March 5, 1957 W. F. GRUPE 2,784,133

METHOD OF STAMPING OR PRINTING UNDER HEAT AND PRESSURE

Filed Aug. 4, 1953 3 Sheets-Sheet 1

Fig. 1

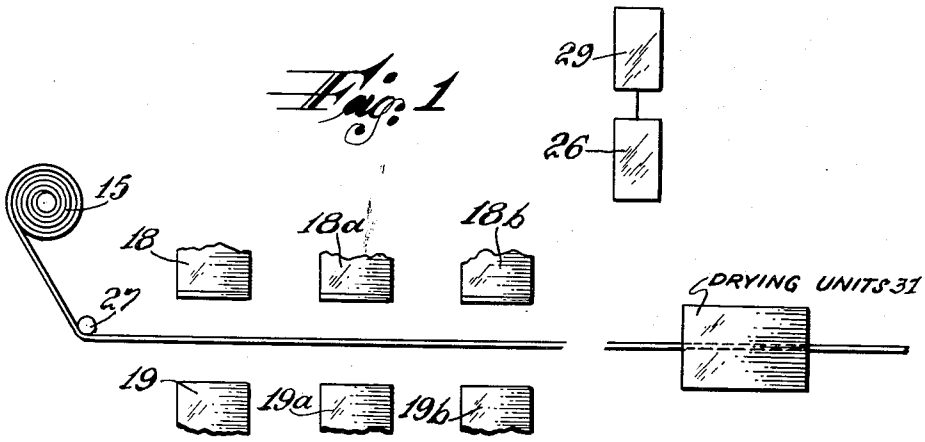


Fig. 2

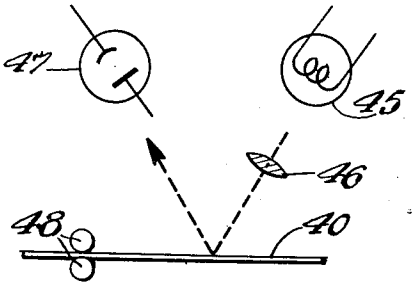


Fig. 3

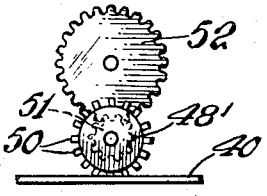


Fig. 4

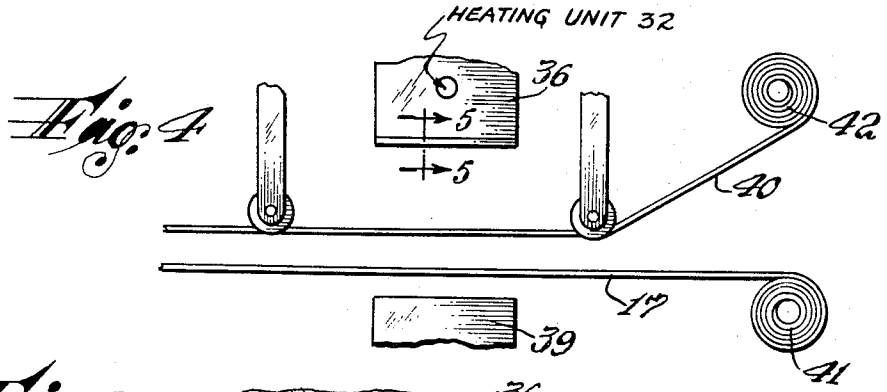
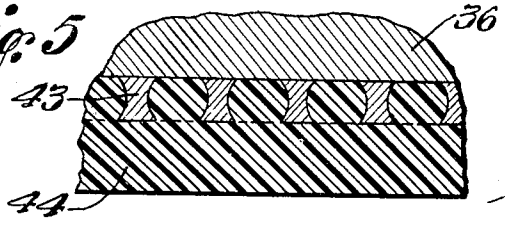


Fig. 5



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Fig. 6

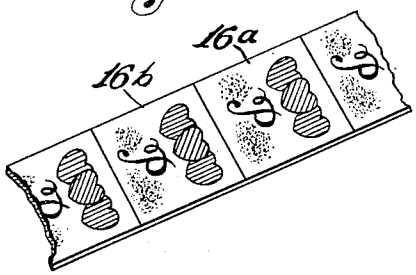


Fig. 7

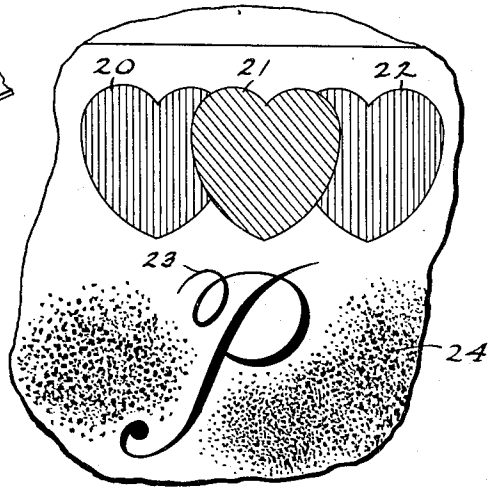


Fig. 8

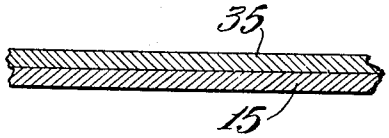


Fig. 9

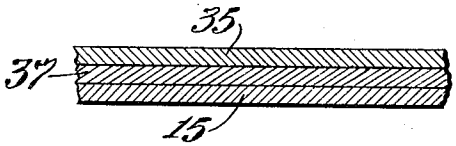


Fig. 10

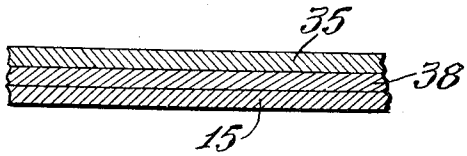
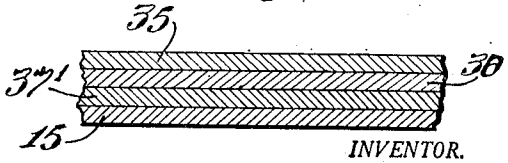


Fig. 11



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METHOD OF STAMPING OR PRINTING UNDER HEAT AND PRESSURE

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Fig. 12

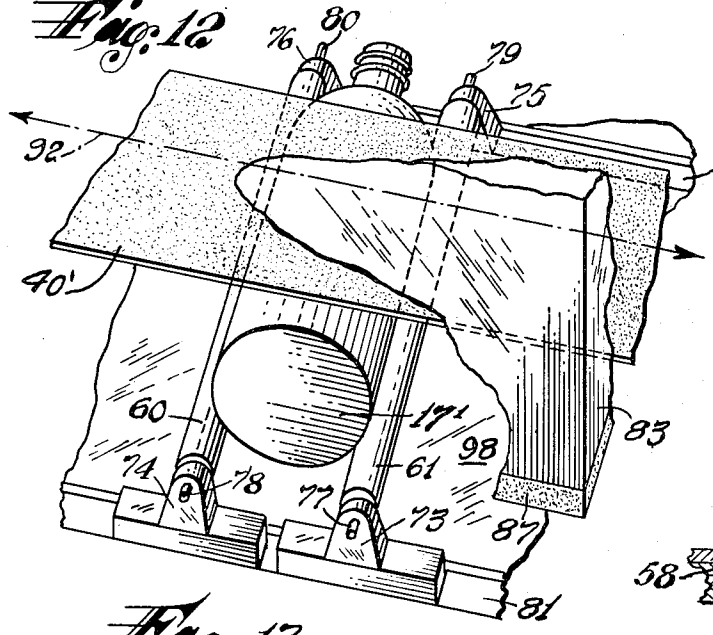


Fig. 15

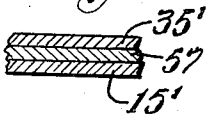


Fig. 16

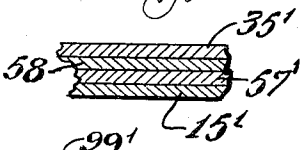


Fig. 13

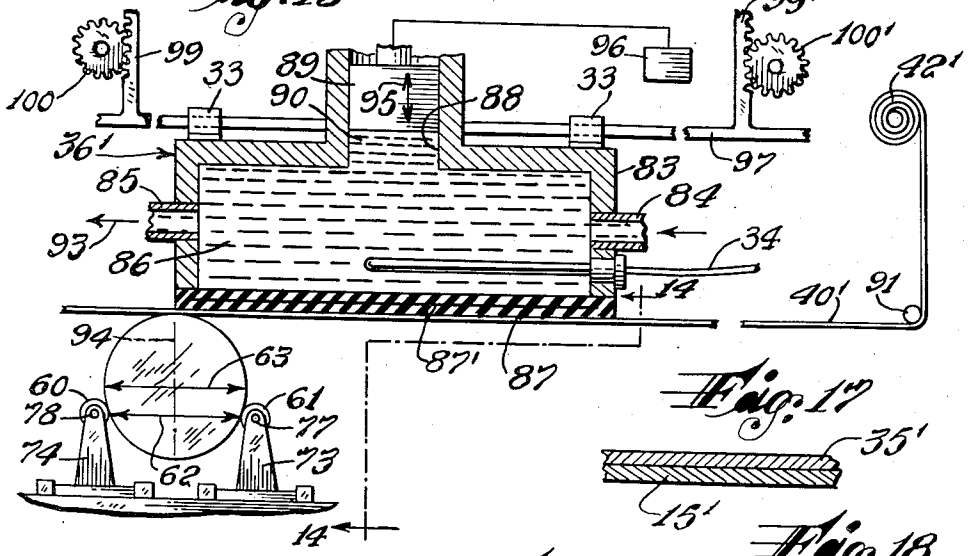
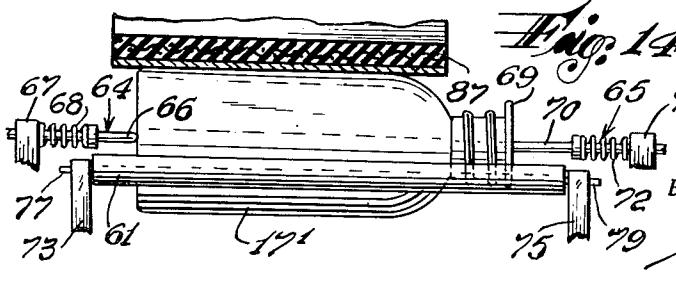


Fig. 17

Fig. 18



Fig. 14



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2,784,133

METHOD OF STAMPING OR PRINTING UNDER HEAT AND PRESSURE

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Application August 4, 1953, Serial No. 372,335

2 Claims. (Cl. 154—97.5)

This invention relates to the printing or stamping of matter, such as trademark and explanatory indicia, on containers and other objects of various types, and application of informative and ornamental indicia to articles generally. The invention has particular reference to application of indicia of the multi-color type, which, heretofore, has required use of separate printing dies for each of the several colors, as well as drying intervals after each color application. Other technical problems were encountered in the methods heretofore used for the purpose, including the high cost of the individual special dies used for the special color applications, and delays in production incident thereto. The dies in the methods heretofore used had to be of special metals or alloys to stand the operating conditions, their cost added to the other cost factors above mentioned, so that the overall cost of production was very high. In many cases the cost of production was prohibitive.

The methods of this invention, hereinafter more fully described, are such that a single, flat, inexpensive heated die or pressure member is used to effect application of the entire indicia to be applied to the article, in a single operation. The methods of this invention do away with the cost of special dies, separate color applications, separate drying intervals, and other production problems of methods heretofore used. In many cases the methods of my invention will open up to printing or stamping operations uses which were previously simply not feasible because of cost and technical problems. Pursuant to the present invention, the indicia to be transferred is formed, as a normally inert, heat and pressure-sensitive film on a flexible roll tape or foil, in the form of repeated pattern-impressions of frames, each bearing the complete indicia (in all of its colors) to be transferred. The process of this invention is adapted to apply multi-colored impressions at a single operation and without requiring drying intervals. The indicia may be of an infinite variety of forms—for example, dots to provide "milky way" effects, differently colored areas and lines, as well as areas and lines superimposed over other contrasting color areas or lines. The possible range of designs for reproduction, pursuant to the invention, such as combinations of dots, lines, etc. is infinite.

The method of this invention permits of the transfer from a source such as roll tape, of repeated design-pattern effects onto articles to be stamped therewith. Means may be provided for automatically registering each frame with the article or surface to be covered thereby.

Heretofore trademarks and other indicia were applied to glassware by the silk screen process, pursuant to which one color is applied at a time. The application of the method of this invention to relatively inflexible objects, such as glassware of oval, circular, or other cross-section, is attained pursuant to the form of my method shown in Figs. 12–18, below more fully described and illustrated in Figs. 12–18. Single or multi-color indicia impressions or coatings may be applied to articles, such as glassware,

pursuant to said method, with many important advantages over methods heretofore used, including these: Multi-color applications may be made without requiring separate applications of the different colors, and without requiring drying time intervals; the complete design is impressed or transferred onto the glassware, pursuant to the present method, in one operation.

As is well known, glassware and organic equivalents or substitutes cannot be made with a great degree of accuracy. The processes of making such articles involve the use of high temperatures and annealing. During the heating of the masses of the materials of which these articles are made, and during the subsequent annealing steps, the nature of the materials is such that, in practice, deviations from an ideal are the rule rather than the exception. For example, a glass or rigid organic bottle which is intended to be of circular cross-section, as shown in Fig. 13, will be found, upon accurate measurement, to deviate therefrom. There are substantial deviations among articles made by the same process of manufacture, under the same controlled conditions, and by the use of identical molds. The recognized surface deviation characteristics of such articles heretofore presented a serious problem to the application of indicia, such as trademarks, thereto. The method of this invention, shown in Figs. 12–18, enables the application of indicia to such articles in a novel manner which has many advantages including that of automatically compensating for deviations in surface contour. The uniformity and ease of application of indicia pursuant to the method presently more fully described are other important features thereof.

These and other advantageous objects, which will appear from the drawings and from the description hereinafter, are accomplished by the method of my invention, of which embodiments are illustrated in the drawings. It will be apparent, from a consideration of said drawings and the following description, that the invention may be carried out by use of other materials and apparatus; the invention is not limited to the forms shown in the drawings.

In the drawings:

Fig. 1 is a schematic view showing a method of initially impressing a heat and pressure-sensitive film onto the tape roll, pursuant to the methods of this invention,

Fig. 2 is a fragmentary schematic view of a frame registering means which may be used in connection with the invention,

Fig. 3 is a similar schematic view of another means which may be used for the purpose,

Fig. 4 is a schematic view of a method embodying the invention, and a form of apparatus suitable for carrying the same out,

Fig. 5 is an enlarged fragmentary sectional view, taken on line 5—5 of Fig. 4,

Fig. 6 is a fragmentary perspective view showing two complete frames stamped on an article pursuant to the method of this invention,

Fig. 7 is a fragmentary enlarged plan view thereof,

Fig. 8 is a fragmentary sectional view of one form of roll tape carrier embodying the invention,

Figs. 9, 10 and 11 are fragmentary sectional views of other forms thereof,

Fig. 12 is a fragmentary perspective view of a method and apparatus embodying the invention, for use with relatively inflexible or tubular objects,

Fig. 13 is a fragmentary vertical, partly schematic, sectional view, showing the application of the method and apparatus of Fig. 12 at the initiation of the cycle of printing on an object,

Fig. 14 is a fragmentary elevational view of the object and a means for holding the same against accidental

displacement, which may be used with the method and apparatus of Figs. 12 and 13, taken on line 14—14 of Fig. 13, and

Figs. 15–18 are fragmentary sectional views of the carrier tape and coatings thereon described more fully hereinafter.

As shown in the drawings (Fig. 1), the roll of tape 15 may initially be a flexible, normally relatively inert carrier material, such as regenerated cellulose film (for example, cellophane, cellulose acetate film, glassine film, or any other relatively flexible, inert film suited to the method). The tape 15 is provided with a heat and pressure sensitive printing film or surface 35 (Fig. 8) applied by the use of dies, 18, 18*a*, 18*b* of Fig. 1; said film will constitute repeated frames indicated at 16*a*, 16*b* (Fig. 6), which may in turn be stamped under heat and pressure (Fig. 4) on the article 17. Said design film 35 may be initially applied to the roll tape 15 as shown, for example, in Fig. 1, by passing said tape 15 intermediate printing heads and printing beds.

Where the indicia to be impressed on the article 17 is to be of more than one color, as indicated by the differently colored areas 20, 21, 22 of Fig. 7, printing heads, 18, 18*a*, 18*b* would be provided (one for each color) said heads having dies for impressions of the particular color area by the respective head, and suitable inking means would be used to apply such color to the dies and thus to the tape. There would be separate beds 19, 19*a*, 19*b* registered with the respective printing heads 18, 18*a*, 18*b*, and suitable drying units as shown in Fig. 1 at 31 would be provided; means such as that just described and exemplified in Fig. 1 would be used to provide the indicia film or surface 35 on the tape 15 (Fig. 8) to thereby provide the tape 40 (Fig. 4) having the surface 35 impressed thereon as a normally inert heat- and pressure-sensitive film, which may, when desired, pursuant to the invention, be rapidly and accurately transferred to the article 17 to be impressed.

It will be appreciated that the variations of design impressions 35 imposed on tape 15 from the die faces of heads 18, 18*a*, 18*b*, and by use of suitable printing means in the initial printing stage shown in Fig. 1, would be limited only by the ingenuity and ability of one having the benefit of the disclosure of this application. The tape is dried (as at 31) and passed from the printing station to a take-up station where it may be rolled up to form a roll 42 of tape having a heat- and pressure-sensitive surface for subsequent application to articles 17, pursuant to the invention. In the subsequent application of the indicia of tape 40 (which is the roll tape 15 of Fig. 1 with the impressed indicia coating film 35 thereon as in Fig. 8) onto articles 17 as exemplified in Fig. 4, there may be provided control means such as 26, 29 of Fig. 1 in association with the die 36 of Fig. 4 and advance-dwell cycle means, such as shown in Figs. 2 and 3. The control unit 26 may be coupled with a take-up station or an advance-dwell station for movement of the tape 40 (Fig. 4) intermediate the die 36 and article 17. There may be provided suitable control means 29 coupled with the die or pressure member 36 to synchronize its movements with the movements of the tape as controlled by the control unit 26, for the purpose mentioned. Likewise, control units 26, 29 may be coupled for synchronous control action. Likewise, in initially forming surface 35 on roll tape 15, as in Fig. 1, similar or other control means may be provided.

The impressions made by the printing heads on the tape 15 may be synchronized by use of suitable advance-dwell cycle mechanism, schematically illustrated as a control unit 26 which may be coupled with means such as the take-up station or intermediate drive means 27 for driving the tape 15 intermediate the printing heads and beds in timed cycles of advancing and dwelling, such that the desired frame impressions will be serially registered

and impressed on the tape. A control means, indicated schematically in Fig. 1 at 29, may be coupled with the printing heads to synchronize its movements with the movements of the tape as controlled by the control unit 26 for the purpose above mentioned. Conventional rotary multi-color printing presses might be used in applying the indicia film 35 to tape 15. The frames 16*a*, 16*b* etc. (Fig. 6) might be printed or transferred in single units or in units of two or more. An infinite variety of combined design pattern effects, in addition to combinations of line and color effects otherwise difficult to attain, may be impressed on the article 17 in a single operation and without requiring subsequent drying intervals, pursuant to the method of this invention. As shown in Fig. 7, which is intended as illustrative only of a type of mixed pattern effect that may be attained pursuant to this invention, contrasting color figures, characters etc. 20—22 may be impressed in mixed or other relation; a message, ornament, or other indicia 23 may be provided, either corresponding with or of different color than the objects 20—22, and a "milky way" dot background effect 24 may be provided. Figs. 8–11 illustrate various forms embodying the invention which may be utilized in impressing the transfer design film 35, onto the tape pursuant to the invention.

A simple form of providing the tape 15 with the transfer film 35, pursuant to the method of this invention, is illustrated in Fig. 8, wherein the carrier tape 15 is shown provided with a heat and pressure-sensitive design transfer film 36; this end may be attained by printing directly from the printing head 18 onto the tape, to provide the design transfer film 35 thereon, using suitable pigments and resins to provide a thermoplastic surface 35 which would on drying be normally inert but may be activated and transferred at will by use of suitable heat and pressure means. A representative red formula for providing the color red for the objects 20, 22 (ruled in Fig. 7 of the drawing to indicate that color as shown in the Patent Office draftsman's chart) for inking a die secured to its head (18, 18*a*, 18*b*) may have the following representative formula:

	Percent
Molybdate Orange	15.26
Red toner	4.58
Transparent extender	4.58
½" RS nitrocellulose (40% solids)	3.82
White shellac (40% solids)	6.87
Castor oil	3.82
Denatured alcohol	61.07
	100.00

In the case of the color green for the object 21 of Fig. 7 (ruled to correspond with the official Patent Office draftsman's chart for that color) the following representative formula may be used:

	Percent
Phosphotungstic Acid Green	10.71
Titanium dioxide	5.35
White shellac (40% solids)	1.20
½" RS nitrocellulose (40% solids)	7.73
Castor oil	2.39
Methyl ethyl ketone	0.71
Denatured alcohol	71.91
	100.00

Where the receptivity of the article 17 to be stamped pursuant to the method of this invention is good relatively low temperatures (150 deg.–300 deg. F.) and pressure (dependent on a number of factors such as the nature of article 17) applied to the die or pressure member 36 will be sufficient to produce a clear transfer impression. Where the receptivity of the imprint is not good, as, for example where the article 17 to be stamped

has relatively high heat resisting characteristics, a light coating of microcrystalline wax **37** may be applied intermediate the carrier **15** and transfer film **35**, as shown in Fig. 9. It will be understood that wherever used herein and unless otherwise specifically noted, descriptive words for specific materials or products are to be taken as not limited to their usual context, and shall be deemed to include equivalents and substitutes. Thus, for example in the case of the coating **37**, just mentioned, in place of microcrystalline wax **37**, any other plastic or similar material of wax-like characteristics may be used, to promote the transfer impression and prevent the transfer film **35** from adhering to the carrier **15** when the tape **40**, as in Fig. 4, is subjected to heat and pressure of the die or pressure member **36**. If an overall lustre or gloss is desired in the transfer coating applied to the article **17**, pursuant to the invention, a thin film of lacquer **38** may be interposed between the carrier **15** and the transfer film **35**. A typical lacquer-coat formula suitable for the purpose is as follows:

	Percent
Acrylic ester resin	12–16
Castor oil	2–3
Ketone solvent	81–86

The film **35** may be printed upon the lacquer coat **38** in the form shown in Fig. 10, or upon the wax coating **37** in the form shown in Fig. 9, so that upon being transferred to the work **17** (the article to be coated pursuant to the method of this invention), the lacquer layer would become the outer and protective surface or gloss medium.

Where it is desired to apply a high temperature in the step of stamping, illustrated in Fig. 4, a coating of microcrystalline wax, indicated at **37'** in Fig. 11, may be applied first onto the carrier **15**; then the layer of lacquer **38** may be applied thereover, with the design of color film **35** being printed as the outermost film.

To further improve the adhesion between the printed design and the work to be decorated and for other purposes, adhesive coatings, such as layers of shellac, may be added to assist the bonding of film **35** to the article **17**. A final sizing coating might be applied over the outermost coating on the tape **15**.

Tape **15**, with any of the forms of coatings above mentioned is dried and then constitutes the normally inert roll of tape **40** of Fig. 4. Article **17** which may be stamped pursuant to the invention may be any material; for example, organic and plastic products, products of cloth, wood, leather, paper sheeting, etc. In Fig. 4, for convenience of illustration the article **17** is shown as in the form of a roll **41**. It will be understood that articles of non-continuous form, such as bottles, flat objects, etc. of single or multiple units to be stamped, may be inserted intermediate the die or pressure member **36** and the table **39**.

Articles **17** of irregular contour such as, for example, textiles, plastic and other objects of generally irregular surface configuration may be stamped pursuant to the invention, as may also articles **17** of relatively uniform surface configuration.

The die is heated by any suitable means, such as shown at **32**, thermostatic controls may be provided therefor, and movement of the table **39** and die or pressure-member **36** toward each other under pressure it attained pursuant to the method, as shown in Fig. 4, to compress the tape **40**, which may be unwound from reel form such as at **42** onto the article under pressure, to thereby effect a transfer of the pattern from the roll of tape onto the article as indicated. The article **17** may be fed beneath the stamping die or pressure member **36** in timed sequence to the cycles of descent and elevation of said die, being removed by hand, or automatically by the use of suitable apparatus for feeding and removing articles in sequence to descent and elevation of the die or pressure member **36**. The die or pressure member **36** is preferably smooth-faced, so as to attain effective pressure of the tape printing surface **35** onto the article **17** to be stamped therewith.

The die or pressure member **36** may have a heating unit as shown at **32** of Fig. 4 and may be made limitedly yieldable on contact, as by providing it with a surface **44** of limitedly yieldable material such as a silicone rubber film **44**, whereby the face of said die or pressure member may adapt itself to faithfully follow irregular contours and to prevent crushing and harsh, damaging action on the surface of the article **17**, particularly where such surfaces may be irregular (a frequently encountered situation as in the case of such articles as textile fibres). The limitedly yieldable faces **44** of die or pressure member **36** may be applied to the die or pressure member in any desired or convenient form, as by the apertured grid **43** (Fig. 5) which is coated with said face **44**.

The stamping of the frames **16***a*, **16***b*, on the article **17** pursuant to the invention, is attained by the use of heat and pressure so that the stamping impression becomes permanently bonded into the article itself. In the case of a plastic material, for example, such as polyethylene, the heat and pressure application will cause the surface of the article **17** to melt and the pigments of the design coating **35** will fuse into the article so that, in a single operation, a permanent melting-coating effect is attained, which forms a permanent part of the article being coated. Where the article **17** is a textile material, use of the method of the invention results in attaining the effect of a dye, as the application of heat and pressure causes the design transfer film **35** to flow and bond itself into the fibres of the cloth.

Where the article **17** is in the form of a continuous tape, to which design frames, such as **16***a*, **16***b*, are to be applied seriatum, means may be provided for synchronizing the cycles of descent and elevation of the die or pressure member **36** and of advance and dwell of the material **17**. One such means, as shown in Fig. 2 may be photoelectric, including a light source **45**, lens **46**, and photoelectric cell **47** pre-set to be activated with respect to a design element or spot or aperture. As indicated at **48**, means for controlling the cycles of movement and dwell of the tape **40** may be provided, keyed to the photoelectric means. In Fig. 3, the means for imparting advance and dwell cycles to the tape **40** is shown to comprise the sprocket **48'** whose teeth **50** may be meshed with apertures provided marginally of the tape **40**; the sprocket may be driven to advance and dwell by any suitable mechansm such as by providing the sprocket with a pinion **51** in mesh with advance and dwell means **52**. The latter may be a gear driven by suitable other means not shown, and might be synchronized with the means for driving the die and for feeding the article **17**. Similar means might also be used in the initial application of film **35** to tape **15** as shown in Fig. 1.

The method of Figs. 12–18

Heretofore, the conventional method of applying trademark or other indicia to glassware was by the silk screen process, pursuant to which one color is applied at a time. The application of the method of this invention to relatively inflexible objects, such as glassware of oval or circular cross-section, is attained pursuant to the form of my method shown in Figs. 12–18, below more fully described and illustrated in Figs. 12–18. Single or multicolor indicia impressions or coatings may be applied to articles, such as glassware, pursuant to said method, with many important advantages over methods heretofore used, including these: Multi-color applications may be made without requiring separate applications of the different colors, and without requiring drying time intervals; the complete design is impressed or transferred onto the glassware, pursuant to the present method, in one operation. The colors are dry and are firmly bonded on the

glass, ready to be passed through the lehr to heat the glass and colors and fuse the colors to the glass.

It will likewise be appreciated that the method of Figs. 12–18 is equally applicable to printing on bottles and to other relatively rigid articles of glassware or other materials of circular, oval, or generally circular or oval cross-section. As is well known, glassware and organic equivalents or substitutes cannot be made with a great degree of accuracy. The processes of making such articles involve the use of high temperatures and annealing. During the heating of the masses of materials of which these articles are made, and during the subsequent annealing steps, the nature of the materials is such that, in practice, deviations from an ideal are the rule rather than the exception. For example, a glass or rigid organic bottle which is intended to be of circular cross-section, as shown in Figs. 12 and 13, will be found, upon accurate measurement, to deviate therefrom. There are substantial deviations among articles made by the same process of manufacture, under the same controlled conditions, and by the use of identical molds. The recognized surface deviation characteristics of such articles heretofore presented a serious problem to the application of indicia, such as trademarks, thereto. The method of this invention, shown in Figs. 12–18, enables the application of indicia to such articles in a novel manner which has many advantages including that of automatically compensating for deviations in surface contour.

Pursuant to the invention, as shown in Fig. 17, the carrier tape 15′ (which may correspond to tape 15 of Fig. 5), is coated with a heat and pressure-sensitive design transfer film 35′, made of heat and pressure sensitive ceramic color materials (the latter may correspond with those presently used in the application of colors to glassware by the silk screen method). Where the film 35′ is to be a multi-color film, it will be printed onto tape 15 from separate dies or plates. If desired, there may be provided an intermediate coating 38′ of lacquer or the like (Fig. 18). A microcrystalline wax coating 57′ (Fig. 16) may be applied intermediate the tape 15′ and the heat and pressure design transfer film 35′, to promote the transfer impression and prevent the transfer film from adhering to the carrier 15′. Fig. 16 shows the carrier 15′ provided with a wax coating 57′ over which a layer of lacquer 58 may be applied. A final sizing coating may be applied over the outermost coating of the tape 15′.

The tape 15′ with any of the forms of coatings above mentioned is dried and then constitutes the normally inert, heat and pressure sensitive tape 40′ of Figs. 12 and 13. The article 17′ to be stamped, pursuant to the method shown in Figs. 12–18 is rotatably positioned on rollers 60, 61, which are spaced apart a distance 62 (Fig. 13) less than the diameter 63 of the article 17′. By this arrangement, the article will be suspended intermediate and on said rollers and may be freely rotated on its axis in such suspended position. The article 17′ may be held against axial displacement on the rollers by means such as shown at 64, 65, in Fig. 14, contacting the ends of the bottle. Member 64, for example, which engages the closed end of the bottle, may consist of a pin point rod 66, axially slidable in a bearing 67 and normally urged against the end of the bottle by a spring 68. The open end of the bottle may be contacted by a disc 69 mounted on a rod 70, axially slidable in a bearing 71, and normally urged into engagement with the bottle responsive to the spring 72. It will be understood that other means for the purpose mentioned may be substituted therefor.

Rollers 60, 61 are journalled in suitable bearings 73—76, for which purpose said rollers may be provided with stub shafts 77—80 rotatably journalled in said bearings. The bearings in turn may be movable relative to each other and may be adapted to be fixed in adjusted position. In practice, the bearings would be set for a particular job to conform to the dimensions of the article to be supported by the rollers.

They would be fixed in the so determined position and would remain in that position for the duration of that particular job. Means may be provided to secure the bearings in their adjusted position; for example, the bearings may be slidably disposed in ways 81, 82 in the support on which said bearings are mounted, and may be locked in such predetermined relative position by bolt, cam or other means suited to that end.

The articles 17′ to be stamped pursuant to the form of invention shown in Figs. 12–18, is positioned on the rollers 60, 61, and then, if desired, the means 64, 65 are brought into contact with the ends of the article to position the same rotatably on said rollers while precluding the accidental movement of the article in the plane parallel to the axis of said rollers. The die 36′ (Fig. 13) is preferably provided with a face 87, which may be of material such as a silicone rubber film, which is limitedly yieldable, enabling the die or pressure member, on application of pressure by means 89 directed downwardly thereon, as indicated by arrow 95, to press the tape 40′ onto article 17′ firmly while enabling the face of the die to adapt itself to faithfully follow irregular contours and to prevent crushing and harsh damaging action on the surface of the article 17′ particularly where such surfaces may be irregular (a frequently encountered situation). The limitedly yieldable face 87 of die or pressure member 36 may be applied to the die in any desired or convenient form, as by the apertured grid 87′ (Fig. 13) which is coated with said face 87.

In the form shown in Figs. 12, 13, 14, the casing 83 is, essentially, the die, and diaphragm 87 is, essentially, the die or pressure member face. The die or pressure member casing 83 may be of solid construction or may be a casing 83 which is hollow interiorly thereof and provided with inlet and outlet ports 84, 85 for the circulation of heated oil or other heated pressure medium 86 therethrough. Casing 83 may have a piston 89 movable therein, to exert pressure on the oil 86 and thereby on the flexible diaphragm 87, closing the lower face of casing 83. It will be apparent that exertion of pressure on piston 89 may be attained by use of any suitable means controlled by means such as hand levers, valves or automatic equipment, to regulate the pressure exerted on the oil 86 within the casing 83 to set up a predetermined pressure on diaphragm 87 and to normally urge the latter downwardly.

The tape 40′ is advanced by means (not shown) from the reel 42′ (Fig. 13) in a plane intermediate article 17′ and the diaphragm 87 of casing 83 for the printing operation and then, if desired, onto a take-up reel (not shown). Suitable guide and registering means, such as shown, for example, in Figs. 2 and 3 of the drawings, may be used to register the tape with the die 36′ and article 17′, and means may be provided, such as schematically illustrated in Fig. 13 and designated by reference character 91 for synchronizing cycles of movement of the casing 83 in a plane 92 at right angles to the longitudinal axis of the article 17′. The relative disposition of the parts at the beginning of the printing cycle may be that shown in Fig. 13. Article 17′ would be placed by the hand of the operator or automatically (by suitable equipment) on rollers 60, 61, and then would be in registry with the left-hand end of the casing 83, viewing the parts as shown in the drawings. The roll of tape 40′ bearing the indicia thereon with which the bottle 17′ is to be printed, would be registered with a line 94 approximately aligned with the said left-hand end of die or pressure member 36′. On movement of the casing 83 to the left, in the direction of arrow 93, and under downward pressure 95, the tape 40′ will be pressed firmly against the bottle 17′ and the latter rotated while the design film 35′ of said tape is transferred by virtue of the heat and pressure exerted, progressively impressed circumferentially onto the bottle.

As the bottle 17' is rotated, it will progressively present successive portions thereof circumferentially to the tape 40'. The oil 86 in casing 83 is heated by any suitable means (such as the electric heating element 34 of Fig. 13) in its circulation through the ports, 84, 85, so that the diaphragm 87 will be heated and will thereby exert and heat pressure against the tape and thereby onto the bottle, to effect a heat and pressure transfer of the pattern indicia film 35' from the tape 40' onto the article.

Any suitable means for controlling the movement of plunger 89 in the direction of arrow 95 may be used, as for example, indicated in Fig. 13 by reference character 96, schematically indicating hand-operated or automatic equipment to control the extent of movement of the plunger 89 in the cylinder 90 and thereby the degree of pressure exerted on the diaphragm 87, which need be sufficient only to urge the same to move slightly below the plane of a true straight line drawn across the face of the casing 83. As the diaphragm is limitedly yieldable and maintained under pressure, it will be apparent that irregularities in circumferential contour of the article 17' will be absorbed thereby and automatically compensated for.

Means for feeding the tape 40' and for advancing the casing 83 to the left in the direction of arrow 93 may be synchronized so as to occur in unison or so as to occur in sequence timed to the movement of the indicia frames, such as 16*a*, 16*b* of Fig. 6 of the design film coating 35' of the transfer tape 40, to be applied to article 17'. Any suitable photoelectric, friction contact, or other means may be used in cooperation with control means 96 to assure registration of tape 40' with an actual or imaginary starting line 94 for the initiation of each printing cycle.

Various modifications will become apparent from a consideration of the foregoing description. For example, casing 83 may be moved horizontally, by suspending the same on a rail 97 by means of rollers or brackets 33. It will be apparent that by increasing the length of casing 83, and setting up duplicate stations for additional articles comparable to the station disclosed in Fig. 13, two or more articles may be printed simultaneously with the use of a single casing 83 operative against a single tape 40'. Instead of moving the die or pressure member 36' at the plane indicated by arrow 93 while maintaining rollers 60, 61 in fixed position on base 98, the latter 98 might be movable on a rail or otherwise at a plane at right angles to the axis of article 17' while the die or pressure member 36' is stationary.

Suitable means may be provided for adjusting the die head 83 vertically for accommodation of objects 17'

of different sizes. Such means may, for example, be a rack and pinion means shown at 100, 99 secured to the die head 83 or the suspension means 97 therefor and to a driving means (not shown). The latter would be connected to the pinion 100 in the form shown in Fig. 13. Hydraulic, friction or other means to the same end may be substituted for the purpose. Suitable thermostatic control elements may be cut into the circuit for the heaters 34 of Fig. 13 and 32 of Fig. 4 to control the heating temperatures.

The printing heads 18, 18*a*, 18*b*, and the printing casing head 83 have been described above as provided with the limitedly yieldable faces, if desired, as shown in Figs. 5, 13 and 14. The printing beds or tables, such as 19, 19*a*, 19*b* might be similarly provided with limitedly yieldable faces instead of or in addition to the limited yieldable faces of the printing heads.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:

1. The method of printing indicia onto the outer wall of a tubular, elongated, rigid article under heat and pressure from a tape bearing said indicia printed as repeated heat and pressure sensitive impressions of one or more colors on said tape, comprising positioning the tubular article for rotation on its axis, positioning a heat and pressure member having an elongated yieldable, flat face, in line with the tubular article, mounting said tape between said yieldable face and the article, and rotating the article by moving the flat face of the heat and pressure member, with the tape intermediate the pressure member and the article, yieldably transversely across the article while pressing said member downwardly, thereby progressively printing the indicia of the tape circumferentially onto the article.

2. In the method of claim 1, the further step of removing said article and replacing it with another similar article so positioned for rotation on its longitudinal axis, as too permit a repetition of the printing operation.

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