

## [54] METHOD AND APPARATUS FOR HOT STAMPING CYLINDRICAL ARTICLES

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101/9

[51] Int. Cl. .... B44c 1/14

[58] Field of Search ..... 101/7, 8, 9-11,  
101/38, 38 A; 156/233, 234, 238, 540, 542,  
552, 240

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3,657,053 4/1972 Warsager ..... 156/540  
3,657,054 4/1972 Warsager ..... 156/234 X

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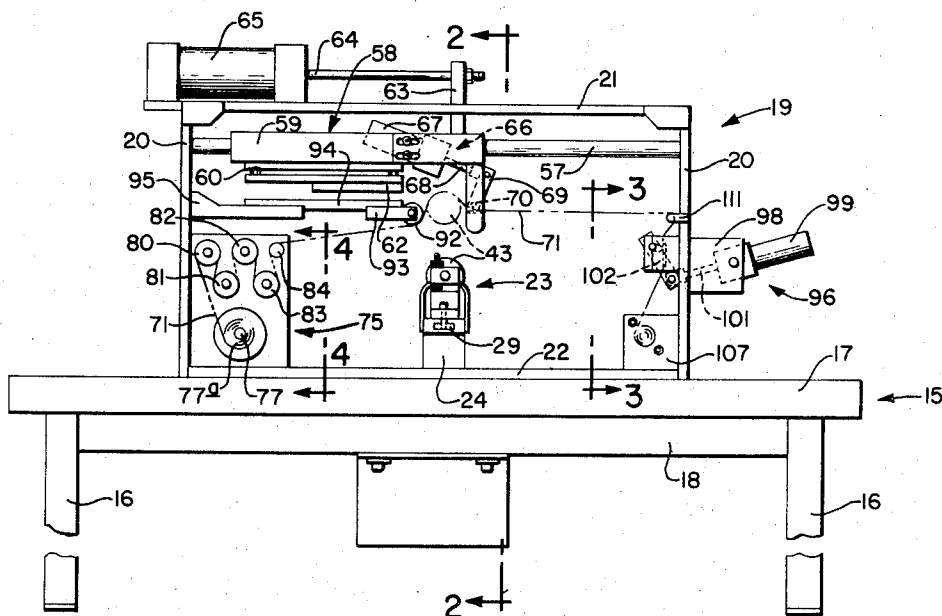
Attorney, Agent, or Firm—Donald L. Johnson; John F. Sieberth; E. Donald Mays

[57]

## ABSTRACT

A method and apparatus for hot stamping or heat transferring an image to a cylindrical object. A cylindrical object, such as a hollow plastic bottle, is rotatably mounted on a support platform which is horizontally movable. A horizontally movable die is mounted on a frame above the bottle-holding platform. A strip of movable decorating tape is interposed between the cylindrical article and the die. Means are provided for applying fluid pressure to the interior of the bottle to rigidify the bottle during the printing step. The die moves across the decorating tape pressing the tape onto the surface of the bottle and rotating the bottle as the die moves over the tape. Gripping means are provided for gripping the tape and pulling the tape forward at the same rate of movement as the die.

11 Claims, 11 Drawing Figures



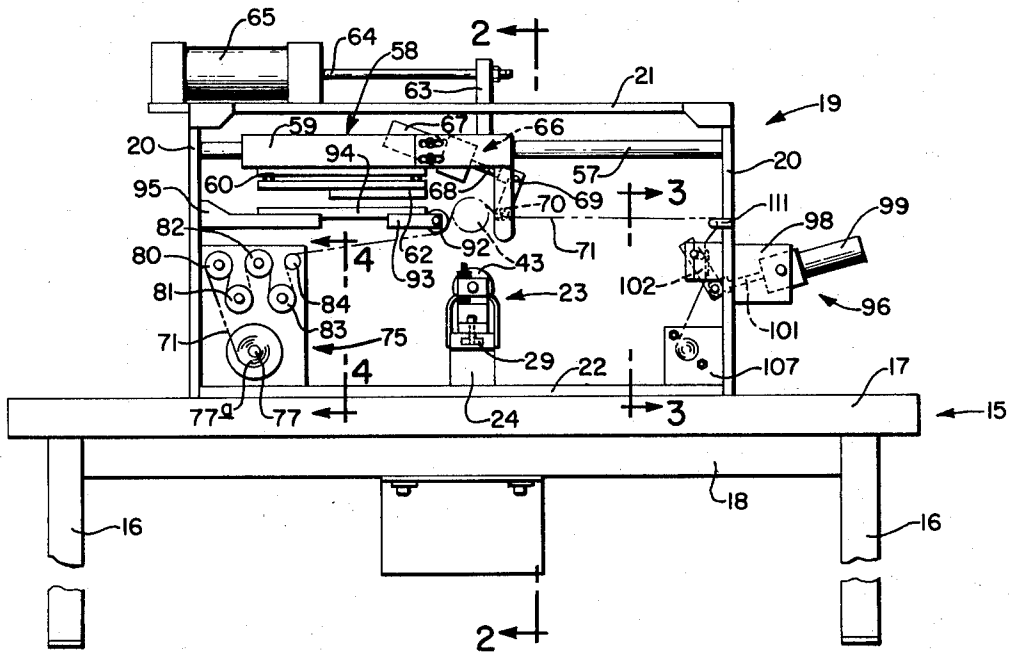


FIG. 1.

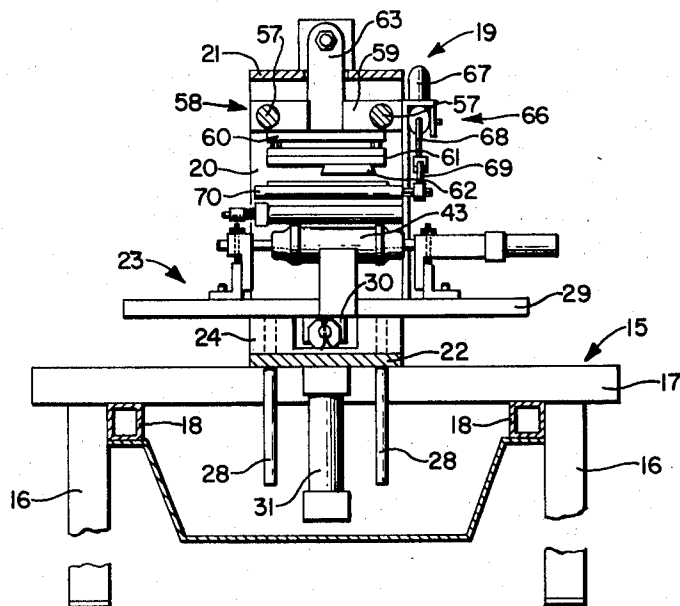


FIG. 2.



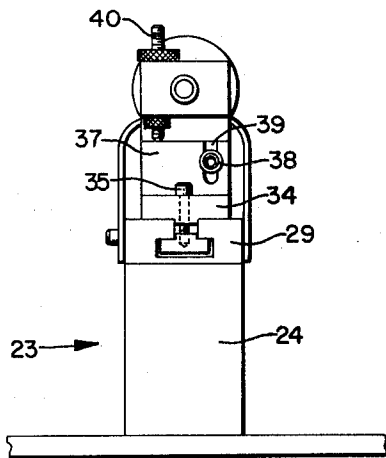


FIG. 5.

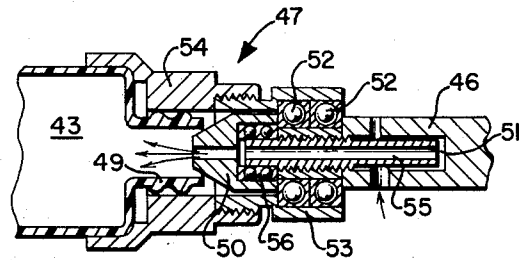


FIG. 7.

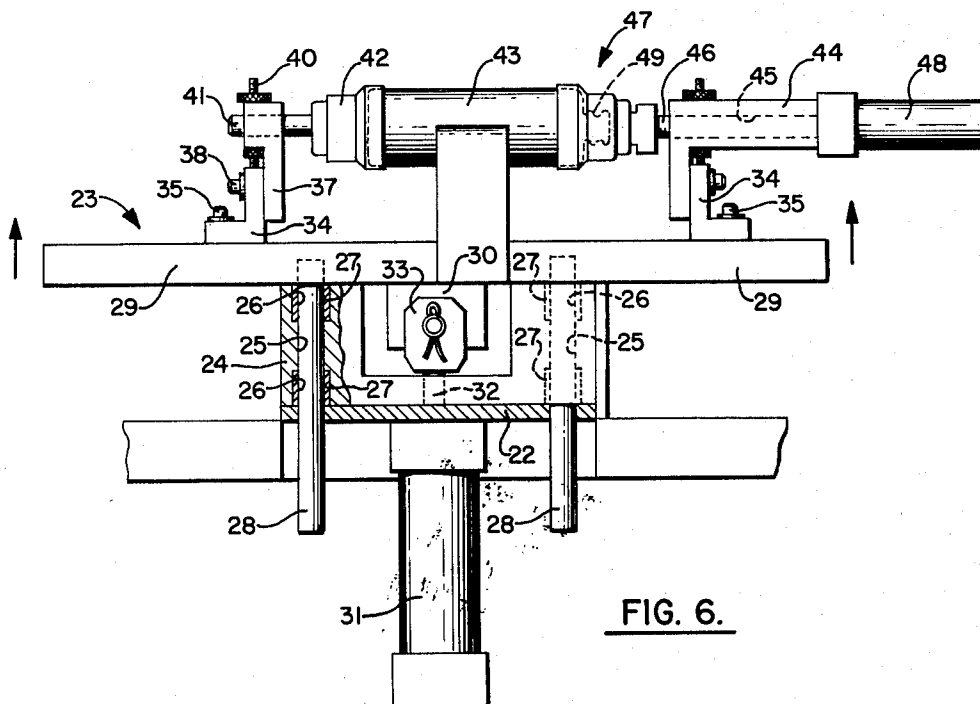


FIG. 6.



## METHOD AND APPARATUS FOR HOT STAMPING CYLINDRICAL ARTICLES

### BACKGROUND OF THE INVENTION

Cylindrical articles, such as hollow, flexible wall plastic bottles, have been decorated using hot stamping techniques for some time. One method and apparatus for hot stamping either cylindrical or non-cylindrical, e.g., oval, plastic bottles is shown in U.S. Pat. No. 2,751,701. The method and apparatus disclosed in the foregoing patent requires that the bottle be placed within a die support holder which substantially surrounds the bottle. A heat-transferable foil is interposed between the heated die in the die holder and the bottle surface. Air pressure is applied to the interior of the bottle to rigidify the walls of the bottle and effect the transfer of the indicia to the bottle wall. While the machine and method disclosed in the foregoing patent have found wide acceptance and are commercially used, the technique requires a rather elaborate and expensive machine and suffers the disadvantage that circumferential printing over the entire surface of cylindrical bottles is generally not feasible.

One apparatus for decorating the surface of cylindrical articles wherein the article is rolled between a heated die with an indicia-transferring tape interposed therebetween is shown in U.S. Pat. No. 3,309,256. However, the apparatus disclosed in this patent depends upon frictional contact among the die, the tape and the wall of the container to maintain the position of the tape as the bottle is rotated. Oftentimes, apparatuses of this type permit the tape to slip between the bottle and the die, thus resulting in smearing or distortion of the indicia as it is transferred to the bottle.

Another type of apparatus for transferring hot stamping indicia to the surface of cylindrical bottles is shown in U.S. Pat. No. 3,608,480. This apparatus requires that the bottles be conveyed on a roller chain underneath a hot stamp die, thus resulting in distortion of the surface of the article and making it difficult to achieve a clean, accurate transfer of the impression from the die to the bottle.

Another type of apparatus utilized for hot stamping plastic articles which are oval or generally rectangular in shape is shown in U.S. Pat. No. 3,657,053. This apparatus has an elevatable platform to hold the rectangular bottle and press it against a die with an indicia-transferring foil interposed between the surface of the bottle and the die. The bottle holder is adapted primarily for non-cylindrical bottles and thus is not believed capable of hot stamping by peripheral rolling cylindrical articles such as hollow plastic bottles.

Thus, it is seen that the hot stamping art is in need of a method and apparatus which will permit hot stamping of cylindrical articles such as hollow plastic bottles wherein the indicia transfer tape or hot stamp foil can be securely positioned between the bottle and the hot stamp die and moved at exactly the same rate that the die progresses across the surface of the bottle, thereby permitting accurate and truthful transfer of the indicia on the hot die face to the bottle surface. The apparatus of the present invention provides a positive control for the movement of the foil coordinated with the rotation of the hollow, cylindrical, plastic container across the surface of the die.

### SUMMARY OF THE INVENTION

It is an object of the present invention to provide a hot stamping apparatus and method which can faithfully reproduce the indicia on a hot stamp die on the entire circumferential surface of a hollow cylindrical container.

It is another object of the present invention to provide a hot stamping apparatus and method which utilize an apparatus of substantially simple and economical construction.

An additional object of the present invention is to provide a method and apparatus for hot stamping cylindrical articles which can be readily changed to accommodate various sized cylindrical articles.

A further object of the present invention is to provide an apparatus and method for hot stamping cylindrical articles which can provide continuous positive contact among the hot stamp die, the transfer foil and the bottle wall throughout the revolution of the cylindrical bottle.

These and other objects of the invention are provided for in the apparatus aspects in an apparatus for decorating cylindrical articles which includes a base for supporting the apparatus. A generally rectangular open frame is mounted on the base. A vertically movable article holder platform is mounted on the base within the frame. A horizontally movable die holder is mounted on the frame above the article holder platform. A die is mounted on the die holder. A strip of movable decorating tape extends between the article holder platform and the die. Means to vertically move the article holder platform are provided. Means are provided to horizontally move the die holder and the die into engagement with the decorating tape and the article carried by the article holder platform. Means to move the tape coordinated with the movement of the die and the die holder are provided.

The method aspects of the present invention are provided for in a method for applying decoration to a cylindrical article which includes the step of positioning the article for rotation about its longitudinal axis. The article is moved vertically into engagement with a strip of decorating material. A heated die is moved horizontally in a direction perpendicular to the longitudinal axis of the article to engage the strip of decorating material and to press the decorating material against the cylindrical article. The article is rotated on its longitudinal axis. The strip of decorating material is advanced in the direction of movement of the die at the same rate as the die.

### BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a front elevational view of an apparatus for hot stamping cylindrical articles constructed in accordance with the present invention;

FIG. 2 is a vertical, sectional view of the apparatus of FIG. 1 taken along the line 2—2;

FIG. 3 is an enlarged vertical, sectional, elevational view of a portion of the apparatus of FIG. 1 taken along the line 3—3;

FIG. 3A is an enlarged sectional view of a portion of the tape take-up gripping mechanism taken along the line 3A—3A of FIG. 3;

FIG. 4 is an enlarged vertical, sectional, elevational view of a portion of the apparatus of FIG. 1 taken along the line 4—4;

FIG. 5 is an enlarged elevational end view of a portion of the elevating platform and bottle holder portion of the apparatus as seen in FIG. 1;

FIG. 6 is a partially broken, side, elevational, enlarged view of the elevating platform and holder assembly for the cylindrical article as shown in FIG. 1;

FIG. 7 is a broken, longitudinal, sectional, enlarged view of one end of the bottle gripping and inflating apparatus;

FIG. 8 is an elevational side view of a portion of the hot stamping apparatus of FIG. 1 showing the bottle in the raised position prior to contacting the bottle with the die;

FIG. 9 is a view similar to FIG. 8 showing the position of the apparatus after the die has traversed over the bottle and applied the hot stamping indicia thereto; and

FIG. 10 is an enlarged, broken, sectional view of the gripping mechanism of the tape advancing assembly.

#### DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to FIGS. 1 and 2, the hot stamping apparatus of the present invention includes a base, designated generally by the numeral 15. The base includes four legs 16 adapted to rest on the floor. The legs are attached to and support a rectangular top 17. The rectangular hollow reinforcing members 18 are attached to the legs and to the top to provide additional rigidity to the base. A generally rectangular open frame, designated generally by the numeral 19 is fixedly attached to the top 17 of the base. Frame 19 includes opposed, generally rectangular end plates 20—20 which are rigidly attached at their edges to top plate 21 and to bottom plate 22. An article holder platform assembly, designated generally by the numeral 23, is mounted on the top 17 of the base substantially midway between the end walls or end plates 20—20 of the frame. As seen more clearly in FIGS. 5 and 6, the article holder assembly includes a U-shaped base block 24 which is attached to the bottom plate of the frame as by welding or other suitable means. The arms of base block 24 are provided with vertical bores 25—25, which bores are provided with counterbored recesses 26 at each end thereof which receive bushings 27. Vertical support rods 28—28 are slidably mounted within the bores 25—25. The lower ends of the support rods 28—28 pass through openings provided in the bottom plate of the frame and have their upper ends attached to horizontal support member 29. A depending, rectangular bracket 30 is attached by welding or other suitable means to the underside of the support member 29 and extends into the hollow space provided in the U of the base block 24. A double-acting, fluid actuated power cylinder 31 has its upper end attached to the underside of bottom plate 22 of the frame, as by welding or bolting or other suitable means. The power cylinder is provided with a piston rod 32 which slidably extends through an opening in bottom plate 22 and is attached at its bifurcated end 33 to the bracket 30 on support member 29. Air or hydraulic lines (not shown) are attached to each end of the power cylinder 31 and through suitable pressure sources, valves and switches permit movement of the article holder assembly 23 in the vertical direction.

A pair of L-shaped, spaced apart support brackets 34—34 are slidably attached to the top of support

member 29 by means of bolts 35. Rectangular bracket 37 is attached to the left-hand, L-shaped bracket 34 by means of a set screw 38 which is received in a slot 39 provided in the L-shaped bracket. Bracket 37 is provided with a micrometer adjustment screw 40 whose lower end bears on the top surface of L-shaped bracket 34 to provide fine adjustment for the height of the upper bracket 37. Bracket 37 is provided with a bore which receives a rotatable shaft 41 having a generally cup-shaped receiver 42 on its inner end, which receiver is adapted to grip and align the plastic bottle 43.

Right-hand, L-shaped bracket 34 has attached to its upwardly extending portion an L-shaped bracket 44 which is provided with a bore 45 which rotatably receives a shaft 46. The left outer end of shaft 46 is attached to a generally cup-shaped, neck-receiving assembly, designated generally by the numeral 47. The right end of shaft 46 is attached to a fluid powered, double-acting power cylinder 48. The power cylinder 48 is provided with connections (not shown) for supplying fluid, such as air or hydraulic fluid, to actuate the cylinder to move shaft 46 and the bottle neck holder assembly 47 into and out of engagement with the neck 49 of the plastic bottle 43.

Referring now to FIG. 7, the bottle neck holder assembly 47 includes a nozzle member 50 whose forward end is tapered and adapted to engage the neck 49 of the bottle to provide a pressurized seal therewith. Shaft 46 is provided with a counterbore 51 in the end thereof, a portion of which is threaded, and threadably receives the central portion of the nozzle 50 to attach the nozzle to the end of the shaft 46. A pair of roller bearings 52—52 are mounted for rotation at the end of shaft 46. The outer race of the roller bearings is coupled to sleeve 53 which has threadably attached to its outer end the generally cup-shaped bottle neck receiving member 54. Nozzle member 50 is mounted for rotation on the end of an insert member 55 which is threadably received in the bore 51 of shaft 46 for rotation therewith. Roller bearings 56 permit rotation of nozzle member 50 on the end of insert member 55.

Referring now to FIGS. 1 and 2, a pair of support rods 57—57 extend between the end walls 20—20 of the frame adjacent the top plate 21. A die platform assembly, designated generally by the numeral 58, is slidably mounted on the two support rods 57—57 through the base plate 59 which provides passage therethrough to slidably receive the rods. Base plate 59 has attached to its underside a water cooled plate 60 which, in turn, has attached to its four corners a heater block 61 which, in turn, has attached to its face a metal or rubber die 62 which carries the indicia desired to be printed on the bottle. The die support platform assembly has attached to its right-hand end an upstanding bracket member 63. The bracket member is attached to the outer end of a piston rod 64 which is attached to a piston (not shown) in fluid powered, double-acting power cylinder 65. Fluid connections are provided (not shown) to the power cylinder to provide actuation of the cylinder to move the die support platform assembly from left to right and to return it to its original position.

As seen in FIG. 2, and in dotted outline in FIG. 1, the die support platform assembly 58 supports a decorating tape advancing assembly, designated generally by the numeral 66. The assembly includes a small, double-acting power cylinder 67 which is mounted on the side

of the base plate 59. Piston rod 68 extending from the cylinder is connected at its outer end to a pivotable arm 69 which is attached to a tape-gripping bar 70. On actuation of the power cylinder 67 (see FIG. 10), the tape-gripping bar 70 is pressed against an underlying support bar 74 having a resilient strip 74a on its upper surface to securely grip the metal or plastic decorative tape 71 which carries the heat-transferable material adapted to be transferred to the surface of the bottle. The tape-gripping bar 70 is rotatably mounted in a pair of downwardly extending brackets 72—72 which are attached to the base plate 59 of the die platform assembly. Tape-gripping bar 70 is provided with a downwardly projecting extension bar 73 having a rounded end thereon. The extension bar 73 presses the decorative tape material 71 against the cross bar 74 carried by brackets 72—72 to fixedly grip the tape for movement across the cylindrical surface of the plastic cylindrical bottle 43.

Referring now to FIGS. 1 and 4, the hot stamp or decorating tape supply assembly, designated generally by the numeral 75, includes a rectangular support plate 76 attached to the frame 19 at the rear lower left-hand corner thereof. A shaft 77 extends from the plate and supports a roll of decorative tape 77a. The tape is positioned on shaft 77 between adjustable spool ends 78—78. Thumb screws 79—79 lock the spool ends to the shaft to permit use of decorating tapes of different widths. Decorating tape 71 from the roll 77a passes serially over first tension roller 80, second tension roller 81, third tension roller 82, and fourth tension roller 83 and finally over idler roller 84. Each of the tension rollers includes a cylindrical tube 85 rotatably journeled on the shaft 86 by means of roller bearing assemblies 87 at each end thereof. The right-hand end of each cylindrical tube 85 is in frictional abutment with the right-hand support plate 76. The left-hand end of the tube is frictionally engaged by a collar 88 which is keyed to shaft 86 to prevent rotation thereof. The collar is pressed against the end of the tube by a spring 89. Cylindrical sleeve 90 is received over the left-hand end of shaft 86 and presses the spring 89 against the collar. The sleeve is retained on the end of the shaft by means of set screw 91. The surfaces of the tubes 85 are polished so as not to scratch the tape. The tension on the tension rollers can be adjusted to provide the degree of resistance necessary to insure that the tape 71 is under the desired degree of tension.

After the decorating tape 75 passes over the idler roller 84, it next engages the underside of position roller 92 which is attached by spaced apart brackets 93—93 to the radiant heater plate 94. The radiant heater plate 94 is fixedly attached to the left end frame member 20 by means of spaced apart brackets 95—95.

Referring now to FIGS. 1 and 3, the decorating tape take-up mechanism includes a tape take-up subassembly, designated generally by the numeral 96, and a tape windup subassembly, designated generally by the numeral 97. The tape take-up subassembly includes a generally rectangular, hollow support bracket 98 mounted on the side of frame member 20. A double-acting, pneumatic power cylinder 99 is pivotably mounted on bracket 98 by means of shaft 100. Piston rod 101 is pivotably attached at its outer end to arm 102 which is attached to the rectangular end of tape-locking bar 103. As seen more clearly in FIGS. 3 and 3A, tape-locking bar 103 is rotatably mounted on the frame end plate 20 by means of spaced apart, rectangular

brackets 104—104. The underside of the locking bar 103 is provided with a downwardly extending extension 105 which has a rounded end portion adapted to press the tape 71 against the strip of rubber or other resilient material 105a which is carried by the rectangular backing bar 106 which is fixedly mounted between the brackets 104—104.

The tape windup subassembly 97 is mounted on rectangular bracket 107 attached to the frame 19 at the lower right-hand corner thereof. Shaft 110 extends from the motor 108 and winds up the used portion of the decorating tape 71. The left-hand end of the shaft is attached to drive motor 108 which is preferably a low torque, high rpm electric motor. The drive motor 108 preferably runs continuously and drives the shaft 110 to take up the used decorating tape when the tape is released by the tape-locking bar 103 of the tape take-up subassembly 96. As the tape comes from the bottle after stamping, it first passes over idler roller 111 mounted on the right-hand end wall 20 of the frame.

The operation of the hot stamping apparatus of the present invention will not be described with particular reference to FIGS. 8 and 9 and also reference to FIGS. 1 and 2. Initially, the bottle 43 may be placed in the article holder assembly 23 by hand by a manual operator or through a suitably designed automatic bottle-feeding apparatus. Through suitable power supply means, i.e., air or hydraulic fluid, together with suitable electrical timing means (not shown), the article-holding assembly 23 is elevated from the lower or proximate position shown in FIGS. 1 and 2 to the distal or upper position shown in FIGS. 8 and 9. Die support platform assembly 58 at the initiation of the cycle is positioned at the left-hand side of the hot stamping apparatus as shown in FIGS. 1 and 8. In this position the die 62 is immediately above and exposed to radiant heat provided by the radiant heat plate 94. Additionally, the die 62 is heated from its back side by means of heater plate 61 carried on the die support platform assembly. Upon the initiation of the electrical signals, air or hydraulic fluid is supplied to double-acting cylinder 65 to initiate movement of the die platform assembly 58 from left to right. The article holder assembly 23 has positioned the plastic bottle in the position shown in FIG. 8, i.e., where the bottle makes firm contact with a portion of the strip of decorating foil 71. As the die support platform 58 moves from left to right, the die 62 makes contact with the foil or decorative material covering the bottle 43 and presses the decorative material firmly against the bottle which has been preinflated by a compressed fluid such as air through a supply source (not shown). The rigidified bottle and foil are pressed firmly against the die, and the bottle is rotated clockwise in precise and accurate registry with the die as it rotates. The heat from the die and the indicia carried on the face of the die release the thin metal or other suitable indicia-marking material from the face of the tape and apply it to the surface of the bottle 43 as the bottle is rotated. When the die support platform reaches the position shown in FIG. 9, i.e., after substantially complete rotation or rotation through whatever degree of arc is required, a timer mechanism (not shown) actuates the article-holding assembly to move the assembly downward to disengage the plastic bottle 43 from the foil and from the die 62. During the time the die is moving from left to right, the tape-advancing assembly 66 positively grips the tape by means of the tape-gripping bar 70 and



pulls the tape from the supply roll 77a at precisely the same rate as produced by rotation of the bottle 43, whereby positive, firm engagement is made among the die 62, the tape 71 and the peripheral surface of the pressurized plastic bottle 43.

The transfer characteristics of a particular decorating tape-bottle combination may require that the tape remain in contact with the bottle wall for a short time after passing underneath the die to insure good transfer of the indicia to the bottle wall. In this case, the timer (not shown) that actuates the tape-gripping bar 70 is set to provide a slight delay in gripping the tape to permit the tape to adhere to the bottle wall for a short interval after passing under the die - i.e., for about 10° to 180° of arc travel by the bottle during its rotation.

The tension rollers 80 through 83 described hereinbefore provide a drag or retardation for the tape 71 to insure that the tape is continuously under tension and does not wrinkle or pucker during the time the tape is being applied to the surface of the bottle by the die 62. At the end of the hot stamping step as seen in FIG. 9, the tape advance assembly 66 opens to free the used portion of the tape 71 and the timer actuates the tape take-up assembly 96 to release the end of the tape, whereby the tape windup motor 108 winds up the used excess decorative material 71 on shaft 110. At the end of a time cycle designed to take up the used tape, the tape-locking bar 103 of the tape take-up holding assembly locks down to stop the windup of the excess tape. The timer then actuates power cylinder 65 to reverse the travel of die platform assembly 58 to move the assembly from the right-hand position shown in FIG. 9 back to the left-hand position shown in FIG. 8. At the same time, the timer actuates the tape-advancing assembly 66 to release the tape-gripping bar, thus to permit the advancing assembly to move back over the tape free of engagement therewith. The sequence is then repeated for additional hot stamping of other cylindrical articles.

From the foregoing, it can be seen that the hot stamping apparatus of the present invention provides a method and apparatus for hot stamping cylindrical articles wherein the article is pressed into firm contact with the decorative tape and the die and rotated with exact registry therewith to produce a precise smudge and distortion-free transfer of the indicia from the die to the face of the plastic container. Thus the apparatus and method of the present invention solve many of the problems present heretofore in prior art hot stamping apparatuses, such as inability to maintain firm contact among the die, the tape and the surface of the bottle, which results in slippage of the decorative foil producing smudging or distortion of the indicia transferred to the bottle periphery.

While the invention has been described with reference to the drawings, it is understood that the present description is only by way of example and that many variations and modifications of the construction of the present invention will be apparent to those skilled in the art. Therefore, the invention is to be limited only by the following claims.

What is claimed is:

1. In an apparatus for decorating a cylindrical article, the combination comprising:

- a. a base for supporting said apparatus;
- b. a generally rectangular, open frame mounted on said base;

- c. a vertically movable, article holder platform mounted on said base within said frame;
- d. a horizontally movable die holder mounted on said frame above said article holder platform;
- e. a die mounted on said die holder;
- f. a strip of movable decorating tape extending between said article holder platform and said die;
- g. means to vertically move said article holder platform;
- h. means to horizontally move said die holder and said die into engagement with said tape and said cylindrical article carried by said article holder platform; and
- i. tape gripping means attached directly to and supported solely from said die holder and adapted to fixedly grip said tape to move said tape at the same horizontal rate as said die holder and said die.

2. In the apparatus of claim 1 wherein said tape-gripping means includes a fluid actuated power source, a pivotable arm attached to said power source, a tape-gripping bar attached to said arm, and a support bar adapted to make contact with said tape-gripping bar to grip said tape therebetween.

3. In the apparatus of claim 1 including tape take-up means and wherein said tape take-up means includes continuously energized tape windup means and intermittently operable tape-holding means.

4. In the apparatus of claim 3 wherein said tape-holding means includes a fluid power source, a pivotable arm attached to said power source, a tape-locking bar attached to said arm, and a backing bar adapted to make contact with said tape-locking bar to grip said tape therebetween.

5. In the apparatus of claim 3 wherein said tape windup means includes a continuously energized power means.

6. In the apparatus of claim 1 including means spaced from the face of said die for heating the face of said die by radiant heat when said die is in the retracted position.

7. In the apparatus of claim 6 wherein said means for heating the face of said die includes a radiant heater plate fixedly attached to said frame.

8. In the apparatus of claim 7 wherein said radiant heater plate has attached to its outer end a position roller positioned adjacent said cylindrical article when said article holder platform is in its uppermost position.

9. In the apparatus of claim 1 wherein said article holder platform includes article holding means for rotatably holding said article for decorating, said article holding means providing adjusting means for changing the width and height of said article holding means to accommodate cylindrical articles having different lengths and diameters.

10. In the apparatus of claim 1 wherein said die holder has attached to its underside a cooling plate, which has said die attached to its underside.

11. In a method for applying decoration to a cylindrical article, the steps comprising:

- a. positioning said article for rotation about its longitudinal axis;
- b. moving said article vertically into engagement with a strip of decorating material;
- c. horizontally moving a die platform assembly including a heated die in a plane perpendicular to said longitudinal axis of said article to engage said

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- strip of decorating material and to press said decorating material against said cylindrical article;  
d. rotating said bottle on its longitudinal axis solely by frictional contact between said bottle, said tape and said die;  
e. advancing said strip of decorating material in the direction of movement of said die at the same rate

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- as said die by positively gripping said strip with gripping means attached directly to and supported solely by said die platform assembly; and  
f. causing the face of said die to be exposed to a source of radiant heat external of said die and spaced from said die face.

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UNITED STATES PATENT OFFICE  
CERTIFICATE OF CORRECTION

Patent No. 3,816,207 Dated June 11, 1974

Inventor(s) Elmer L. Robertson et al

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Item [73] Assignee reads "Ethyl Corporation", should read -- Ethyl Development Corporation --. Column 2, line 3, reads "stamping", should read -- stamping --. Column 5, line 3, reads "whic", should -- which --. Column 6, line 2, reads "downwardty", should read -- downwardly --. Column 7, line 51, reads "surrace", should read -- surface --.

Signed and sealed this 8th day of October 1974.

(SEAL)

Attest:

McCOY M. GIBSON JR.  
Attesting Officer

C. MARSHALL DANN  
Commissioner of Patents