An apparatus as defined in claim 2 in which said detent is mounted for adjustment relative to the conical face of said chuck to support bottles having said depressions spaced at greater or lesser intervals.

4. An apparatus as defined in claim 2 including means to move said first and second supporting members relative to each other to engage a bottle for printing and to release the bottle for return to said supporting means.

5. An apparatus as defined in claim 2 in which said first supporting member has a passage adapted for connection to a compressed gas source to supply gas pressure to the interior of a bottle during printing.

6. An apparatus as defined in claim 2 in which said second supporting member has a passage adapted for connection to a compressed gas source to supply gas pressure to the base of a bottle to move the same away from the chuck on completion of the printing operation.

7. An apparatus as defined in claim 2 in which the central depression in the base of each bottle is conical in shape and the conical face of the chuck fits said conical depression to hold the bottle securely during printing.

8. An apparatus as defined in claim 2 in which there is provided means for rotating a bottle upon engagement of said conical faces with opposite ends thereof to position said second depression in the base of the bottle to receive said detent.

9. An apparatus as defined in claim 8 in which said last named rotating means comprises a driving wheel movable into engagement with a bottle held between said supporting members to rotate the bottle until the detent enters said second depression.

10. A silk screen printing apparatus for printing bottles of oval cross section comprising a movable silk screen stencil and squeegee means associated therewith, means for supporting bottles in position adjacent the stencil for printing, rotary supporting means for lifting individual bottles into contact with said stencil and rotating each bottle about an axis having the same radius as the radius of curvature of the surface being printed, in coordination with the movement of the stencil to print on the peripheral surface of the bottle, each of said bottles having an opening at one end and a base at the opposite end having a pair of recesses at predetermined positions therein, said rotary supporting means comprising a rotatable shaft, a first laterally extending arm on said shaft having a movable supporting member at one end having a conical face operatively engageable with the opening of the bottle, a second laterally extending arm on said shaft having a pair of adjustably movable arms at one end thereof, each of said adjustably movable arms having a conically shaped member engageable with the recesses in the base of the bottle to be supported, and means to rotate said shaft to move the bottle about the radius of curvature of the surface being printed in coordination with the movement of the stencil.

11. An apparatus as defined in claim 10 in which said first named movable supporting member includes means movable by compressed gas to engage the opening of the bottle and move the same into engagement with conically shaped members on said adjustably movable arms.

12. An apparatus as defined in claim 10 in which said

11

first named movable supporting member has a passage-way arranged for connection to a compressed gas source for supplying gas pressure to the interior of the bottles during printing.

13. An apparatus as defined in claim 10 including 5 means adjustably mounting said movable supporting member and said adjustably movable arms for movement radially of their respective supporting arm.

14. An apparatus as defined in claim 10 in which 10 each laterally extending arm has as lot in which said movable supporting member and said adjustably movable arms are respectively supported for adjustment radially of said rotatable shaft.

12

References Cited in the file of this patent

UNITED STATES PATENTS

2,202,799	Jackson et al. -----	May 28, 1940
2,229,347	Shurley -----	Jan. 21, 1941
2,553,085	Groce -----	May 15, 1951
2,882,818	Vowles -----	Apr. 21, 1959
2,936,920	Wallace -----	May 17, 1960
2,951,440	Du Buit -----	Sept. 6, 1960
2,978,131	Garvey -----	Apr. 4, 1961
3,053,374	Black -----	Sept. 11, 1962
3,089,414	Jenkins -----	May 14, 1963