United States Patent [19]

Ackley

[11] **3,871,295**

[45] **Mar. 18, 1975**

[54] **CAPSULE ORIENTING APPARATUS AND METHOD OF SPIN PRINTING**

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[52] **U.S. Cl.** **101/426,** 101/40, 118/62, 198/249, 221/173, 198/DIG. 4

[51] **Int. Cl.** **B41f 17/36,** B65g 47/24

[58] **Field of Search** ..... 101/35–40, 101/426; 198/33 R, 33 AA, 33 AB, 33 AC, 33 AD, DIG. 4, 249; 193/43 R, 43 B, 43 D; 221/171–173, 278, 1; 118/62

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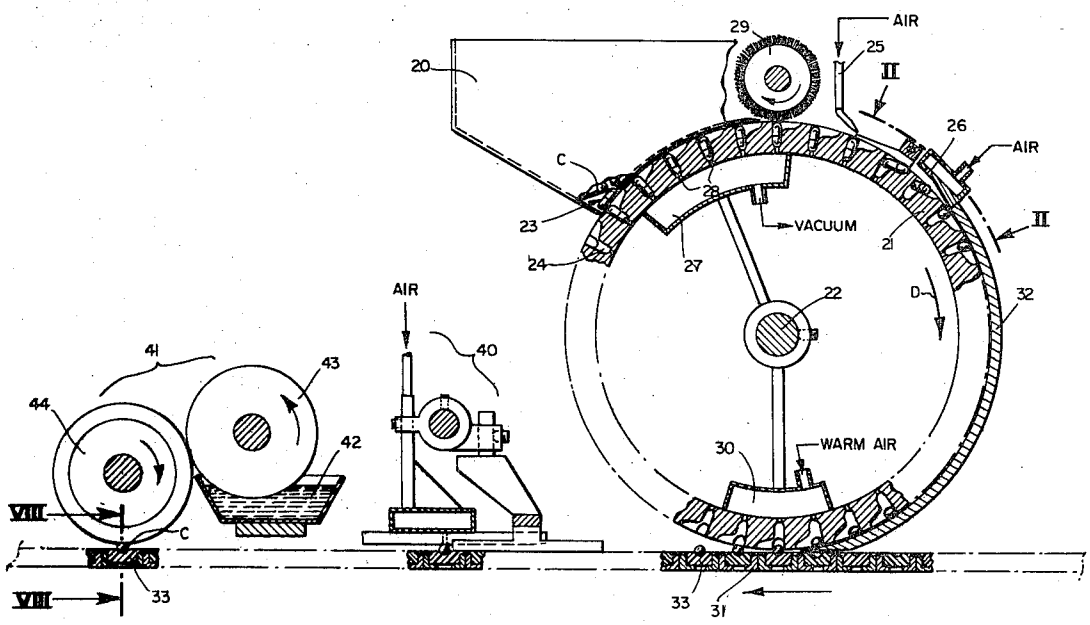
Primary Examiner—Clifford D. Crowder

[57] **ABSTRACT**

Capsule orienting and turning apparatus and method for use in a spin printing procedure in which a printing roll moves at a greater speed than the capsule, thus causing the capsule to rotate about its own axis while it is being printed. Many capsules, randomly arranged in a hopper, are picked up in a rotary conveyor which arranges them first in vertical arrangement relative to the path of movement of the conveyor, some capsules upright and some inverted, and an air jet shifts the body portions of the upright capsules in the machine direction so that the cap portions can subsequently be shifted in a sidewise direction by a subsequent sideward-directed air jet. Those capsules which are inverted are not affected by the first air jet because of a barrier which prevents their movement; the cap portions of these inverted capsules are blown sidewise by the sidewardly directed air stream. In this way, the positions of the capsules are rectified, with all of the cap portions on one side of the predetermined path and all of the body portions on the other side of the predetermined path.

11 Claims, 9 Drawing Figures



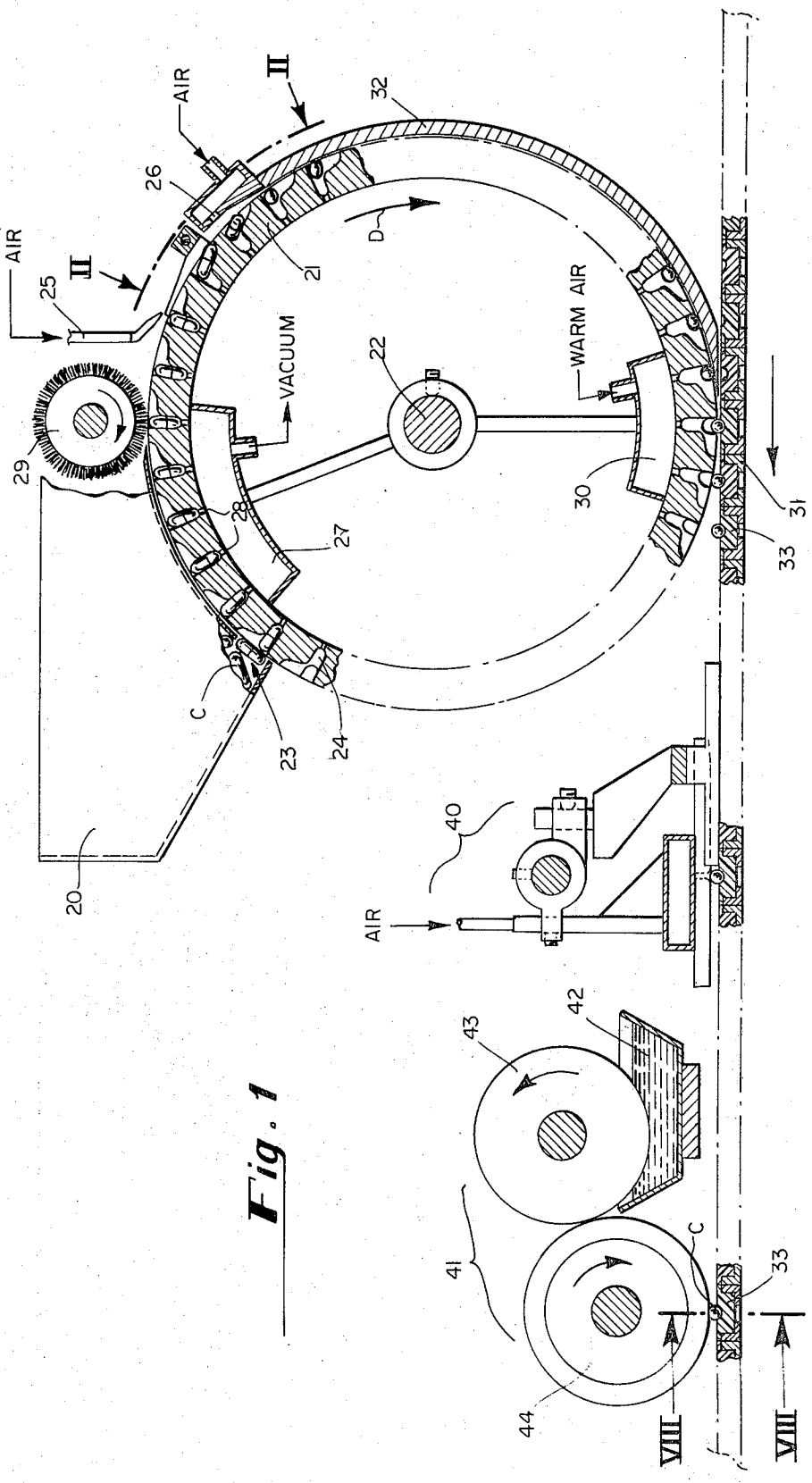

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Fig. 1

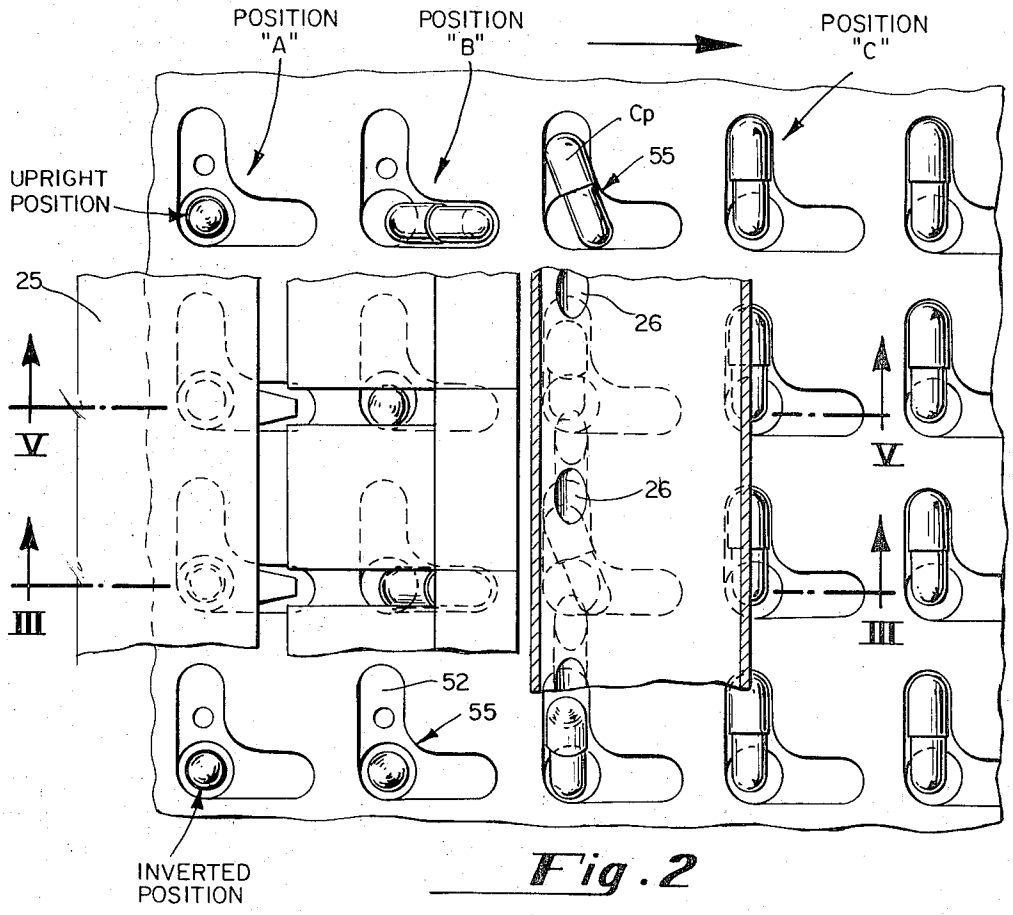

Fig. 2

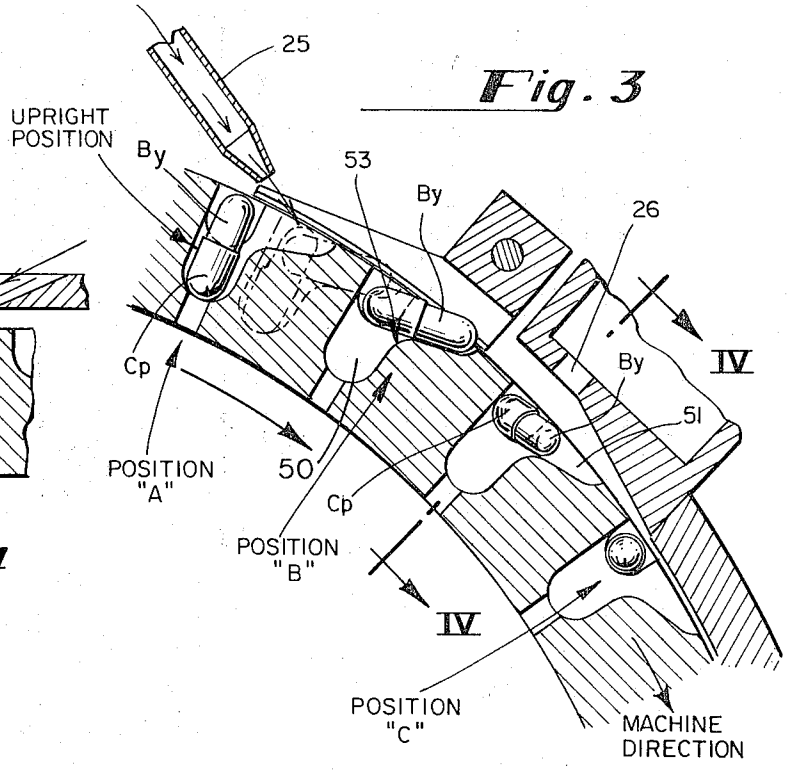

Fig. 3

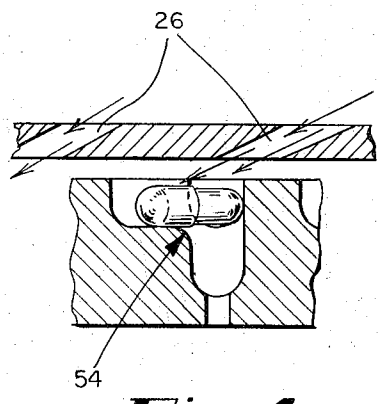

Fig. 4

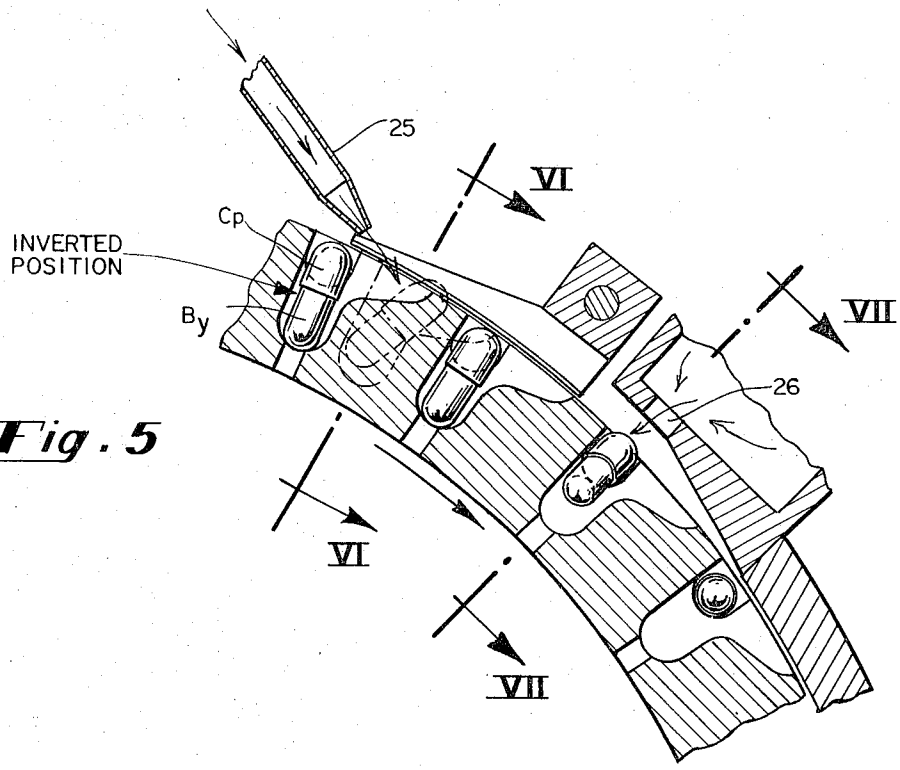

Fig. 5

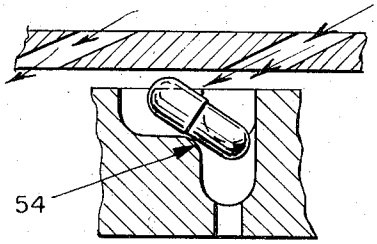

Fig. 7

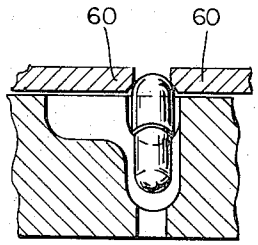

Fig. 6

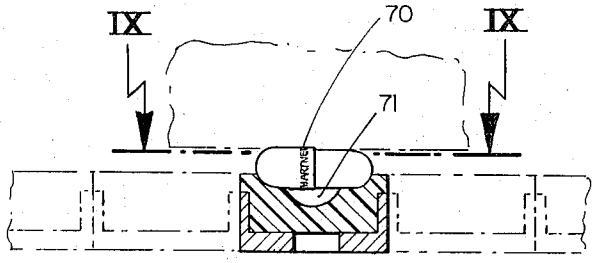

Fig. 8

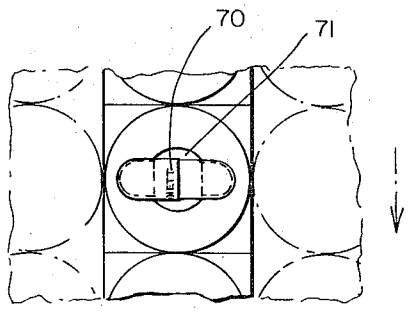

Fig. 9

CAPSULE ORIENTING APPARATUS AND METHOD OF SPIN PRINTING

INTRODUCTION

This invention relates to a capsule orienting and turning apparatus for orienting and rectifying the positions of capsules which are originally disposed in a random arrangement in a container such as a hopper or the like. According to this invention, the capsules may be disposed in a uniform manner on a conveyor with all of the cap portions at one side and all of the body portions on the other, with the capsules having their axes disposed at approximately right angles to the path of the movement of the conveyor. In this position the capsules are arrayed in a preferred position for such subsequent processing operations as spin printing, in which procedure the conveyors are mounted in a rotatable position on individual carriers, and are passed in contact with a rotating printing roll which rotates at a speed which is considerably greater than the speed of movement of the capsule conveyor, thus causing each capsule to spin about its own axis during the printing process in a manner to apply special printing indicia having a large angle of wrap around the capsule.

BACKGROUND OF THE INVENTION

Marking machines of various types have been used commerically for marking indicia on a multiplicity of objects all of which have essentially the same size and shape. For example, machines have been successfully used for applying to relatively small articles such as pharmaceutical capsules, pellets, pills and the like, markings such as alphabetical letters, manufacturer's trademarks or other characterizing symbols for the purpose of ready identification. However, in most commercial procedures, particularly in the pharmaceutical industry, one of the primary objects of marking has been to prevent counterfeiting of products and of materials contained therein. In order to achieve this purpose, it has been highly desirable to apply an extremely accurate marking, having such a finely detailed character that counterfeiting is difficult or virtually impossible. In order to achieve this result, it has been considered necessary to avoid any relative movement between the article and the printing roll, and to avoid spinning of the pharmaceutical article about its axis.

DISCUSSION OF THE PRIOR ART

The Ackley Pat. No. 2,931,292 discloses an article marking machine of the type referred to above, which has been in successful commercial use for many years. Such an apparatus is particularly useful for handling objects which are symmetrical in form, such as pellets, pills or the like which are usually generally cylindrical or oval in shape.

Marking machines of the type disclosed in the Ackley Patent are ideally constructed for accepting large numbers of individual objects which are randomly arranged in a hopper, moving them along a conveyor belt and printing with extreme fineness and accuracy on one or both sides of the objects while holding the objects completely stationary in carriers which are specifically designed for the purpose.

In the pharmaceutical industry a physiologically active substance, usually in powdered form, is often placed into a capsule which is composed of two portions: a body portion of predetermined diameter and a cap portion of slightly larger diameter which slides telescopically over the body portion. In order to prevent the removal of a genuine pharmaceutical material from the capsule and substitution of a counterfeit material, such capsules have recently adopted a self-locking structure, such that the body portion and the cap portion are automatically locked to each other upon pushing the body portion onto the cap portion through a predetermined distance.

Accordingly, many capsules which are coming into extensive use at this time are not symmetrical in shape, because the cap portion necessarily has a larger diameter than the body portion.

In the cases of all such capsules, and in situations relating to many other pharmaceutical and other objects, it is often desirable to apply the printed indicia over a wide angle of surface curvature. For example, when the manufacturer has a long name, the name may be wrapped all the way around, or as much as 180 degrees of the circumference of the capsule or other objects, or even more. This is effectively accomplished by causing the object to spin about its axis or center as the indicia are printed on the surface of the object. When the object is supported in a manner to allow slippage for freedom of rotation sufficient printing friction can be provided to eliminate any substantial slippage between the printing means and the surface printed upon.

OBJECTS OF THE INVENTION

It is accordingly an object of this invention to provide an automatic machine which can accept for mass production large numbers of capsules which are arranged completely at random in a container such as a feed hopper for example, and which can sort out and orient the capsules so that they are spaced apart uniformly from each other and so that they can be "rectified," which term as used in connection with this invention means arranging all of the cap portions toward one side of the predetermined path of movement of the capsules and arranging all of the body portions toward the other side of such path.

It is another object of this invention to provide an apparatus of this type which picks up the capsules from the hopper with a high degree of efficiency and reliability, which arranges them in a vertical position with respect to the path of movement, and which then shifts them to a transverse position with respect to the path of movement and deposits them in a rectified condition on a conveyor belt, with the axes of the capsules substantially crosswise to the direction of movement of the conveyor belt, in a condition ideally adapted for spin printing.

Other objects and advantages of this invention, including the simplicity and economy of the same, and the ease with which it may be adapted to the high speed mass production of spin printed capsules, will readily become apparent hereinafter and in the drawings.

DRAWINGS

FIG. 1 is a view in side elevation, with certain parts shown in section, illustrating one embodiment in accordance with this invention.

FIG. 2 is a fragmentary sectional view of a portion of the apparatus, taken as indicated by the lines and arrows II—II which appear in FIG. 1.

FIG. 3 is a sectional view, taken as indicated by the lines and arrows III—III which appear in FIG. 2.

FIG. 4 is a fragmentary sectional view of a portion of the apparatus, taken as indicated by the lines and arrows IV—IV which appear in FIG. 3.

FIG. 5 is a fragmentary sectional view, taken as indicated by the lines and arrows V—V which appear in FIG. 2.

FIGS. 6 and 7 are sectional views taken as indicated by the lines and arrows VI—VI and VII—VII, respectively, which appear in FIG. 5.

FIG. 8 is a sectional view of a portion of the spin printing apparatus appearing in FIG. 1, taken as indicated by the lines and arrows VIII—VIII which appear in FIG. 1.

FIG. 9 is a view in plan of a portion of the capsule conveyor which is used in the spin printing operation, looking in the direction indicated by the lines and arrows IX—IX which appear in FIG. 8.

DETAILED DESCRIPTION OF THE ILLUSTRATED EMBODIMENTS

The following description is not intended to limit the scope of the invention, as defined in the appended claims, but will be presented in specific terms in order more clearly to describe the construction and operation of the particular forms of the invention that have been selected for illustration in the drawings.

Turning to FIG. 1, the number 20 designates a capsule carrying hopper which is mounted on a suitable support (not shown), above a portion of a rotatable cylinder 21 which is mounted for rotation about an axle 22. A motor (not shown) is provided for rotating the cylinder 21. The hopper 20 has an opening as indicated at 23 for delivery of capsules to a plurality of equally spaced, generally elongated cavities 24 which are formed in and extend across the outer surface of the rotatable cylinder 21. It will be observed that the capsule cavities have elongated portions which extend in a generally radial direction, as will be described in more specific detail hereinafter, allowing the capsules to be received by the cylinder 21 in generally radial positions. As will become apparent in further detail hereinafter, some of the capsules naturally fall into the cavities 24 in an upright position, with the body portions above the cap portions, while other capsules fall naturally into the cavities 24 in an inverted position, with the cap portions above the body portions.

The number 25 designates a plurality of longitudinally directed air jets which are arranged to provide blasts of air in a direction generally along the direction D in which the rotatable cylinder 21 is rotating. The number 26 designates another group of air jets, which are directed substantially crosswise of the machine, which tend to shift certain capsules in a crosswise direction as appears in FIG. 1, and as will be described in further detail hereinafter.

The number 27 designates a stationary vacuum chest which is located immediately adjacent to the inner surface of the cylinder 21 and which serves to assist in the introduction of the capsules into their cavities, the influence of the vacuum being effected through small holes 28 which extend through inner portions of the cylinder 21 into the capsule cavities 24.

The number 29 designates a rotating brush which serves to straighten out any capsules that might be lying in an angular position, as opposed to the upright position illustrated in FIG. 1.

The number 30 designates a source of warm air located adjacent to the bottom of the cylinder 21, and serves to assist in the gravity release and transfer of the capsules from a bottom portion of the cylinder 21 onto a conveyor belt 31.

It will be apparent that the air jet means 25 and 26 are mounted in stationary positions but are spaced close to the rotating cylinder 21. Similar comments apply with respect to the vacuum chest 27 and to the warm air chest 30.

A curved plate 32 is arranged in closely spaced relation to the lower, outer surface of cylinder 21, preventing the capsules from falling prematurely by gravity out of their capsule cavities 24. However, such plate 32 terminates just short of the bottom of the cylinder 21, thus liberating the capsules to move by gravity, and under the influence of warm air, onto individual capsule carriers 33 carried by the conveyor 31.

The number 40 designates an air blasting means for separating the cap and the body portion to a limited degree in order to provide an exact overall length for each capsule, preparatory to the spin printing operation. This air separator is the subject of a separate application for patent, Ser. No. 393,964 filed Sept. 4, 1973 and which is not itself a part of the invention claimed herein. The number 41 generically designates an offset printing apparatus which is ideally adapted for spin printing in accordance with this invention. It includes an ink reservior 42, a transfer roll 43, and a printing roll 44 which is continuously rotated in the direction indicated by the arrow thereon, in contact with the capsules as they move underneath the roll 44, carried by their carriers 33 on the conveyor 31. In the spin printing process, one or more elongated forms of indicia are preferably printed on the outer surface of the capsule by adjusting the speed of rotation of the roll 44 so that its surface speed is considerably greater than the speed of movement of the conveyor 31. Preferably, the capsule carrier 33 is composed of a slippery material such as polytetrafluoroethylene for example, which has a coefficient of friction which is less than that of the printing roll, thus permitting the capsule to rotate freely upon its axis under the frictional influence of the printing roll 44 during the spin printing process.

Referring now to FIGS. 2, 3 and 4 of the drawings, it will be apparent that each capsule cavity 24 includes a generally radially directed pocket portion 50, a generally longitudinally directed portion 51 and a generally transversely directed portion 52. The pocket portion 50 is connected by walls having a surface curvature at 53 to the longitudinal portion 51, and by walls having surface curvature 54 to transverse portion 52. Another wall having a curved surface portion 55 provides a connection from longitudinal pocket portion 51 to transverse pocket portion 52.

A typical capsule is shown in FIG. 3 in its upright position, in which the body portion By is located above the cap portion Cp. It will be appreciated that the longitudinally directed air jets 25 in FIG. 3 impinge upon the body portions By in the manner shown therein, and tilts them about the curved surface 53 to the position illustrated as position B in FIG. 3. It will further be appreciated from FIG. 3 and FIG. 4 that the transverse air jets 26 impinge upon the cap portions Cp and slide them around the curved portion 55 (see also the upper portion of FIG. 2, central portion), forcing the capsule into the position illustrated as "position C" in the drawings.

Turning now to FIG. 5 of the drawings, the capsule is there shown in its inverted position with the cap *Cp* above the body portion *By*. The longitudinally directed air jet **25** impinges upon the cap portion *Cp* as shown in dotted lines in FIG. **5**, but the cap portion *Cp* is prevented from swinging into "position B" by stop members **60, 60** which appear in FIG. **6** and are spaced apart at a distance greater than the diameter of *By* but less than the diameter of *Cp*. Subsequently, the transversely directed air jet **26** swings the capsule around the curved surface **54** which appears in FIG. **7**, forcing the cap portion toward the same side of the machine as the cap portions from the capsules that were originally in their upright positions. Thus, in this manner, all of the capsules are "rectified" which, in accordance with this invention, means that all caps of the capsules are arranged toward one side with respect to the machine direction and all of the body portions of the capsules are arranged toward the other side with respect to the machine direction.

It will now be apparent that, with all of the capsules thus rectified, they move downwardly around the periphery of the rotatable cylinder **21** maintained within their pockets in a rectified condition by the guard plate **32**, and are deposited, under the influence of gravity and of the warm air **30**, onto the carriers **33**. They are subsequently subjected to spin printing in a manner to apply bands **70, 70** or the like, as appears in FIGS. **8** and **9** of the drawings, the printing roll **44** being driven at a greater peripheral velocity than the velocity of movement of the conveyor **31** and recessed at **71** to avoid smearing of the printed indicia.

Although this invention has been described in conjunction with certain specific forms and certain modifications thereof, it will be appreciated that a wide variety of other modifications can be made without departing from the spirit of the invention. For example, some of the features of the invention may be used independently of other features, including the use or non-use of the vacuum chest **27** or the warm air chest **30** and the use or non-use of the apparatus for partially separating the cap and the body portions prior to spin printing. Indeed, the capsule orienting and rectifying apparatus is capable of uses independent of spin printing, although it is admirably adapted for that use.

Additonally, in accordance with this invention, various equivalent elements may be substituted for those shown and specifically described, and in many instances parts may be reversed in ways which will become apparent to those skilled in the art, all without departing from the scope and spirit of this invention as defined in the appended claims.

I claim:

1. In a capsule orienting and turning apparatus, the combination which comprises:

a continuously movable capsule transporting apparatus having a plurality of spaced-apart pockets for the capsules,

means moving said transporting apparatus to move said pockets from positions facing open upwardly to positions facing open downwardly,

means for feeding a plurality of capsules for reception in said pockets while said pockets are open upwardly,

each said pocket having an elongated pocket portion for receiving said capsule therein with the capsule axis substantially perpendicular to the direction of capsule movement, referred to in this claim as position "A",

each said pocket also having a longitudinal pocket portion arranged to carry the capsule with the capsule axis extending in approximately the direction of its movement, referred to in this claim as position "B",

and each said pocket having a laterally extending pocket portion arranged to carry the capsule arranged crosswise of position "A" and also crosswise of the direction of of its movement, referred to in this claim as position "C",

and shifting means, operative while the capsule pockets and capsules are moving, to shift capsules from position "A" to position "B" and then to position "C", with all the cap portions in rectified orientation.

2. The apparatus defined in claim **1** wherein means is provided for shifting some of said capsules directly from position "A" to position "C".

3. The apparatus defined in claim **1** wherein said shifting means includes means forming a passage arranged to carry high velocity fluid.

4. The apparatus defined in claim **3** wherein said fluid is air.

5. Apparatus as defined in claim **1**, arranged for rectifying the positions of capsules each of which has a body portion of given transverse dimension and a cap portion of larger transverse dimension than that of said body portion, wherein means are provided for moving said capsule from position "A" to position "B" and wherein spacer stop means are provided of such size as to prevent the cap portion of the capsule from tilting into the position "B" pocket portion but to permit the body portion to do so.

6. Apparatus as defined in claim **1** wherein each pocket includes a wall of rounded configuration connecting the position "A" pocket portion to the position "B" pocket portion, and wherein said shifting means includes a means for applying a blast of air to the upper portion of said capsule, when said upper portion is the body portion which is of lesser transverse dimension than the cap portion of said capsule, to tilt said capsule body portion into the position "B" pocket portion.

7. Apparatus as defined in claim **1** wherein said pocket includes a wall of rounded configuration connecting the position "A" pocket portion to the position "C" pocket portion, and wherein said shifting means includes a means for applying a blast of air to the upper portion of said capsule, when said upper portion is the cap portion which is of greater transverse dimension than said body portion of said capsule, to tilt said capsule cap portion into the position "C" pocket portion.

8. The apparatus as defined in claim **1** wherein means are provided for moving said capsule from position "A" to position "B" and wherein each pocket includes a wall of rounded configuration connecting the position "B" pocket portion to the position "C" pocket portion, and wherein means are provided for applying a blast of air to the cap portion of said capsule, to swing said cap portion into the position "C" pocket portion.

9. In a capsule orienting and turning apparatus for printing capsules which are randomly arranged in a container, said capsules having body portions and cap portions which are of greater transverse dimensions than said body portions, the combination which comprises:

a continuously movable capsule separating and transporting conveyor having a plurality of generally vertically-arranged pockets for receiving the capsules in upstanding positions therein, said pockets being substantially equally spaced apart, each said pocket also having a capsule body receiving longitudinal pocket portion which is too small to receive the corresponding cap portion, and which is arranged to carry the capsule with the capsule axis extending in approximately the direction of its movement, and each said pocket having a laterally extending pocket portion which is large enough to receive said cap portion and which is arranged to carry the capsule arranged crosswise of the direction of its movement, means for moving said conveyor along a predetermined path with some of the capsules upright and some inverted, first means for directing a stream of air against the body portions of those capsules which are in upright positions, in a direction generally along said predetermined path, and second air directing means directed transversely of said predetermined path for shifting the cap portions of those capsules which are in an inverted position, and also the cap portions of those capsules which have been shifted by said first means, all in a direction generally sidewise with respect to said predetermined path.

10. In a method of printing capsules which are randomly arranged in a container, said capsules having body portions and cap portions which are of greater transverse dimension than said body portions, the steps which comprise: separating the capsules from one another, arranging them at substantially equal spacing and standing substantially upright, and moving them continuously along a predetermined path, some with caps up and some with caps down, directing a stream of air against the upper portions of the capsules to force those upper portions which are body portions into an orientation generally along the line of said predetermined path, while blocking any such movement of those capsule upper portions which are cap portions, and directing a second stream of air transversely upon all cap portions to swing all capsules to a transverse position of rectified orientation with all the cap portions on the same side and downstream with respect to said second stream of air, and printing upon the capsules while they are in a rectified orientation.

11. In a method of spin printing capsules which are randomly arranged in a container, said capsules having body portions and cap portions which are of greater transverse dimension than said body portions, the steps which comprise: separating the capsules from one another, feeding said capsules for reception in pockets which are open upwardly, with the capsule axis substantially perpendicular to the path of capsule movement, shifting some of the capsules to a position where referred to in this claim as position "A", shifting some of the capsules to a position where the capsule axis extends approximately in the direction of capsule movement referred to in this claim as position "B", and then turning all of the capsules to an alignment with their axes transverse to position "A" and also transverse to the direction of their movement, thereby rectifying said capsules with all their cap portions and body portions similarly oriented, maintaining said capsules in a rotatable condition and contacting said rectified capsules with a printing surface which is moving faster than the speed of movement of the capsules, thereby rotating said capsules while they are being printed.

* * * * *