United States Patent

Gery et al.

[15] **3,635,154**

[45] **Jan. 18, 1972**

[54] APPARATUS FOR PRINTING ON CONVEX SURFACES

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[22] Filed: **Sept. 29, 1969**

[21] Appl. No.: **861,712**

[52] **U.S. Cl.**.....**101/44**, 101/334, 101/379

[51] **Int. Cl.**.....**B41f 17/20**

[58] **Field of Search**.....101/376, 379, 380, 41–44, 101/333, 334, 97, 98, 101, 104, 105, 298–305

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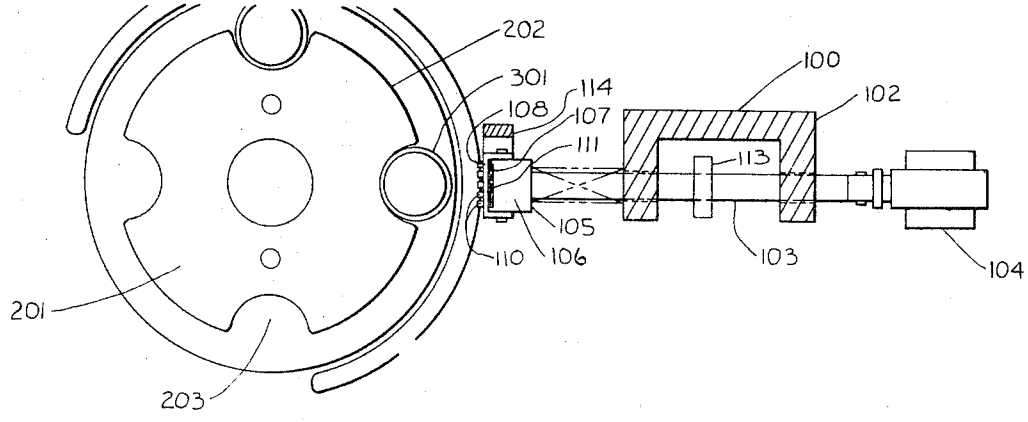
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[57] **ABSTRACT**

A printing device wherein a print carrier is movable toward and away from a convex surface to be printed, a depressible pad being carried by the carrier for movement therewith toward the convex surface in facing relation with the latter. A flexible printing sheet is located on the pad, being carried by the carrier and having type members, for movement with the carrier into conforming engagement with a convex surface being printed.

5 Claims, 5 Drawing Figures



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SHEET 1 OF 2

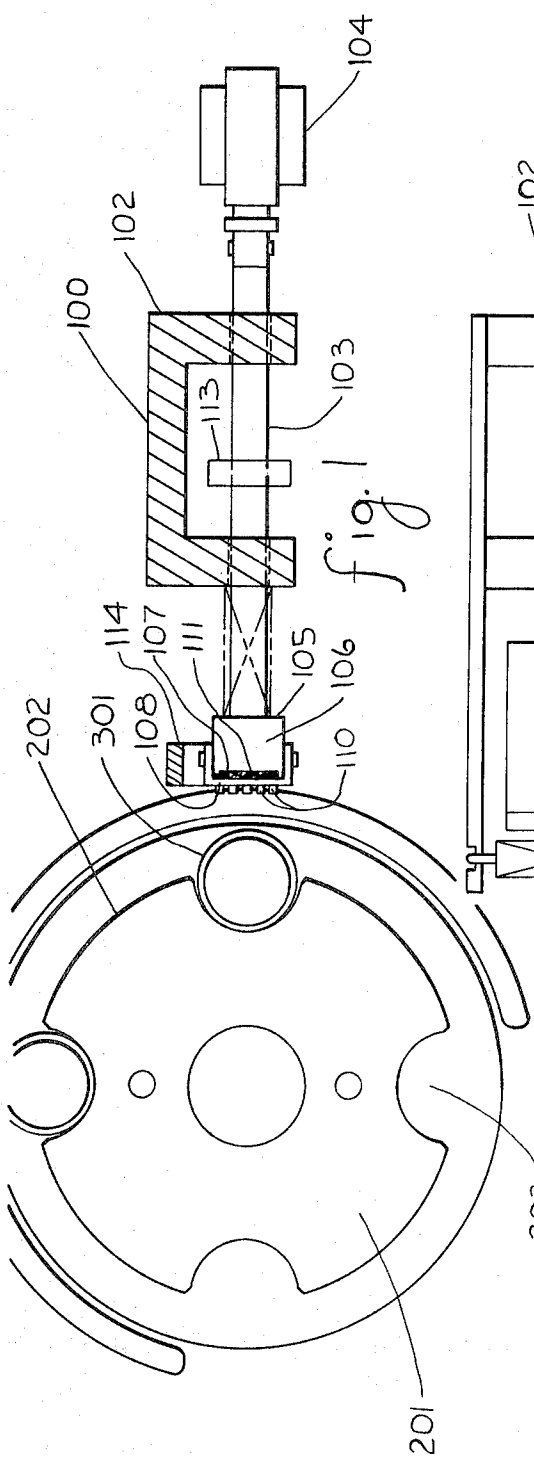


Fig. 1

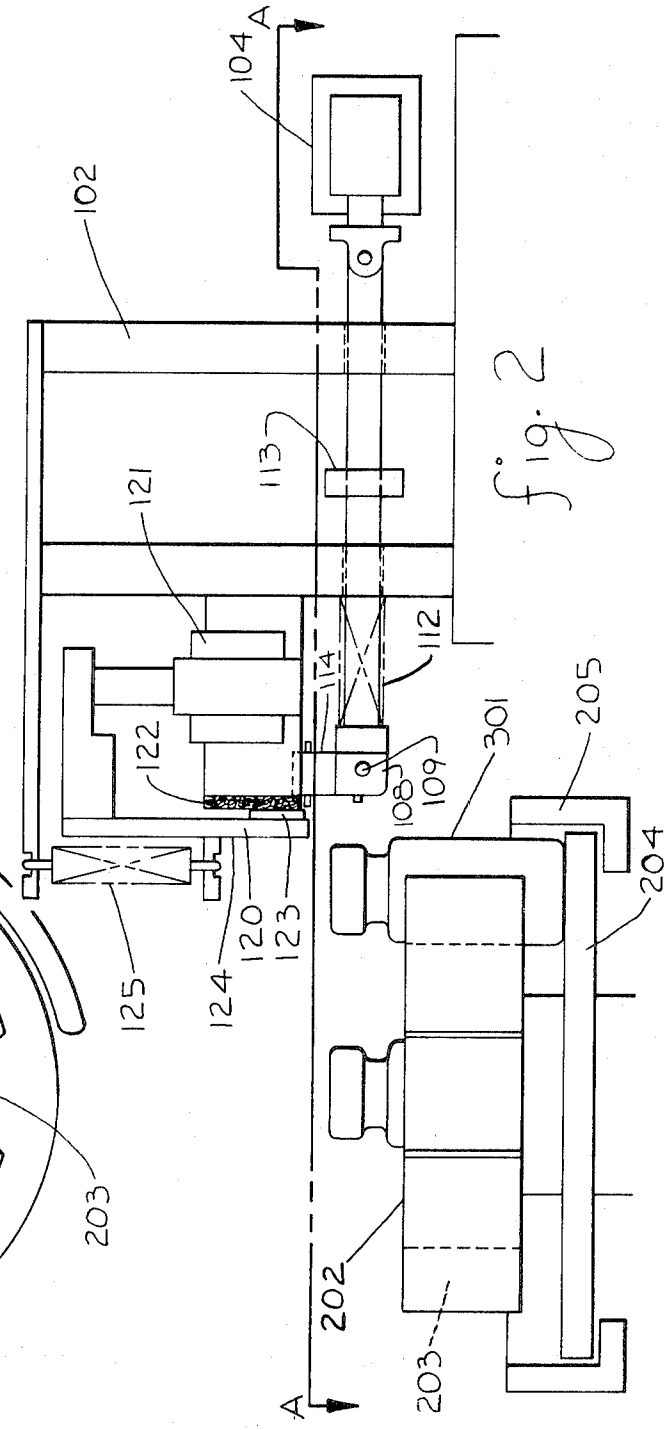


Fig. 2

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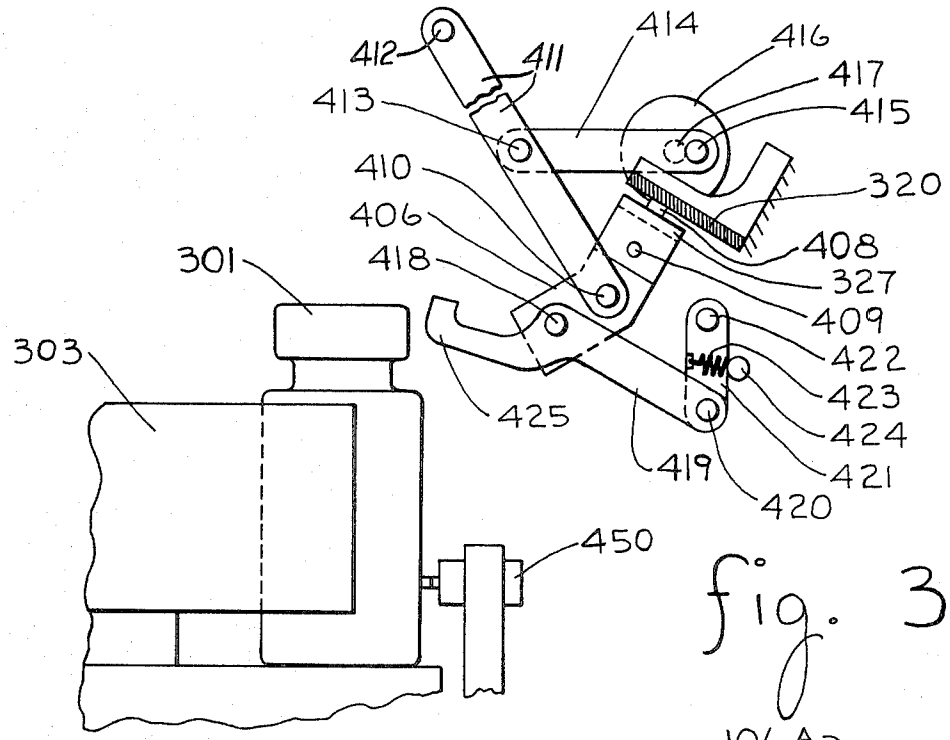


fig. 3

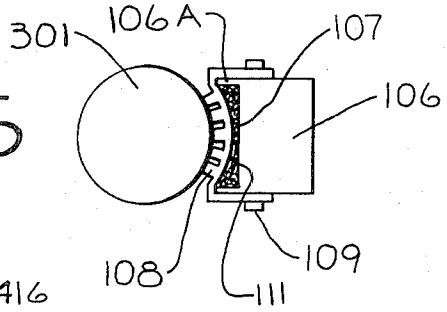


fig. 5

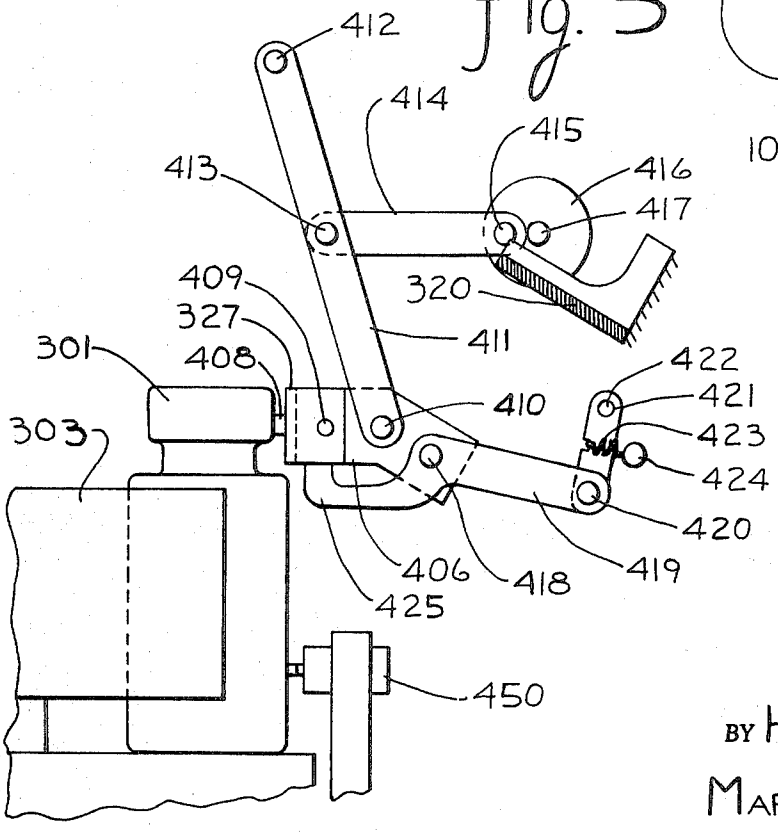


fig. 4

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APPARATUS FOR PRINTING ON CONVEX SURFACES

BACKGROUND OF THE INVENTION

While there are many varied applications for apparatus to print upon convex surfaces, say the printing on cans, jars, etc., all of which applications are intended to be comprehended herein, the apparatus of the present invention has been primarily developed and employed for use in the imprinting of pharmacal containers, and will be illustrated and described hereinafter with particular reference thereto.

As is well known to those versed in the manufacture and distribution of pharmaceuticals, it is often necessary or desirable to package drugs, and the like, such that the package carries indicia pertinent to formulation, date, contents, batch and lot numbers, and other information, such that the information remains with the pharmaceuticals during the life of the container and contents.

The application of information to pharmaceutical packages, as practiced in the prior art is subject to serious difficulties. The adhesive attachment of a label to a container is unreliable over a substantial period of time and in different environments, say being mutilated or removed as by abrasion and moisture.

The prior art method of printing directly on glass is not entirely satisfactory, as the print is quite easily removed, by inadvertent wiping or customary handling. Imprinting on the caps of containers involves the not infrequent loss of caps or transposition between containers.

The present invention finds advantageous employment in conjunction with the use of a sealing band about the neck of a container, the band being of a type which is partially removable to permit opening of the container, with the remainder of the band remaining about the container neck. Such sealing bands or rings are conventionally used with various cylindrical containers, such as vials or bottles. While the printing apparatus of the present invention is primarily intended for use on such vials or bottles having sealing rings or bands, as to print directly upon the sealing rings, it is appreciated that the advantageous features of the instant invention may be employed in various other printing systems without departing from the teachings herein.

In the printing of curved or contoured surfaces, distortion of the characters must be minimized for full legibility, and the quantity of printing medium or ink deposited by the type members must be precisely controlled to insure sufficient ink for ease of reading, without an excess of ink likely to cause smudging.

SUMMARY OF THE INVENTION

Accordingly, it is an important object of the present invention to provide a printing apparatus for printing on a curved or arcuate surface, say on the unremovable seal portion of a container, information pertaining to the contents of the container.

It is another object of the present invention to provide a printing apparatus for printing on containers, on which the quantity of printing ink is capable of close and accurate control.

It is another object of the present invention to provide a printing mechanism of the type described which operates in timed relation with the container filling, closing and sealing procedures such that information is printed on the container while the latter is still located in the filling, capping, sealing or other handling equipment.

It is still another object of the present invention to provide a printing apparatus which is highly automated and operative in timed relation with other packaging mechanisms so that little or no manual intervention is required.

Other objects of the present invention will become apparent upon reading the following specification and referring to the accompanying drawings, which form a material part of this disclosure.

The invention accordingly consists in the features of construction combinations of elements, and arrangements of parts, which will be exemplified in the construction hereinafter described, and of which the scope will be indicated by the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a generally horizontal sectional view showing printing apparatus of the present invention and taken approximately along the line 1—1 of FIG. 2.

FIG. 2 is a side elevational view of the printing apparatus shown in FIG. 1.

FIG. 3 is a partial elevational view showing a slightly modified embodiment of printing apparatus in accordance with the teachings of the present invention and illustrating an inking step in operation of the apparatus.

FIG. 4 is an elevational view of the apparatus of FIG. 3, but showing a position of operation in which the apparatus is imprinting a container.

FIG. 5 is a horizontal or plan view partially showing the printing mechanism of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now more particularly to the drawings, and specifically to FIG. 1, the mechanism to which the printing mechanism **100** is attached, comprises a rotary index table **201** which is used to position container **301** at various stations such as load, close, print and discharge. The container can be filled with the desired contents at one station while printing the coded information pertaining to these contents on a container occurs simultaneously at another station. Since turntables and indexing mechanism of this type are very commonly used in manufacturing processes, no detail is shown pertaining to the driving of the index table. The rotary index table **201** consists of the ring **202** which has slotted portions **203** which are used to locate the container such that the container will properly follow the motion of the rotary index table **201**. It also consists of a rotary shelf plate **204** which can be made vertically adjustable with respect to the ring **202** for various height containers. Adjacent to the shelf plate **204** is a non-rotating ring **205** which is used to retain the containers improper relationship with the slotted portions **203** during the rotational movement. This ring **205** is provided with appropriate open areas at the points where the containers are inserted into and removed from slots **203** of the ring **202**. As shown in FIG. 1, the print mechanism **100** is located adjacent to one of the index positions of the rotary index table **201**. This print mechanism **100** is mounted to the same pad (not shown) as the mechanisms of the rotary index table **201**. The print mechanism **100** comprises a U-shape support member **102** into which are mounted bearings through which the control rod **103** operates. A solenoid **104** is used to move a print head **105** into and out of printing position with the container **301**. The print head **105** consists of an anvil block or carrier **106** secured to the rod **103**. Between the anvil block **106** and a flexible printing or type sheet **108** such as a rubber strip, is a resilient pad **107**. The flexible type sheet **108** is designed to contain all the characters to be printed on the container **301**, as by raised type members or formations **110**. The resiliency of pad **107** in combination with the flexibility of the rubber print sheet **108** enables the type members **110**, on contact with a curved surface to effectively flow around the curved surface, see FIG. 5, which enables radial printing of the individual characters onto the curved container. Obviously, containers with flat surfaces could also be utilized in this unit even though the advantage of being able to print on a curved surface will not be fully utilized. The printing or type sheet **108** is provided with a hole at each end such that on stretching of the rubber sheet, these holes can be mounted to the pins **109**, FIG. 2, securely fastened to the type block or carrier **106**.

In particular, the anvil block or carrier **106** is formed on one side with a generally rectangular recess or concavity **111**, best seen in FIGS. 1 and 5, facing generally toward the container **301**. The resilient pad **107** is suitable fixed in the recess or

cavity 111 and has its outer face (toward the adjacent container 301), generally flush with the carrier surfaces bounding the recess 111. The printing sheet 108 extends across and in facing engagement with the carrier surfaces bounding the recess and in frictional facing engagement with the flush face or surface of resilient pad 107. The printing sheet or strip 108 is therefore resiliently depressible conformably with the engaged pad 107 into the recess 111 while in engagement with the pad, so that distortion of the printing sheet and type members 110 is obviated or minimized.

Again as shown in FIG. 1, it can be seen that in order to print in this manner on a curved surface of a container, it is only necessary to retract the print head to allow insertion of the container and release under spring force the print head 105 when the container is in position. The timing of this retraction and reinsertion of the print head 105 for printing is controlled by a timing mechanism which times the movement of the rotary index table 201 with action of the solenoid 104. In order to provide the print type 110 with a proper amount of printing ink so that the printing function can run continuously, an inking mechanism 120 is mounted to the same mechanism support member 102 as the print head rod 103. This inking mechanism comprises a solenoid 121 as shown in FIG. 2, a storage ink reservoir 122, an ink transfer pad 123, a drive plate 124 to which an ink transfer pad 123 is attached and a spring 125 which is used to retain the ink transfer member 124 in noninterference position during the time that the print head 105 is operated. The timing between the rotary index table 201, the print head control solenoid 104 and the ink solenoid 121, must all remain in synchronism; as a result, signals are provided from the rotary index table 201 for the correct timing of solenoid 104 and 121. Since timing of this type is common and is well understood in the art, no further description of this timing will be given. Operation of the ink transfer member 124 is such that the ink transfer bar 120 moves from the position shown in FIG. 2 at which point the ink is transferred from the ink reservoir 122 to the inking pad 123 to a lowered position in which the ink pad 123 is in alignment with the print type 108 of the print head 105. Assuming that a cycle of operation commences at the conclusion of a previous printing, the next phase of the program calls for closing the switch and energizing the solenoid 104. Energizing solenoid 104 brings the print head and associated parts 105 into the rear position shown in FIG. 2. After the solenoid 104 is closed, solenoid 121 is energized which moves the ink pad 123 off of the inking reservoir 122 and into alignment with the type 108 of the part head 105. When the ink transfer bar 120 and the inking pad 123 are in alignment with the print head 105, solenoid 104 is deenergized allowing spring 112 to return the print head 105 to the left, such that it strikes against the inking transfer pad 123. During the time when the solenoid 104 was first turned on, the rotary index table 201 is moving the next container 301 into the printing position shown in FIG. 1. After the conclusion of bringing the next container into this position, the solenoid 121 is deenergized allowing the spring 125 to retract the ink transfer bar 120 and the ink transfer pad 123 into its upper position as shown in FIG. 2 for transferring ink to the ink transfer pad 123 for the next cycle. When the ink transfer bar 120 and the ink transfer pad 123 is removed from the front of the print head 105 and the print type 108, the ink that had been previously deposited on the ink transfer pad 123 is transferred to the type 108. When the transfer rod 120 has moved a sufficient distance to clear the print head 105, the print head 105 is impelled further towards the container 301 by the spring 112. The free movement of the spring 112 and the print head 105 towards the container 301 is sufficient such that the container acts as the stop for the movement of the print head 105. As a result, this impact to do the stopping of the movement of the print head 105 against the container 310 causes the ink formation on the type 108 to transfer to the surface to be printed on the container 301. The force of the spring 112 at this time is still sufficient to cause compression of the type 180 and the resilient pad 107 so that the type 108 will follow the contour of the curved container. After this print cycle, solenoid 104 is again energized repeating the cycle just described.

It will now be appreciated that the carrier body 106 or print head 105 is mounted by means of the elongate member or rod 103 of movement of its recessed side toward and away from the concave surface of container 301 to be printed. Further, suitable stop means, such as a lug 113, may be adjustably carried by the mounting rod 103 for limiting engagement, say with the support means or frame 102 such that the printing sheet 108 and its print members 110 are properly engaged for printing relation with a surface of container 301. Also, additional stop means may be provided at 114, say on the print head 105, for limiting engagement of the print type 110 with the inking member 120 carrying the ink transfer pad 123. The stop means 114 may be adjustable so that desired pressure occurs between the ink transfer pad 123 and print members 110. The stop means 114 may be of resilient or other suitable construction say a coil compression spring if desired.

In some applications it may not be possible to provide the timing as required by the two solenoids 104 and 102. As a result, an alternate method of applying ink to the print head 105 will now be described.

As shown in FIG. 3 and FIG. 4, the containers 301 are shown in the rotary index table 203, only a portion of which is shown. As shown in FIG. 4, the print type members 408 are shown in print engagement with the container 301 in this particular mechanism. The print type 408 is mounted to a print head or carrier 406 by means of mounting pins 409 similar to that shown and described in relation to FIGS. 1 and 2. The print head 406 is pivotally connected by a pin 410 to a link 411. The other end of the ink 411 is pivoted by a pin 412 to the satisfactory frame of the equipment. Intermediate to pivot pins 410 and 412 is a third pivot pin 413 to which is mounted a link 414 connected at its other end by a pivot pin 415 to an eccentric 416. Eccentric 416 is mounted to a shaft 417 of a motor or clutch which can be controlled in timed relationship with the operation of the machine. As shown in FIG. 4, when the eccentric 416 is in the position shown, the link 414 is in such a position that the link 411 has been rotated its maximum clockwise direction such that the print head 406 and the print type 408 are in printing position with respect to the container 301. As the eccentric 416 rotates clockwise, the link 414 is carried to the right as shown in FIG. 3 and the link 411 is rotated counterclockwise. As the pivot pin 410 moves in the counterclockwise direction with respect to pivot pin 412, the print head 406 is carried to the right with it. A portion of the print head 406 is designed to extend below the pivot pin 410 and mounted to this depending portion is a pivot pin 418. Pivot pin 418 carries an auxiliary link 419 which at its other end is connected by a pivot pin 420 to a link 421 pivotally mounted to the frame of the machine by a pivot pin 422. A spring 423 is used to normally retain link 421 against a fixed stop pin 424 mounted in the machine frame. As shown in FIG. 4, the link 421 has been rotated clockwise away from the stop pin 424 at the extreme motion of the link 411 in the printing position. An extension 425 of link 419 is designed such that the print head 406 cannot rotate counterclockwise beyond the horizontal position during the print mode. As a result, in he final portion of its motion, the print head 406 pulls the link 419 to the left which in turn moves the link 421 clockwise away from the stop pin 242 as shown in FIG. 4. The spring 423 therefore acts to yieldably hold the print head 406 in a given position against extension 425 for printing.

As the eccentric 416 rotates clockwise, spring 423 pulls the links 421, 419 and the print head 406 to the right until such times that the link 421 bottoms against stop pin 424. Further movement of the eccentric 416 causes the link 411 to continue to rotate in the counterclockwise direction until the pivot pin 415 is approximately 180° from where it is shown in FIG. 4 or as it is shown in FIG. 3. During this portion of the cycle, the pivot pin 418 is held from moving further to the right through its connection with stop pin 424. As a result, as the

print head 406 is moved to the right through its connection with pivot pin 410, the print head 406 is rotated clockwise about pivot pin 418 since the line of force from pivot pin 410 acts above the pivot pin 418. As a result, the print head 406 is rotated a distance sufficient such that when the eccentric 416 is in the position shown in FIG. 3, the print type 408 comes into pressure engagement with an ink pad 320. The linkage is designed in such a manner that when the print head reaches the position shown in FIG. 3, an interference engagement occurs between the ink pad 320 and the print type 408 such that the resilient pad 327 is compressed to provide the force necessary to transfer the ink from the ink pad 320 to the print type 408. In the normal operation of the mechanism the eccentric 416 will continue to rotate clockwise a sufficient distance beyond that shown in FIG. 3 to a point where the pressure between the ink pad 320 and the print type 408 is just relieved. At this point, the motor or the clutch driving the eccentric 416 will be stopped in order to stop the eccentric at this position. The start up of the motor and the initiation of the next cycle for printing will occur when the next container 301 reaches its printing position as sensed by a switch closure of switch 450 thus repeating the cycle just described. As a result, the description related to FIG. 3 and 4 shows the alternate method of inking the print type 408 from that previously described in reference to FIG. 1 and 2.

From the forgoing, it is seen that the present invention provides a printing apparatus which fully accomplishes its intended objects and is well adapted to meet practical conditions of manufacture and use.

Although the present invention has been described in some detail by way of illustration and example for purposes of clarity of understanding, it is understood that certain changes and modifications may be made within the spirit of the invention.

What is claimed is:

1. Apparatus for printing on a convex surface, said apparatus comprising a carrier, mounting means mounting said carrier for movement toward and away from said surface, a resiliently depressible pad carried by said carrier on one side thereof and having one face facing toward said surface upon carrier movement toward said surface, a flexible printing sheet on said one face of said pad for movement with said carrier and resilient depression with said pad, and type members on said printing sheet for conforming engagement with said surface upon movement of said carrier and depression of said pad, said one side of said carrier being hollow, said pad being located in said hollow, and said printing sheet extending across said hollow in facing engagement with said pad and having spaced locations anchored to said carrier on opposite sides of said hollow, said hollow being generally rectangular and said pad being conformably engageable in said hollow substantially flush with carrier surfaces on opposite sides of said hollow, and said printing sheet bearing on said carrier surfaces, for flush frictional facing engagement of said printing sheet with the said pad.

2. Apparatus for printing on a convex surface, said apparatus comprising a carrier mounting means mounting said carrier for movement toward and away from said surface, a resiliently depressible pad carried by said carrier on one side thereof and having one face facing toward said surface upon carrier movement toward said surface, a flexible printing sheet on said one face of said pad for movement with said carrier and resilient depression with said pad, and type members on said printing sheet for conforming engagement with said surface upon movement of said carrier and depression of said pad, said mounting means comprising a carrier pivot mounting said carrier for swinging movement into and out of facing relation with said surface, a support means supporting said carrier pivot for movement toward and away from said surface, and a carrier swinging linkage pivotally connected to said carrier for swinging the latter about said carrier pivot upon carrier pivot movement by said support means, whereby said carrier is movable with said support means toward said surface when in said facing relation and away from said surface when out of said facing relation.

3. Apparatus according to claim 2, in combination with inking means located in position for facing engagement with said carrier when the latter is moved away from said surface and swung about said carrier pivot.

4. Apparatus according to claim 3, said support means comprising a tension link pivoted to said carrier resisted by said carrier swinging linkage, and an extension on said tension link engageable with said carrier to limit swinging movement of said carrier in one direction to its position facing said surface.

5. Apparatus according to claim 4, said carrier swinging linkage comprising a swingable link having one end journaled and its other end swingable and pivotally connected to said carrier at a location always on one side of an extension of said tension link, to positively constrain said carrier to movement between said positions facing said surface and said inking means.

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