United States Patent [19]

Noguchi

[11] **3,889,591**

[45] **June 17, 1975**

[54] **METHOD AND APPARATUS FOR PRINTING INDICIA ON PRODUCTS**

[75] Inventor: **Yukihide Noguchi**, Osaka, Japan

[73] Assignee: **Takeda Chemical Industries, Ltd.**, Osaka, Japan

[22] Filed: **Nov. 26, 1973**

[21] Appl. No.: **419,200**

[30] **Foreign Application Priority Data**

Nov. 28, 1972 Japan 47-119512
Nov. 28, 1972 Japan 47-137236

[52] **U.S. Cl.** **101/37**; 101/426; 198/234; 198/DIG. 4; 221/171

[51] **Int. Cl.** **B41f 17/36**

[58] **Field of Search** ..... 198/234, 258, DIG. 4; 221/171, 173; 101/35–40, 426

[56] **References Cited**

UNITED STATES PATENTS

2,293,121	8/1942	Dudley, Jr.	198/258
2,859,689	11/1958	Ackley	101/35
3,261,281	7/1966	Hartmeister	101/40 XR
3,802,340	4/1974	Braun	101/37

Primary Examiner—Clifford D. Crowder
Attorney, Agent, or Firm—Wenderoth, Lind & Ponack

[57] **ABSTRACT**

A branding machine for automatically printing indicia on tablets, pills, candies or any other products of any similar shape and/or size, which comprises a hopper unit, a feed unit including at least one rotary drum having the periphery formed with a plurality of radially inwardly recessed receptacles arranged in at least one row and a printer unit. The receptacles are successively communicated with a vacuum source for receiving the products therein under suction at first, then with a source of compressed air for posture correction of said products within the associated receptacles, again with the vacuum source for holding the posture-corrected products in a definite posture thereby to enable them to be printed by the printing unit, and finally with the compressed air source for successively ejecting the printed products on to a subsequent processing station. A method for reproduction of the indicia on the products.

10 Claims, 5 Drawing Figures

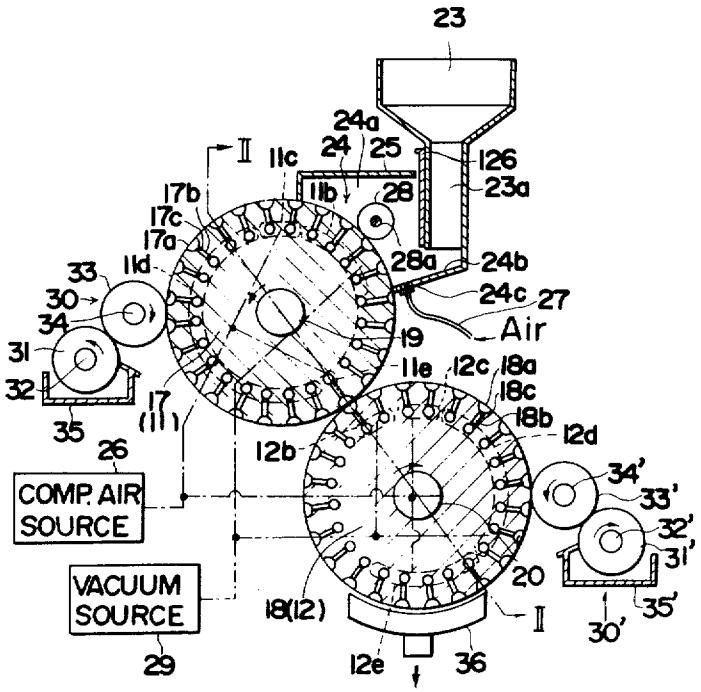


FIG. 1

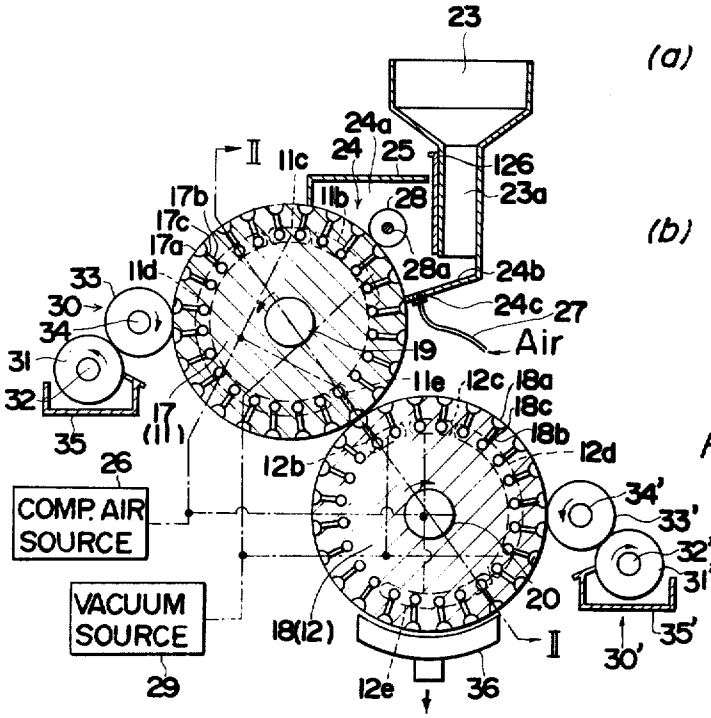


FIG. 2

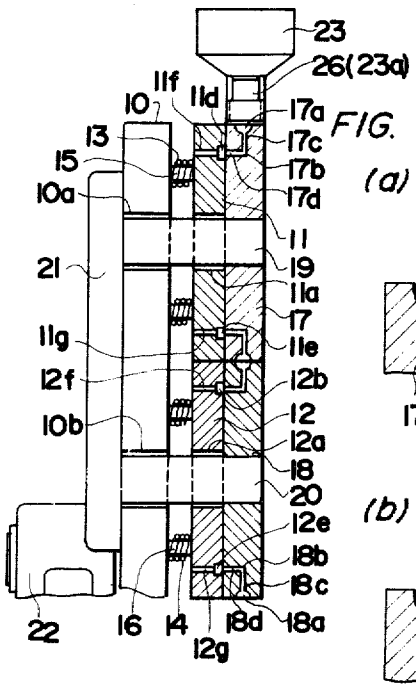


FIG. 3

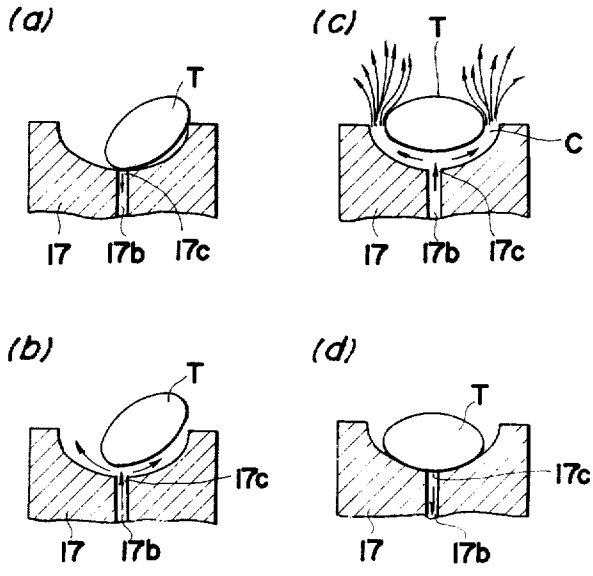


FIG. 4

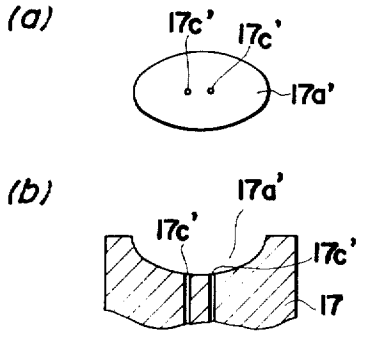
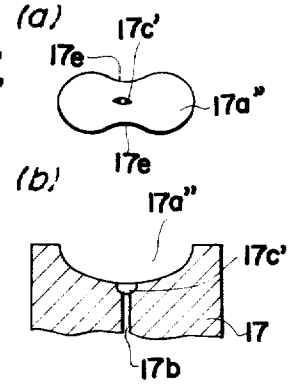


FIG. 5



METHOD AND APPARATUS FOR PRINTING INDICIA ON PRODUCTS

The present invention relates to a branding machine and, more particularly, to a branding machine for automatically printing indicia on tablets, pills, candies, or any other products of any size or shape.

Tablets, pills, candies or any other products on which indicia are reproduced by a branding machine are, for the sake of brevity, hereinafter referred to as products and the branding machine in itself is well known as an instrument for reproducing on the product any indicia such as trademark, brand name, and/or quality indication not only to identify the products, but also to ensure customer recognition of the particular products.

A variety of branding machines are heretofore employed mostly in pharmaceutical industries. On the other hand, it is well known that medicinal products, for example, tablets or pills, are, immediately before they are made up into a package, subjected to a polishing process wherein a suitable wax is applied to the products to give a luster thereto. The lustered products are usually carefully handled but, notwithstanding, when they are subjected to a subsequent branding process, a certain percentage of them tend to lose their luster, reducing the commercial value thereof. This is true of most conventional branding machines wherein relative mechanical rubbing or friction takes place between each product and a corresponding receptacle in which it is held in position during the branding process.

In addition, in any of the conventional branding machines, centering of each product relative to the corresponding receptacle is not positively effected and, therefore, some of the products, which are not correctly received in the corresponding receptacles, are wrongly imprinted, for example, displaced from a printing roll. Displaced reproduction of, for example, a trademark on the products is very uncomfortable to see.

Furthermore, in some of the conventional branding machines employing a hopper connected with a feed disc, conveyor or drum by means of a closed chute, blockage of the closed chute often occurs with the tablets bridging between a pair of opposed side panels which form part of the closed chute, and the branding efficiency is, therefore, reduced.

Accordingly, an essential object of the present invention is to provide a branding machine of the type referred to above, wherein no relative mechanical rubbing or friction substantially take place, thus eliminating the disadvantages inherent in the conventional branding machines.

Another important object of the present invention is to provide a branding machine wherein, during transportation of each product carried by a rotating drum, the product is first sucked into a corresponding one of the receptacles, then floated within the receptacle for centering purpose, again sucked to hold the floated product in a predetermined position within the receptacle and finally blown onto a suitable container or another rotating drum.

A further object of the present invention is to provide a branding machine of the type referred to above, which can handle products of similar shape even though they are irregular as to the size, without substantially incurring a displaced reproduction of an indicium or indicia.

A still further object of the present invention is to provide a branding machine of the type referred to above, which can be used either for printing one side of each product or for printing both sides of each product.

It is a related object of the present invention to provide a method for reproducing indicia on at least one side of each product, which is practised by the branding machine of the type referred to above and wherein each product is accurately centered within the corresponding receptacle by the application of air prior to a subsequent branding process.

According to the present invention, a branding machine herein disclosed basically comprises a hopper unit, a feed unit including at least one rotary drum having the periphery formed with a plurality of radially inwardly recessed receptacles arranged in at least one row in equidistantly spaced relation to each other and from the axis of rotation of the rotary drum, and a printer unit. Each of the receptacles in the rotary drum is, during rotation of said drum, sequentially communicated with a vacuum source to receive a product from the hopper unit, with a source of compressed air to effect centering of the product thus received in the receptacle, i.e., to accurately position the received product within the receptacle, with the vacuum source to hold the product in position within the receptacle after it has been centered with respect to the receptacle, for enabling the product to be printed in a stably held position, and finally with the source of compressed air to blow the printed product off from the receptacle onto a subsequent process.

In case where both sides of each product are to be printed, another rotary drum of the same construction may be employed.

In any event, an essential feature of the present invention resides in the employment of the principle of aerodynamics for accurately positioning each of the products within the receptacle thereby avoiding displaced reproduction of indicia on the product during the subsequent printing process. More specifically, during transfer of each product from one position adjacent to the hopper unit to another position adjacent to the printer unit with the rotary drum rotating a predetermined angle on both sides of the vertical line passing through the axis of rotation of said drum, the product received in the receptacle from the hopper unit is, no matter what posture it has assumed within the receptacle, floated in air within the receptacle thereby to center the center of gravity of the product on the stagnation point at which flow of air directed towards the product is divided, imparting an aerodynamic force to the product so as to upwardly lift the latter.

By the aerodynamic force acting on the product, the posture of the product within the receptacle can be advantageously corrected to enable the product to be accurately printed with indicia during the subsequent branding process. Mere application of the aerodynamic force to the product without the amount thereof being adequately controlled may cause the product to be blown away from the receptacle and, to avoid this, air is applied to one side surface of the product within the receptacle under a pressure so predetermined that the product can be held in a state of equilibrium in the air without being forced to fly away from the receptacle.

These and other objects and features of the present invention will become apparent from the following de-

scription taken in conjunction with a preferred embodiment thereof with reference to the accompanying drawings, in which;

FIG. 1 is a schematic front sectional view of a branding machine according to the present invention,

FIG. 2 is a side sectional view taken along the line II—II in FIG. 1,

FIGS. 3(*a*) to (*d*) are schematic diagrams showing a sequence of centering a tablet performed by the branding machine of FIG. 1,

FIGS. 4(*a*) and (*b*) are top plan and side sectional views, respectively, of a portion of a rotary drum, showing an arrangement of the receptacle for use in association with a tablet of of substantially elliptical shape, and

FIGS. 5(*a*) and (*b*) are similar views to FIGS. 4 (*a*) and(*b*), respectively, showing a modification of the arrangement of FIGS. 4(*a*) and (*b*).

Before the description of the present invention proceeds, it should be noted that, for the sake of brevity, like parts are designated by like reference numerals throughout the accompanying drawings and that the description thereof will be made as intended to print each of substantially circular tablets having outwardly rounded surfaces on both sides thereof.

Referring first to FIGS. 1 and 2, a branding machine embodying the present invention comprises a bench (not shown) and an upright support 10 vertically extending from said bench and having a pair of bearing openings 10*a* and 10*b* formed therein in spaced relation with respect to each other. The upright support 10 carries a pair of annular presser plates 11 and 12, which may be of one-piece construction, each presser plate 11 or 12 having a through hole 11*a* or 12*a* formed therein and aligned with the bearing opening 10*a* or 10*b*. For the purpose as will become clear from the subsequent description, each of the presser plates 11 and 12 is biased in one direction away from the upright support 10 by the action of compression springs 13 or 14. These compression springs 13 or 14 are mounted on a corresponding number of connecting rods 15 or 16 each having one end collapsibly received by one of the upright support 10 and presser plate 11 or 12 and the other end rigidly connected to the other of the upright support 10 and presser plate 11 or 12.

These presser plates 11 and 12 are held in position between the upright support 10 and rotary drums 17 and 18 which are respectively rigidly mounted on shafts 19 and 20 extending through the through holes 11*a* and 12*a* and the bearing openings 10*a* and 10*b* and terminating within a gear box 21.

A train of gears (not shown) is provided within the gear box 21 for transmitting a motive power from an electrically operated motor 22 to the shafts 19 and 20 thereby rotating said shafts 19 and 20 and, hence, rotating the rotary drums 17 and 18 in opposite directions as indicated by the arrows in synchronism with each other.

The rotary drums 17 and 18 are of the same diameter and the space between the shafts 19 and 20 is selected such as to permit the peripheral surface of either of the rotary drum 17 or 18 to be positioned very close to that of the other 18 or 17 without substantially forming an undue clearance therebetween in reference to the smallest possible thickness of articles to be printed by the branding machine of the present invention.

In the arrangement so far described, operation of the motor 22 causes the shafts 19 and 20 to rotate and, hence, the rotary drums 17 and 18 to rotate, in the opposite directions in synchronism with each other, with the motive power transmitted thereto through the gear train within the gear box 21. During synchroneous rotation of the rotary drums 17 and 18, the drums slide in contact with the presser plates 11 and 12, respectively, biased thereto by the compression springs 13 and 14.

In the vicinity of the rotary drum 17, a hopper unit is arranged which comprises a substantially funnel-shaped hopper 23 having a downwardly oriented guide 23*a*. The hopper 23 includes a floating chamber 24 defined by a pair of side plates 24*a*, spaced from each other by a distance corresponding to the axial length of the rotary drum 17, and a bottom plate 24*b* having one end rigidly connected to the hopper 23 and the other end terminating close to the peripheral surface of the rotary drum 17. A lid 25 may be provided at an upper portion of the chamber 24, bridging over the side plates 24*a* thereby to define the chamber 24 in cooperation with the side plates 24*a*, the bottom plate 24*b*, a portion of the peripheral surface of the drum 17 and the hopper 23.

The floating chamber 24 is communicated with the downwardly oriented guide 23*a* whereby a mass of tablets supplied into the hopper 23 can be fed thereto by gravity. Supply of tablets from the hopper 23 to the chamber 24 through the guide 23*a* can be adequately controlled by a shuttering plate/26 which is manually upwardly and downwardly movable for adjustment of the opening between the guide 23*a* and the floating chamber 24. In order to avoid a blockage of tablets within the guide 23*a* adjacent the floating chamber 24, the bottom plate 24*b* is formed therein with a plurality of blow holes 24*c*, arranged side by side over the width thereof, which are in turn communicated with a source 26 of compressed air through a connecting tube 27 so that some of the tablets fed onto the floating chamber 24 can be held in a fluidized state within the floating chamber 24. An idle roller 28, made of rubber, either synthetic or natural, and supported by a spindle 28*a* having both ends journalled to the opposite side plates 24*a*, acts to ensure that each receptacle described later receives an individual tablet therein from the hopper unit. This roller 28 may be omitted and the hopper unit functions satisfactorily.

The rotary drums 17 and 18 are of the same construction and, therefore, for the sake of brevity, only one of them, that is, therotary drum 17, will be now described in detail. Elements of the rotary drum 18, not mentioned in the subsequent description, which correspond to the elements of the rotary drum 17, are designated by like alphabetic characters in combination with the reference numeral "18".

The rotary drum 17 has the outer peripheral surface formed with a plurality of radially inwardly recessed receptacles 17*a* which are circumferentially arranged in at least one row in the rotary drum and equidistantly spaced from each other. The rotary drum 17 is formed therein with a corresponding number of L-shaped passages 17*b* each having a first end 17*c* open at the bottom of the receptacle 17*a* and a second end 17*d* open at one end face of the drum 17 which faces the corresponding presser plate 11. It should be noted that the second ends 17*d* of the individual passages 17*b* in the rotary drum 17 are, therefore, arranged in a circular configuration equally spaced from the outer peripheral

surface of said drum **17** or from the axis of rotation of the drum **17**.

These passages **17***b* or **18***b* are, during rotaion of the rotary drum **17** or **18**, selectively communicated with a source **26** of compressed air and a vacuum source **29** in a manner as will be described later. For this purpose, the presser plate **11** is formed on one surface facing the rotary drum **17** with first, second, third and fourth grooves **11***b*, **11***c*, **11***d* and **11***e* in alignment with the path of travel of the second open ends **17***d* of the individual passages **17***b*. The first and third grooves **11***b* and **11***d* are communicated with the vacuum source **29** respectivly through passages formed in the presser plate **11**, only one of these passages for communication between the third groove **11***d* and the vacuum source **29** being designated by **11***f* in FIG. **2**. The second and fourth grooves **11***c* and **11***e* are communicated with the compressed air source **26** respectively through passages formed in the presser plate **11**, only one of these passages for communication between the fourth groove **11***e* and the compressed air source **26** being designated by **11***g* in FIG. **2**.

similarly, the presser plate **12** is formed on one surface facing the rotary drum **18** with first, second, third and fourth grooves **12***b*, **12***c*, **12***d* and **12***e* in alignment with the path of travel of the second open ends **18***d* of the individual passages **18***b*. The first and third grooves **12***b* and **12***d* are communicated with the vacuum source **29** respectively through passages formed in the presser plate **12**, only one of these passages for communication between the first groove **12***b* and the vacuum source **29** being designated by **12***f* in FIG. **2**. The second and fourth grooves **12***c* and **12***e* are communicated with the compressed air source **26** respectively through passages formed in the presser plate **12**, only one of these passages for communication between the fourth groove **12***e* and the compressed air source **26** being designated by **12***g* in FIG. **2**.

In any event, the details of the grooves **11***b* to **11***e* and **12***b* to **12***e* and their functions will be described later.

Printer units **30** and **30'** of the same construction are provided, one for each rotary drum **17** and **18**. Each of these printer units **30** and **30'** comprises a rotogravure cylinder **31** or **31'**, supported rigidly on a shaft **32** or **32'**, which rotatably extends through the upright structure **10** and is coupled to the motor **22** through the gear box **21** for rotation thereabout at the same peripheral velocity as that of the rotary drum **17** or **18**, respectively, and a rubber-lined printing cylinder **33** or **33'** rotatably mounted on a shaft **34** or **34'** which is supported by the upright structure **10** and yieldably biased in any known manner so as to permit the printing cylinder **33** or **33'** to pressure-contact both the rotogravure cylinder **31** or **31'** and the rotary drum **17** or **18**. A portion of each of the rotogravure cylinders **31** and **31'** is immersed in a printing ink contained in an ink container **35** or **35'** supported in position by a suitable framework (not shown) forming a part of the bench. Each of these rotogravure cylinders **31** and **31'** has around the circumference thereof a plurality of engravings (not shown) indicative of indicia to be printed on each tablet through a corresponding one of the printing cylinders **33** and **33'**.

Operation and construction of each of the printer units **30** and **30'** are well known to those skilled in the art and, therefore, the details thereof are herein omitted for the sake of brevity.

As regards the rotary drum **17**, the first groove **11***b* in the presser plate **11** extends for a distance sufficiently covered within the floating chamber **24** for enabling some of the tablets within th floating chamber **24** to be sucked into corresponding receptacles **17***a* which are then communicated to the vacuum source **29**; the second groove **11***c* extends immediately above the shaft **19** in such a way that both ends thereof are situated on both sides of the vertical line passing through the axis of the shaft **19**; the third groove **11***d* extends between the second and fourth grooves **11***c* and **11***e* for transference of tablets, received in the corresponding receptacles **17***a* after having been centered, to the rotary drum **18** past the printing unit **30**; and the fourth groove **11***e* must be positioned such that each tablet in the receptacle **17***a* brought in position in alignment with the imaginary line connecting the axes of the shafts **19** and **20** can be blown off onto and sucked in one of the receptacles **18***a* of the rotary drum **18** then aligned with the receptacle **17***a* and communicated with the vacuum source **29** through the first groove **12***b* in the presser plate **12**.

As regards the rotary drum **18**, the first groove **12***b* in the presser plate **12** is positioned in the manner as hereinabove described; the second groove **12***c* extends immediately above the shaft **20** in such a way that both ends thereof are situated on both sides of the vertical line passing through the axis of the shaft **20**; and the third groove **12***d* extends between the second and fourth grooves **12***c* and **12***e* for transference of tablets, received in the corresponding receptacles **18***a* after having been centered, towards a chute **36** onto which the tablets are ejected from the respective receptacles **18***a* when the latter is communicated with the fourth groove **12***e*. The chute **36** may be interposed between the rotary drum **18** and a suitable container or belt conveyor (not shown) for subsequent processing of the printed tablets.

While in the above mechanical construction, in case where only one side printing is desired or sufficient, a set of the rotary drum **18** and the printer unit **30'**, particularly the rotogravure cylinder **31'**, may be removed or omitted.

In operation, assuming that the motor **22** is energized to rotate the rotary drums **17** and **18** in the opposite directions in synchronism with each other and also to rotate the rotogravure cylinders **31** and **31'** and that the sources **26** and **29**, which may be composed of compressors, are respectively operated, some tablets in the floating chamber **24** are successively sucked and received in the receptacles **17***a* of the rotary drum **17** in an arbitrary posture as said drum **17** passes through the floating chamber **24**, since the passages **17***b* are then communicated to the vacuum source **29** through the first groove **11***b* in the presser plate **11** contacting said drum **17**. As each of receptacles **17***a* carrying the tablets therein approaches the top position immediately above the shaft **19**, the receptacles **17***a* are successively communicated to the compressed air source **26** through the second groove **11***c* by means of the corresponding passages **17***b* while communication thereof with the vacuum source **29** is immediately interrupted. Upon communication between each receptacle **17***a* and the compressed air source **26**, the tablet that has been received in the associated receptacle **17***a* in an arbitrary posture is floated in air for correction of the posture as will be discussed later. This correction of

posture of each of the tablets is effected by the aid of air in such a way as to render the center of gravity of each tablet to be aligned with the first open end 17*c* of the passage 17*b* opened towards the associated receptacle 17*a*.

Immediately after the posture correction has been thus effected, the associated receptacle 17 becomes discommunicated from the compressed air source 26 and substantially simultaneously communicated again with the vacuum source 29 through the third groove 11*d* whereby the tablet floated in the air within the associated receptacle 17*a* is immediately seated in a correct posture at the bottom of the associated receptacle 17*a*.

While the rotary drum 17 continues to rotate, each tablet received in the associated receptacle 17*a* in a corrected posture is transferred towards the rotary drum 18. During this transference, one side face of the tablet exposed outside the associated receptacle 17*a*, i.e., not in contact with the bottom of the receptacle 17, is printed by the printing cylinder 33 in the known manner.

Subsequent communication between each receptacle 17*a* and the compressed air source 26 through the fourth groove 11*e* permits the corresponding tablet having one side face bearing a printed indicium to be fed into the corresponding receptacle 18*a* of the rotary drum 18, which is at this time communicated to the vacuum source 29, with the printed side face of said tablet seated at the bottom of said receptacle 18*a* while the other side face thereof that has been seated at the bottom of the receptacle 17*a* becomes exposed outside said receptacle 18*a*.

Each of the tablets fed to the rotary drum 18 in the manner as hereinabove described is subjected to posture correction and printing prior to being ejected onto the chute 36 in the substantially same manner as that received by the rotary drum 17 have been subjected.

Hereinafter the discussion as to how the posture correction can be achieved will be made with reference to FIGS. 3(*a*) to (*d*) wherein only one of the receptacles 17*a* in the rotary drum 17 is taken into consideration for facilitating a better understanding thereof, though the same is true of the other receptacles in the rotary drum 17 as well as the receptacles 18*a* in the rotary drum 18.

FIG. 3(*a*) illustrates the receptacle 17*a* receiving therein a tablet T in a wrong or incorrect posture while the air within the passage 17*b* then communicated to the vacuum source 29 is drawn. This posture of the tablet T shown in FIG. 3(*a*) is unfavourable because of possibility of displaced and/or unclear reproduction of the indicium or indicia when such tablet is subjected to the printing process. While in the condition as shown in FIG. 3(*a*) and when air is supplied to the passage 17*b* upon communication between the receptacle 17*a* and the compressed air source 26 through the second groove 11*c* in the presser plate 11 (FIGS. 1 and 2), the tablet T in the wrong or incorrect posture is first floated in air in such a manner as shown in FIG. 3(*b*) without being blown off the receptacle 17*a* and immediately assumes such a posture as shown in FIG. 3(*c*). This is possible because the lifting force exerted by the compressed air passing through the passage 17*b* for upwardly lifting the tablet T is adequately adjusted in consideration of the size of the receptacle 17*a* and the weight and size of the tablet used, for example, by regulating the pressure of the compressed air. More specifically, so long as the center of gravity of the tablet locates displaced from a line of action of the lifting force, the tablet T is aerodynamically out of equilibrium and, therefore, tends to assume a state of equilibrium.

The condition of FIG. 3(*c*) is that the tablet T has been aerodynamically equilibrated with compressed air uniformly flowing outwards of the receptacle 17*a* through a substantially uniform clearance C formed between the side face of the tablet T adjacent to the bottom of the receptacle 17*a* and an inwardly curved wall defining the receptacle 17*a*. In this condition of FIG. 3(*c*), the dynamic pressure is generated on the side face of the tablet T facing the open end 17*c* of the passage 17*b*, thereby upwardly lifting said tablet T with the clearance formed as at C between said side face of said tablet T and the inwardly curved wall defining the receptacle 17*a*. As compressed air in the clearance C flows towards the circumference of the tablet T, which may be possibly referred to as "transition point" relative to such flow of the compressed ir, this dynamic pressure can be balanced by the known pressure recovery process occurring on the other side face of the tablet T since the flow loses its stability, subsequently breaks up into small vortices and finally detaches outwardly from the tablet T under the influence of reduced static pressure, substantially forming a reverse flow around the center of the other side face of the tablet.

By this reverse flow thus created and acting on the other side face of the tablet T, the latter tends to move close to the bottom of the receptacle 17*a*, but the dynamic pressure in the clearance C stably supports said tablet T in air within the receptacle 17*a*. At this time, the center of gravity of the tablet T locates immediately above the open end 17*c* of the passage 17*b* partly because of the substantially symmetrical configuration of the receptacle 17*a* about the axis of the passage 17*b* and partly because of the substantially symmetrical configuration of the tablet T used.

If the passage 17*b* is subsequently communicated with the vacuum source 29 through the third groove 11*d* while the tablet T has been conditioned as shown in FIG. 3(*c*), the tablet T can be immediately sucked into the receptacle 17*a* as shown in FIG. 3(*d*) and firmly held in position with the center of gravity thereof substantially exactly aligned with the axis of the passage 17*b*, thus completing the process of posture correction which is required to provide non-displaced and clear reproduction of the indicium or indicia on each side face of the tablet T during the subsequent branding process. Once the condition of FIG. 3(*d*) has been established, the tablet T is steadily seated within the receptacle 17*a* at the bottom thereof centered about the open end 17*c* of the passage 17*b* in the rotary drum 17 without being arbitrarily moved during the branding process at which time the printing cylinder contacts the tablet T.

To illustrate the effectiveness of this method of posture correction, experiments have been carried out by the use of a solid block corresponding to one unit of the receptacle taken from the rotary drum of the above construction. The receptacle in the solid block had a diameter of 8.5 mm. and a maximum depth of 2.5 mm., the radius of curvature of the bottom wall of said receptacle in solid block being 18.5 mm. This receptacle so dimensioned was coupled to the compressed air source

through a passage of 1.6 mm. in inner diameter formed in the solid block during the process of posture correction. From the compressed air source to the receptacle through the passage, air which flows at a rate of 7 lit./-min. under atmospheric pressure was fed under the gauge pressure of 0.05 kg/cm^2. A tablet used in this experiment was 8.3 mm. in diameter, 4.7 mm. in maximum thickness and 240 mg. in weight and had the radius of curvature of 6.0 mm. in one side face. The procedure was to place the tablet in the receptacle in a wrong and then to communicate the receptacle to the compressed air source.

As a result thereof, the intended posture correction was completed successfully in approximately 0.1 to 0.2 second without the tablet being blown off the receptacle.

The size and shape of each of the receptacles **17***a* and **18***a* respectively formed in the rotary drums **17** and **18** are preferably selected to cope with a mass of similar tablets intended to be printed, but may be appreciably greater than the diameter and radius of curvature of each of the tablets to be printed.

However, in case where an ellipsoidal tablet is to be printed, each receptacle may have the configuration shown in either FIGS. **4**(*a*) and (*b*) or FIGS. **5**(*a*) and (*b*) since the ellipsoidal tablet has a directional property. Referring first to FIGS. **4**(*a*) and (*b*), the bottom surface of the receptacle **17***a'* must have a pair of spaced openings **17***c'* both connected to the open end **17***d* (FIG. **2**), said openings **17***c'* lying in alignment with the maximum axis of the elliptical contour of the opening of the receptacle **17***a'*. In this arrangement, during the posture correction process, the ellipsoidal tablet can be held in position within the receptacle **17***a'* with the center of gravity thereof aligned with the actually intermediate point between the openings **17***b'*.

The receptacle shown in FIGS. **5**(*a*) and (*b*) has a pair of lobes **17***e* inwardly protruding towards the axis of the passage **17***b*. These protruding lobes **17***e*cooperate with each other to cause, when the tablet is floated, the tablet to assume the correct posture in such a way that the maximum axis of the ellipsoidal tablet is aligned with that of the epitrochoidally-shaped opening of the receptacle **17***a''*. In addition thereto, the opening of the passage **17***b* on the bottom surface of the receptacle **17***a''* is preferably enlarged as indicated by **17***c'* to ensure a firm and exact suction of the tablet within the receptacle **17***a''*.

In practice, the rotary drums **17** and **18** are interchangeably mounted on the shafts **19** and **20**, respectively, for replacement of the rotary drums of one type by that of other types thereby to provide the branding machine which accommodates different types of tablets, pills or like materials to be printed.

From the foregoing full description of the present invention, it has now become clear that, because of air used to corrct the posture of each tablet within the corresponding receptacle in the rotary drum, clear and non-displaced reproduction of indicia on either or both of the opposite side faces of said tablet can be appreciated without damaging said tablet.

Although the present invention has been fully described by way of example, it should be noted that various changes and modifications are apparent to those skilled in the art and, therefore, unless otherwise they depart from the true scope of the present invention they should be construed as included therein.

What is claimed is:

1. A branding machine for successively reproducing indicia on a mass of products of similar shape and/or size, which comprises in combination:

a support structure;

at least one rotary drum rotatably carried by said support structure and having the peripheral surface formed with a plurality of radially inwardly recessed receptacles, some of which successively receive therein a corresponding number of the products during each rotation of said rotary drum for transference of said products from a take-in position to a take-out position, said receptacles being arranged in at least one circumferentially extending row in equally spaced relation with respect to each other;

means operatively coupled for continuously driving said rotary drum in one direction;

means disposed adjacent said rotary drum at said take-in position for accommodating therein the mass of said products charged thereinto;

a source of compressed air;

a vacuum source;

first means for permitting a first group of said some of said receptacles to be communicated with said vacuum source for sucking therein a corresponding number of said products;

second means for permitting a second group of said some of said receptacles to be communicated with said compressed air source for effecting a posture correction of each of a corresponding number of said products by floating said product in air within the associated receptacle;

third means for permitting a third group of said some of said receptacles to be communicated with said vacuum source for enabling a corresponding number of said products to be printed with said indicia thereon;

fourth means for permitting the rest of said some of said receptacles to be communicated with said compressed air source for successively ejecting a corresponding number of said products onto a subsequent processing station,

said first to fourth means being operatively coupled and operated simultaneously during each rotation of said rotary drum;

means disposed adjacent said rotary drum and substantially opposed to said accommodating means for printing the indicia on one surface of each of said products, which is exposed outside the associated receptacle, during transference thereof past said third means; and

means operatively coupled for driving said printing means in a direction counter to the direction of rotation of said rotary drum and in the same peripheral velocity as that of said rotary drum.

2. A branding machine as claimed in claim **1**, wherein said accommodating means is positioned at the take-in position which precedes the intersecting point between the level of the peripheral surface of said rotary drum and a vertical line upwardly passing through the axis of rotation of said rotary drum and on the trailing side with respect to the direction of rotation of said rotary drum and wherein said posture correction is effected when the associated receptacles communicated with the compressed air through said second means arrive successively at the top position immediately above the

axis of rotation of said rotary drum which is located on both sides of a vertical line upwardly passing through said axis of rotation of said rotary drum.

3. A branding machine as claimed in claim 1, wherein said two drive means comprise an electrically operated motor which is coupled with said rotary drum and said printing means through a train of gears.

4. A branding machine for successively reproducing indicia on a mass of products of similar shape and/or size, which comprises in combination:

a support structure;

at least one rotary drum rotatably carried by said support structure and having the peripheral surface formed with a plurality of radially inwardly recessed receptacles, said receptacles being arranged in at least one circumferentially extending row in equally spaced relation with respect to each other;

passages formed in said rotary drum and corresponding in number to said receptacles, each of said passages having one end open towards the associated receptacle and the other end open at one end face of said rotary drum, said other ends of said passages being arranged in a circular configuration equidistantly spaced from the axis of rotation of said rotary drum;

means operatively coupled for continuously driving said rotary drum in one direction;

means disposed adjacent said rotary drum and at a delivery position for accommodating therein the mass of said products charged thereinto;

a source of compressed air;

a vacuum source;

a back-up plate supported by said support structure and elastically urged to permit one surface thereof to relatively slidably contact said one end face of said rotary drum, said back-up plate being formed on said one surface thereof with a first groove communicating with said vacuum source, a second groove communicating with said compressed air source, a third groove communicating with said vacuum source and a fourth groove communicating with said compressed air source, said first to fourth grooves being arranged in the order given above in the direction of rotation of said rotary drum and in a circular configuration in alignment with the path of travel of said other open end of each of said passages;

means disposed adjacent said rotary drum and substantially opposed to said accommodating means for printing the indicia on one surface of each of said products, which is exposed outside the associated receptacle; and

means operatively coupled for driving said printing means in a direction counter to the direction of rotation of said rotary drum and at the same peripheral velocity as that of said rotary drum,

said receptacles in said rotary drum operating in sequence during each rotation of said rotary drum in such a way that, when said receptacles are successively brought to the delivery position, said receptacles are communicated with the vacuum source through said frist groove to receive said products each in one receptacle from the accommodating means and hold them in an arbitrary posture within the associated receptacles under suction, said receptacles with said products therein being subsequently communicated with the compressed air source through said second groove for successively effecting a posture correction by floating the product in air within the associated receptacle to enable said product to assume a predetermined posture within the associated receptacle, each of the products in the associated receptacles in the predetermined posture being then printed on one surface thereof with the indicia by said printing means when said products are transferred past said printing means while received in said associated receptacles then communicated with the vacuum source through said third groove, and, when said receptacles with the printed products therein are successively communicated with the compressed air source through said fourth groove, said printed products are ejected onto a subsequent processing station.

5. A branding machine as claimed in claim 4, wherein said accommodating means comprises a hopper having a downwardly extending guide and a chamber interposed between the lowermost opening of said guide and a portion of the peripheral surface of said rotary drum, said chamber being provided with at least one air opening communicated with a source of compressed air for fluidizing a mass of the products within said chamber for avoiding a possible blockage.

6. A branding machine as claimed in claim 4, wherein said two driving means comprise a common electrically operated motor coupled with said rotary drum and said printing means through a train of gears.

7. A branding machine as claimed in claim 4, wherein said delivery position is at a position preceding the intersecting point between the level of the peripheral surface of said rotary drum and a vertical line upwardly passing through the axis of rotation of said rotary drum and on the trailing side with respect to the direction of rotation of said rotary drum and wherein said posture correction is effected when the associated receptacles communicated with the compressed air source through said second groove arrive successively at the top position immediately above the axis of rotation of said rotary drum, said second groove substantially extending on both sides of said vertical line.

8. A branding machine as claimed in claim 4, wherein each of said receptacles has a substantially epitrochoidally opening and wherein said one open end of the associated passage which is open at the bottom of said receptacle is enlarged towards the receptacle.

9. A branding machine as claimed in claim 4, wherein each of said receptacles has a substantially ovalshaped opening and wherein said one open end of the associated passage is branched to open at two positions on the bottom of said receptacle.

10. A method for reproducing indicia on at least one side surface of each of products of similar shape and/or size, which comprises:

successively supplying said products onto respective receptacles radially inwardly recessed and formed in a rotary drum rotatable in one direction, said receptacles being sequentially communicated with a source of compressed air and a vacuum source during each rotation of said rotary drum, said successive supply of said products onto said respective receptacles being effected when said rotatable druum assumes a first position which precedes the intersecting point between the level of the peripheral surface of said rotary drum and a vertical line up-

wardly passing through the axis of rotation of said rotary drum and on the trailing side with respect to the direction of rotation of said rotary drum;

drawing air within each of the receptacles by communicating the latter with said vacuum source for receiving said products in said receptacles and holding them in an arbitrary posture therein under suction, said communication between said receptacles and said vacuum source being established when said rotary drum assumes said first position;

communicating said receptacles with said products therein with said compressed air source for floating each of said products in air within the associated receptacle for posture correction, therby to permit each of said products to assume a predetermined posture within the associated receptacle, said posture correction being effected when said rotary drum assumes a second position immediately above the axis of rotation of said rotary drum which locates on both sides of said vertical line;

communicating said receptacles with the vacuum source to enable the products to be seated in the predetermined posture within the assocated receptacles, said communication between said receptacles and said vacuum source being established when said rotary drum assumes a third position which follows said intersecting point and on the leading side with respect to the rotational direction of said rotary drum;

printing said products while they are held under suction within the associated receptacles; and

ejecting said printed products from said associated receptacles onto a subsequent processing station.

* * * * *