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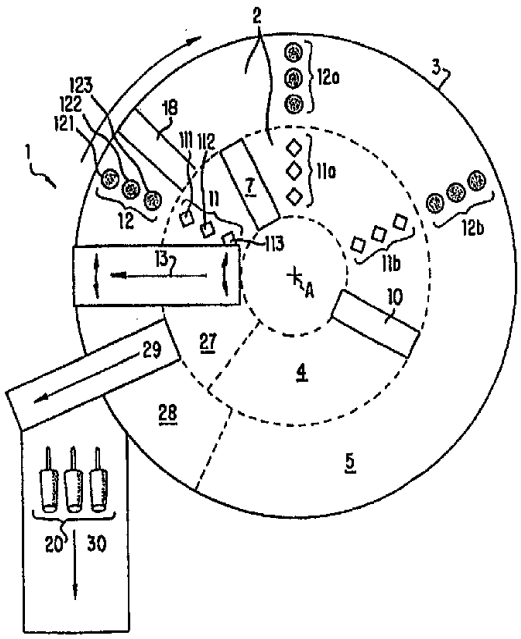
(57) Abstract

A machine and method for making unit confections of shaped complementary parts which consist of different recipes, flavors, colors, textures and/or mix inclusions having groups of complementary molds (11, 12), in which a group of first molds (11) produces physical shapes which displace at least a portion of the product in a group of second molds (12) to produce complementarily joined shaped confections produced in the group of second molds.



MACHINE AND METHOD FOR MAKING HARDENED CONFECTIONS HAVING COMPLEMENTARY PARTS JOINED IN A UNIT

FIELD OF THE INVENTION

This invention relates to a machine and method for making hardened confections of physically joined complementary parts which consist of different recipes, flavors, colors, textures and/or mix inclusions. The parts have complementary shapes which are joined in a resulting confection unit. The confection units are frozen or hardened confections or ices which may be flavored ice, ice cream, frozen yogurt, sherbet, sorbet and the like, known in the industry generically as "frozen confections," "hardened confections" or "ices."

BACKGROUND AND SUMMARY OF THE INVENTION

Chain-conveyor parallel row machines having parallel rows of molds and rotary table machines having concentric groups of molds for making ice confections are known in the art. A chain-conveyor parallel row machine has molds arranged in parallel rows which are caused to linearly advance through a freezing tank by means of a conveying chain. An example of such a machine is shown in United States Patent No. 4,759,197. A rotary table molding machine having groups of molds for making ice confections uses groups of molds which are caused to rotatable advance through a freezing tank by means of a circular mold table.

These known types of machines permit certain types of diversified products to be obtained during a work cycle. Multiple-flavored ice confections can be produced as layers of different flavored ices which are obtained by filling molds in successive steps with different products, as the molds advance in a production cycle. Such machines are also capable of

producing "shell and core" confections in which the "core" is removed by suction before it solidifies but after the "shell" solidifies. Another product is then introduced into the resulting space within the shell.

United States Patent No. 4,986,080 ("the '080 patent") discloses a chain-conveyor parallel row machine having parallel rows of molds and a method of producing double-flavor ices. The '080 patent is a particular adaptation of the machine disclosed in United States Patent No. 4,759,197. The '080 patent discloses a machine in which parallel rows of molds are intermittently advanced through a freezing section by means of a conveying chain. The parallel rows of molds differ in shape, one row to the next, such that the cross-sections of molds of some rows are stated to be "inscribable" into the cross- sections of molds in other rows. The '080 patent includes metering-filling units, a stick-inserting unit and withdrawing devices such as are known in the art.

In general, chain-conveyor parallel row machines have certain operational disadvantages. These include: inefficient mold utilization, resulting from fewer than 50% of all molds being in use at any time; inefficient floor plan utilization, resulting from the complete machine having a significant length; poor repeatability of mold positioning, resulting from variations in conveyor chain pitch dimensions due to wear; and incomplete sealing of the mold area from the freezing area, resulting from jointed, articulated construction inherent in a chain conveyor.

Rotary machines resolve several of these difficulties. Molds are located in a circular unitized mold table that effectively seals the product from the mold chilling brine, which is a hygienic advantage. The chain-conveyor parallel row machines carry molds in a jointed, articulating conveyor that is difficult to seal in order to avoid product contamination by the mold chilling brine. Also, unlike the rotary table machine, the chain-conveyor parallel row machine

requires that moulds be returned to the "start" position by passing moulds upside down under the machine typically through an energy and water consuming washing system. The manner of returning moulds to the start position results in a mould utilisation factor of less than 50%, whereas a mould utilisation factor for rotary table machines can be higher than 75%. Mould utilisation factor is important because moulds are expensive.

An example of a rotary machine and method for making hardened confections having complementary parts joined in a unit is fully described in co-pending Application for United States Letters Patent Serial No. 08/206,388 and co-pending Application for United States Letters Patent Serial No. 08/226,494, both having the common assignee of the present invention both incorporated herein by reference for all purposes.

A machine and method is provided for making unitised confections of complementary parts in an efficient manner that overcomes problems of the chain-conveyor parallel row machines and achieves the advantages incident to rotary design. The invention will now be summarised.

According to the invention, there is provided a machine for making hardened confections of complementary parts, including:

at least one paired group of complementary moulds, the or each paired group including a group of first moulds for producing solidified shapes which fit within corresponding moulds in a group of second moulds included in the or each paired group;

a first filling unit for introducing a first product into the first moulds;

at least one solidifying section;

drive means for successively advancing the or each paired group from the first filling unit through the at least one solidifying section and thereafter back to the first filling unit;

a first withdrawing mechanism for withdrawing solidified shapes from the first moulds of the or each paired group and for introducing the said shapes thus withdrawn into the corresponding second moulds of the same paired group;

a second filling unit for introducing a second product into the second moulds to fill spaces in the second moulds not occupied by the solidified shapes contained therein; and

a second withdrawing mechanism for withdrawing the hardened confections from the second moulds of the or each paired group before return of the said second moulds to the first withdrawal mechanism,

wherein after transfer by the first withdrawing mechanism of solidified shapes from the first moulds of the or each of the paired groups to the second moulds thereof and before withdrawal of corresponding completed confections from the second moulds of the or the same paired group, the first moulds of that paired group are returned to the first filling unit and the first filling unit introduces further first product into the first moulds of that paired group.

The machine may further include a stick inserter for inserting a stick into the product moulded in the first moulds.

Preferably, the drive means is adapted to advance the paired groups of moulds in a generally circular path about an axis. In this case, the paired groups of moulds are circumferentially spaced apart about the axis on a section of a circular table.

The first and second groups of moulds in each paired group of moulds may be spaced apart radially on the said circular table. Alternatively, the first and second groups of moulds in each paired group of moulds may be spaced apart circumferentially on the circular table.

The table is preferably horizontally disposed and unitised.

In embodiments where the or each paired group traverses a generally circular path, the first filling unit may be operationally disposed at or proximate to a beginning position of a rotation cycle of said first moulds.

Preferably, the first filling unit fills the first moulds with a quantity of the said first product according to at least one means from the group consisting of a predetermined period of time, a predetermined volumetric measure and a predetermined weight measure.

Preferably, the second filling unit fills the second moulds with a quantity of the said second product according to at least one means from the group consisting of a predetermined period of time, a predetermined volumetric measure and a predetermined weight measure.

Preferably the stick inserter is located above an advancement path of said first moulds and is so positioned relative to the advancement path that

sticks are inserted into the first moulds before the said first product therein fully solidifies.

The first withdrawing mechanism may include a first mechanism for withdrawing solidified physical shapes from the first moulds and a second mechanism for transferring the physical shapes thus withdrawn into the second moulds.

The first withdrawing mechanism may include means for grasping the sticks inserted into the first product in the first moulds, lifting the solidified physical shapes from the first moulds and introducing the solidified physical shapes into the second moulds when the second moulds are located below the first withdrawing mechanism.

The first withdrawing mechanism may include means for grasping the sticks inserted into the first product in the first moulds, lifting the solidified physical shapes from the first moulds, conveying the product to a location above the second moulds and depositing the product therein.

The second filling unit may be so located that the said second product is introduced into the second moulds of each paired group before transfer thereinto by the first withdrawal mechanism of solidified physical shapes from the first moulds of that paired group.

The second filling unit may introduce a second product differing from the said first product introduced by the first filling unit.

The said second product may differ from the said first product in at least one way from the group of ways consisting of flavour, colour, texture and mix inclusions.

The machine may include a warming section located proximate to the first withdrawing mechanism and so as to be encountered by the or each successive group of the first moulds before the return thereof to the first withdrawing mechanism.

The machine may include a warming section located proximate to the second withdrawing mechanism and so as to be encountered by the or each successive group of the second moulds before the return thereof to the second withdrawing mechanism.

The machine may include a warming section located proximate to the first withdrawing mechanism and so as to be encountered by the or each successive paired group of moulds before the return thereof to the first withdrawing mechanism.

The or a said warming section may include a fluid bath and/or a fluid spray.

In another aspect, the invention provides a machine for making hardened confections of complementary parts, including:

a unitised table that is horizontally disposed and operatively connected to a drive mechanism for rotationally advancing said table about a central axis;

at least one paired group of complementary moulds, the or each paired group including a group of first moulds each adapted for producing a physical shape which complementarily joins with all or part of a physical shape produced by corresponding moulds in a group of second moulds included in said the or each paired group, the or each said paired group located in a section of the table thereby to advance the said first and second moulds along circular paths as the table rotates;

a first filling unit for introducing a first product into the first moulds, the first filling unit being operationally disposed at or proximate to a position defining a beginning of one rotation cycle;

at least one solidifying section through which the or each said paired group is advanced by rotation of the table;

a stick inserter located above the circular path of the first moulds and so positioned with respect thereto that sticks are introduced into the first moulds during hardening of the first product;

a first withdrawing mechanism for withdrawing solidified physical shapes from the first moulds of the or each paired group and for introducing the physical shapes thus withdrawn into the second moulds of the same paired group;

a second filling unit for introducing a second product into the second moulds to fill spaces in the second moulds not occupied by the solidified physical shapes contained therein; and

a second withdrawing mechanism for withdrawing the hardened confections from the second moulds before return of the said second moulds to

the first withdrawal mechanism,

wherein after transfer by the first withdrawing mechanism of solidified physical shapes from the first moulds of the or each paired group to the second moulds thereof and before withdrawal of corresponding completed confections from the second moulds of the or the same paired group, the first moulds of that paired group are returned to the first filling unit and the first filling unit introduces further first product into the first moulds of that paired group,

and wherein the first and second groups of moulds in each paired group are radially arranged with respect to each other on the table.

In this aspect, the machine's first withdrawing mechanism preferably includes a first mechanism for withdrawing solidified physical shapes from the first moulds of the or each paired group and a second mechanism for transferring the solidified physical shapes thus withdrawn into the second moulds of that paired group.

In yet another aspect, the invention provides a rotary machine for making unit confections of complementary parts which consist of different recipes, flavours, colours, textures and/or mix inclusions, said machine including at least one paired group of complementary moulds adjacent to each other on sections of a rotating table, wherein a group of first moulds in the or each paired group produces solidified first physical shapes which fit within and complementarily join all or part of second physical shapes produced in a group of second moulds in the or each said paired group, wherein the solidified first physical shapes produced in the first moulds in the or each paired group are produced during a complete rotation of the table and transferred to corresponding second moulds of that paired group, wherein the confections are completed by solidification of the second physical shapes in the second moulds of that group during a second rotation of the table, and wherein during that second rotation further first solidified physical shapes are produced in the first moulds of that paired group.

In still another aspect, the invention provides a method of making hardened confections of complementary parts, including the steps of:

providing a paired group of complementary moulds, the paired group including a group of first moulds for producing solidified physical shapes each of which fits within a corresponding one of the moulds in a group of second moulds

included in the paired group;

causing the paired group to repeatedly traverse a path from a starting point at which a first filling unit fills each of the first moulds with a first product, through a solidifying section in which said first product solidifies, and back to the said starting point;

transferring solidified physical shapes of the said first product from the first moulds to corresponding second moulds before each return of the first moulds of the paired group to the first filling unit;

at a second filling unit, filling each of the second moulds with a volume of second product to fill the volume of the said each second mould not occupied by a solidified physical shape of first product transferred thereto, so that as the second moulds traverse the path the said second product is solidified as the second moulds pass through the or a further solidifying section; and

withdrawing confections from the second group of moulds after solidification of the said second product,

wherein before the said confections are removed from the second moulds of the paired group of moulds the first moulds of the paired group pass the first filling unit and are filled thereby with further first product.

The method may further include the step of inserting a stick into the said first product in each of the first moulds during progress thereof through the solidifying section.

The step of transferring solidified physical shapes from the first moulds to the second moulds of the paired group may include grasping the sticks inserted into the first moulds, lifting the solidified physical shapes from the first moulds, and introducing the product into the second moulds.

In the method, the said second product may be placed into the second moulds at a time which is before or during or after the step of transfer into the second moulds of the solidified physical shapes from the first moulds.

In a preferred form of the method, the paired group is located on or in a unitised table, the path is circular and advancement of the paired group of moulds along the path is by rotation of the table by a drive means.

The first moulds and the second moulds of the paired group may be spaced apart radially on the unitised table.

However, the first moulds and the second moulds of the paired group may be spaced apart circumferentially on the unitised table.

In the step of filling the first moulds with the first product, the quantity of the said first product placed into each of the first moulds may be according to at least one of a predetermined period of filling time, a predetermined volumetric measure and a predetermined weight measure.

The method may further include the step of warming the first moulds before the step of transferring solidified physical shapes from the first moulds to the second moulds.

The method may further include the step of warming the second moulds before withdrawal of completed confections therefrom.

Following the above summary, some embodiments of the invention will now be summarised before embarking on a more detailed description.

In one embodiment, the invention is a rotary machine having at least two groups of complementary moulds arranged concentrically on a rotating table. The first concentric mould group produces physical shapes which complementarily join with all or part of the shapes produced in the second concentric mould group. The shapes produced by the first mould group are introduced into the moulds of the second group and a unitised confection of two parts results. The first and second mould groups are aligned essentially radially with respect to the rotating table. The resulting confections can each have two or more complementary parts of different recipes, flavors, colors, textures and/or mix inclusions; and the complementary parts may be visually and/or gustatorily distinct in the confection unit.

In another embodiment, the invention is a rotary machine having at least two groups of complementary molds arranged radially in sectors of a rotating table. The first mold group produces physical shapes which complementarily join with all or part of the shapes produced in the second mold group. The shapes produced by the first mold group are introduced into the molds of the second group and a unitized confection of two parts results. The first and second mold groups are aligned as a paired group essentially radially with respect to the rotating table. The resulting confections can each have two or more complementary parts of different recipes, flavors, colors, textures and/or mix inclusions; and the complementary parts may be visually and/or gustatorily distinct in the confection unit.

This invention includes at least one solidifying (i.e., hardening or freezing) section through which each of the groups of complementary molds are advanced by rotation. The molds may be advanced in a unitized table configuration by a drive mechanism for rotatable advancing the paired groups of molds about an axis. The molds of the respective groups determine the complementary shapes that form the finished confection unit. A first filling unit is provided to introduce a first product into the first molds. Sticks are inserted into the product in the first molds. The molded product from the first molds is sized such that it fits within the second molds.

A second filling unit is provided to introduce a second product differing from the first product into the second molds. One embodiment of the present invention enables the second molds to be filled with a quantity of a second product before, during and/or after the first solidified molded product is introduced into the second molds. The second molds are filled with a volume of second product to fill the volume of the second mold in a measure determined approximately by the volume of the second mold less the predetermined volume of the mold in

otherwise occupied when the solidified first product from said first molds is inserted into said second molds. When solid, the solidified molded first products, with the stick inserted, are withdrawn from the first molds and laterally, or radially, transferred from the first molds into the second molds. The introduction of the solidified molded first products into the second molds displaces the flowable second product to thereby fill the spaces existing between the inner wall of the second molds and the outer surface of the first molded products with the flowable second product. When solidified, the resulting multiple-product confection units are withdrawn from the second molds.

In another method of the invention, paired molds are provided within sections of a unitized rotating table and aligned essentially radially with respect to the rotating table. In the pair, the second group of molds is complementary in shape with the first group of molds and receives therein the molded product from the first molds. The molds are advanced by rotation through a solidifying section. The group of first molds is filled with a first product; sticks are inserted into the filled first molds. The group of second molds are filled with a sufficient quantity of a second product to fill the spaces in said second molds that are not otherwise occupied when the solidified first product from said first molds is inserted into said second molds. When solid, the solidified molded first products, with the stick inserted, are withdrawn from the first molds and laterally, or radially, transferred from the first molds into the second molds. The introduction of the solidified molded first products into the second molds displaces the flowable second product to thereby fill the spaces existing between the inner wall of the second molds and the outer surface of the first molded products with the flowable second product. When solidified, the resulting multiple-product confection units are withdrawn from the second molds.

the first group. When the molded first product is introduced into the second molds containing flowable second product, the molded first product displaces the second product to fill the spaces in the second molds.

In one embodiment, after the product in the first molds solidifies, a withdrawing and transfer mechanism withdraws the solidified product from the first molds and transfers the molded product essentially radially to the second molds. In another embodiment, after the product in the first molds solidifies, a withdrawing mechanism withdraws the solidified product from the first molds, waits until the second molds pass under the withdrawing mechanism, and introduces the solidified product into the adjacent second molds of the paired group. In still another embodiment, a withdrawing mechanism withdraws the solidified product from the first molds and transfers the molded product either in an advancing or retarding motion with respect to the motion of the table to the second molds of the pair.

This second product then solidifies as the second molds are advanced by rotation through the solidifying section. A withdrawing unit then withdraws the resulting solidified multiple-product confection units from the second molds, and the confection is transferred for further processing, such as coating if desired, and wrapping and packaging.

In one method of the invention, a first group of molds is provided within a first section of a unitized table. A second group of molds, complementary in shape with the first group of molds, receives therein the molded product from the first molds. The second group of molds are within a second section of the rotating table. The concentric groups of complementary molds are advanced by rotation through a solidifying section. The group of first molds is filled with a first product; sticks are inserted into the filled first molds. The group of second molds are filled with a sufficient quantity of a second product to fill the spaces in said second molds that are not

The invention may also include a unitized table to rotatable advance the paired groups of complementary molds in the course of a production cycle. The first and second filling units which introduce product into the molds may also fill the respective molds with a quantity of respective products during a predetermined period of time (a "time fill"), according to a predetermined volumetric measure (a "volumetric fill") or by a predetermined weight measure (a "weight fill"). The complementary parts of the resulting confections may consist of a variety of different recipes, flavors, colors, textures and/or mix inclusions.

The resulting product is a confection unit of distinct complementary parts consisting of multiple recipes, flavors, colors, textures and/or mix inclusions, wherein separate physical shapes complementarily join with all or part of other physical shapes.

The foregoing and other objects and advantages of the present invention will become more apparent when viewed in light of the accompanying drawings and the following description.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 shows a plan view of an embodiment of the machine for making confection units of complementary parts in accordance with the present invention.

Figure 1A is a figurative representation showing the withdrawal of molded product from the first molds and its transfer into the second molds across the sections of the rotating table by a withdrawing and transfer mechanism.

Figure 1B shows a section of an alternate table configuration having multiple sets of mold groups in the sections of the rotating table.

Figure 1C illustrates the action of a single unit withdrawal and transfer mechanism transferring intermediate product to the second molds and transferring finished molded products to a chute or conveyor.

Figure 2 shows an example of a confection unit produced by the method and machine herein.

Figure 2A is a cross-sectional view of the confection unit taken along line 2A-2A of Figure 2 showing the shapes of the different parts.

Figure 2B shows an example of the solidified intermediate product from the first molds produced by the method and machine herein.

Figure 3 shows a plan view of another embodiment of the machine for making confection units of complementary parts in accordance with the present invention.

Figure 3A shows a section of an alternate table configuration having multiple sets of mold groups aligned together essentially radially with respect to the rotating table.

Figure 3B illustrates the action of the first withdrawal mechanism transferring solidified product of the first molds to the second molds.

Figure 4 shows an example of "paired" groups of molds where more than two shapes are provided to make a confection unit.

Figure 5 shows a plan view of another embodiment of the machine for making confection units of complementary parts in accordance with the present invention.

Figure 6 shows a plan view of another embodiment of the machine for making confection units of complementary parts in accordance with the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT(S)

The present invention includes a number of embodiments which are described in the following examples.

Example 1

Referring to the drawings, Figures 1 and 5 illustrate embodiments of the machine 1 of the present invention for making confection units of complementary parts. Figures 2 and 2A show the unit confection 20 produced by the invention having an inner core 21 formed by a single mold in a first group of molds in the machine 1 and a complementary second shape 22 formed by a single mold in a second group of molds in the machine 1. A stick inserted into the confection unit is shown as 23. The stick 23 may be flat, round, or other functional or decorative shape and is formed from wood, polymer, paper or other material as is known in the art. Figure 2B shows an example 25 of the intermediate product, or inner core, 21 with a stick 23 after the product has been removed from a single mold in a first group of molds.

In Figures 1 and 5, the machine 1 is a rotary machine that comprises a solidifying section 2 through which, as located on or in rotating table 3, concentric groups 11 and 12, 11a and 12a, 11b and 12b, etc., of complementary molds are rotatable advanced in an essentially circular path. The table is preferably planar and horizontally oriented. The individual molds in the groups 11 and 12 are respectively indicated as 111, 112 and 113 and 121, 122 and 123. The individual molds in both groups of molds are preferably tapered so as to facilitate withdrawal of molded product therefrom. The mold groups are in sections 4 and 5 of the rotating table and may be aligned radially and may comprise a group of molds in a single line as shown in Figure 1A at 11 and 12 or in adjacent groupings as shown in Figure 1B. In Figure 1B, six molds in each mold group are respectively shown at 11c and 12c in respective sections of the table. The solidifying

section 2 may be a brine bath, spray system or other mechanism that provides a solidifying or freezing environment, sufficient to harden a confection, such as is known in the art.

The molds in the first group 11 differ from the molds in the second group 12 such that a solidified molded product from the individual molds in the first mold group 11 will fit within the individual molds in the second mold group 12. Groups of molds comparable to groups 11 and 12 may be located on or in the table 3 respectively in the inner section 4 and outer section 5 of the rotating table 3 such as shown as 11a and 12a, 11b and 12b, etc. Also, more than two different groups of radially arranged, concentric, complementary molds may be used to make confections with more than two different recipes, flavors, colors, textures and/or mix inclusions.

With reference to Figures 1 and 5, the machine 1 includes a rotating table 3 having disposed thereon groups of two different types of molds 11 and 12, which respectively produce intermediate product (25 in Figure 2B) and finished product (20 in Figure 2). Point A is the axis of rotation of the horizontal rotating table 3. Each of the groups of molds 11 and 12 are disposed with respect to respective filling units 7 and 18 and, after the molds are filled with product, the filled molds pass through a solidifying section 2. During this passage, the product in the molds hardens. Intermediate in the rotational cycle for the groups of molds 11 is a stick inserter 10. The groups of molds 11 and 12 complete a rotational cycle after passing through respective warming sections 27 and 28 which "loosens" solidified product from the molds so it can be removed. Warming sections 27 and 28 may be combined into one warming section.

In a preferred embodiment, the groups of molds are disposed on a circular, flat, horizontal rotating table. A first filling unit 7, for filling the first molds, is operationally disposed at or proximate to a beginning position of a one rotation cycle for the first molds. The first filling unit 7 introduces a liquid product into the first molds when the first molds are positioned under the

first filling unit 7. Arctuately disposed with regard to the first filling unit 7, there is a stick-inserting unit 10 designed to insert sticks 23 into the product in the first molds when the product starts to solidify during the rotational cycle.

When the second molds are positioned beneath the second filling unit 18, the second filling unit 18 introduces a sufficient quantity or volume of second product to fill the volume of the second mold in a measure determined approximately by the volume of the second mold less the predetermined volume of the mold in the first group. The second product should be liquid or flowable to fill spaces in the second molds that are not otherwise occupied by first molded products when said first molded products are inserted therein. The introduction of the quantity of the second product may occur before, during and/or after the transfer of solidified product from said first molds into said second molds, but the introduction of the second product is preferred to occur before or during the transfer of solidified product from said first molds into said second molds. The spaces that are filled may be spaces existing between the inner wall of the second molds and the molded product transferred from the first molds into the second molds. The second filling unit 18 may fill the second molds with a quantity of the second product according to a predetermined time fill, volumetric fill or weight fill. The second product is of a different recipe, flavor, color, texture and/or mix than the first product that is introduced by the first filling unit 7.

The present invention enables the second molds to be filled with a quantity of a second product before, during and/or after the first solidified molded product is introduced into the second molds. In a preferred embodiment, the second molds are filled with a quantity of a second product before the first solidified molded product is introduced into the second molds. This enables the filling unit to use regular filling nozzles to introduce second product into the

second molds. The second molds are filled with a sufficient quantity of a second product to fill spaces in the second molds that are not otherwise occupied by first molded product when the first molded product is introduced into the second molds. When the molded first product is introduced into the second molds containing flowable second product, the molded first product displaces the second product to fill the spaces in the second molds.

The product in the first molds is solidified by the time the molds reach the withdrawing and transfer mechanism 13, which is located before the end of the rotational cycle of the first molds and at approximately the beginning of the rotational cycle of the second molds. At this point, both the filled group of first molds and the corresponding group of second molds are positioned, essentially radially aligned with respect to the axis of the table, at the withdrawing and transfer mechanism 13 at the same time. The location of the withdrawing and transfer mechanism 13 may correspond generally to the beginning of the one rotation cycle for the second molds.

At the withdrawing and transfer mechanism 13, as illustrated in Figure 1A, the solidified products 25a, 25b and 25c in the first molds 11, as a group, are loosened from the molds after passing through the warming section. The product is removed from the first molds 11 and transferred into the second molds 12 which are sized such as to receive therein the frozen product 25 of the first molds. To facilitate withdrawal of the frozen product 25 from the first molds, the outer surfaces of the first molds are subjected to "warming" in a manner known in the art, for example, by the aid of brine, air or other fluid at a given temperature introduced from below the molds. A warming brine spray section, through which the first molds are advanced, is positioned in Figures 1 and 5 at 27.

In Figure 1A, the transfer of first molded product 25a, 25b and 25c, as a group, from first mold group 11 to second mold group 12 is effected by grasping the inserted sticks 23 and withdrawing the product 25 up and out of the first molds 11, then shifting the product radially across the upper table surface 3U to position 25a, 25b and 25c over second mold group 12. The product 25 is then lowered, dropped or inserted into the second molds 12, essentially following the arrowed sequence up, across and down, as shown by 13A, 13B, and 13C. The mechanism is then recycled for the next mold group 11a, etc.

If the withdrawal and transfer occurs when rotational movement of the table is stopped, the transfer is in a straight axial movement. When the table is stopped and before or during this transfer, the second filling unit 18 may introduce second product into the second molds. If, however, the transfer occurs as the table rotates, the movement by the transfer mechanism is coordinated with the table rotation such that the transfer operation is conducted according to a reciprocating time and positional sequence in correspondence with the table rotation and angular mold separation. When the table is rotating and before or during this transfer, the second filling unit 18 may introduce second product into the second molds.

The withdrawal of the molded products from the group of first molds and the transfer of the molded first product into the group of second molds occurs while most of the other groups of complementary first and second molds contain product therein. The transfer of the molded first product from the first molds to the corresponding complementary second molds is an essentially radial transfer in this embodiment.

The molded first products from the first molds are sized to fit within the second molds and may or may not contact the inner walls of the second molds. Product from the first molds may also have shapes with cross-sections that do not contact the inner side wall of the second

molds except at the bottom. In this situation, mechanical supports may be provided by which the molded first products from the first molds are held upright in the second molds. This allows the molded first product to stand upright in the second molds while allowing the liquid or flowable second product from the second filling unit to fill the space existing between the inner wall of the second molds and the molded first product from the first molds by displacement.

After the second molds are filled by the second filling unit 18 and the molded first product is inserted into the second molds, the filled second molds are rotatable advanced through the solidifying section 2 to solidify the introduced flowable second product. To facilitate withdrawal of the resulting solidified multi-part confections from the second molds, the second molds are "warmed" in a manner as noted above, for example, by the aid of a spray or bath of brine or other fluid directed from below the molds in the warming section 28 through which the second molds are advanced. Then a second withdrawing unit 29 withdraws the confections from the second molds. Withdrawing and transfer mechanism 29 essentially corresponds in structure and operation to either intermittent or continuous operation of unit 13 as described above.

Mechanism 29 may be combined with unit 13, whereby finished confection units 20a, 20b and 20c are withdrawn from molds 12 and deposited on a chute or conveyor 30 in an up, across and down movement as shown by 13D, 13E and 13F in Figure 1C essentially simultaneously as the intermediate products 25a, 25b and 25c are shifted from mold group 11 to mold group 12 in arrowed sequence 13A, 13B and 13C in Figure 1C. The confections 20 are transported to a conventional wrapping and packaging station in a manner known in the art, such as with a chute or conveyor 30.

Example 2

Referring to the drawings, Figures 3 and 6 illustrate embodiments of the machine 1 of the present invention for making confection units of complementary parts. Like Example 1, an example of a unit confection 20 produced by the invention is shown in Figures 2 and 2A. Figure 2B shows an example 25 of the intermediate product, or inner core, 21 with a stick 23 after the product has been removed from a single mold in a first group of molds.

In Figures 3, the machine 1 is a rotary machine that comprises a solidifying section 2 through which, as located on or in rotating table 3, paired groups 11 and 12, 11a and 12a, etc., of complementary molds are rotatable advanced in an essentially circular path. The table is preferably planar and horizontally oriented. The individual molds in the groups 11 and 12 are respectively indicated as 111, 112, 113, 114, 115 and 116 and 121, 122, 123, 124, 125 and 126. The individual molds in both groups of molds are preferably tapered so as to facilitate withdrawal of molded product therefrom. The mold groups are shown in sections 4 and 5 of the rotating table 3 and are aligned essentially radially. The mold groups may be in a single line as shown in Figures 3 and 6 at 11 and 12 or in adjacent groupings as shown in Figure 3A. In Figure 3A, twelve molds in each mold group are respectively shown at 11b and 12b in respective sections of the table. The solidifying section 2 may be a brine bath, spray system or other mechanism that provides a solidifying or freezing environment, sufficient to harden a confection, such as is known in the art. A sufficient temperature of brine for solidifying product in the molds is typically -45°F to -50°F.

The molds in the first group 11 differ from the molds in the second group 12 such that a solidified molded product from the individual molds in the first mold group 11 will fit within the individual molds in the second mold group 12. Groups of molds comparable to groups 11

and 12 may be located on or in the rotating table 3. Also, more than two different groups of radially arranged, complementary molds may be used to make confections with more than two different recipes, flavors, colors, textures and/or mix inclusions.

With reference to Figures 3 and 6, the machine 1 includes a rotating table 3 having disposed thereon groups of two different types of molds 11 and 12, which respectively produce intermediate product (25 in Figure 2B) and finished product (20 in Figure 2). Point A is the axis of rotation of the horizontal rotating table 3. Each of the groups of molds 11 and 12 are disposed with respect to respective filling units 7 and 18 and, after the molds are filled with product, the filled molds pass through a solidifying section 2. During this passage, the product in the molds hardens. Intermediate in the rotational cycle for the groups of molds 11 is a stick inserter 10. The groups of molds 11 and 12 complete a rotational cycle after passing through a warming section 27 which "loosens" solidified product from the molds so it can be removed.

In a preferred embodiment, the paired groups of molds are disposed on a circular, flat, horizontal rotating table 3. A first filling unit 7, for filling the first molds 11, is operationally disposed at or proximate to a beginning position of a one rotation cycle for the first molds. The first filling unit 7 introduces a flowable product into the first molds when the first molds are positioned under the first filling unit 7. Arctuately disposed with regard to the first filling unit 7, there is a stick-inserting unit 10 designed to insert sticks 23 into the product in the first molds while the product is solidifying during the rotational cycle.

When the second molds are positioned beneath the second filling unit 18, the second filling unit 18 introduces a sufficient quantity or volume of second product to fill the volume of the second mold in a measure determined approximately by the volume of the second mold less the predetermined volume of the mold in the first group. The second product should be liquid

or flowable to fill spaces in the second molds that are not otherwise occupied by first molded products when said first molded products are inserted therein. The introduction of the quantity of the second product may occur before, during and/or after the transfer of solidified product from said first molds into said second molds, but the introduction of the second product is preferred to occur before or during the transfer of solidified product from said first molds into said second molds. The spaces that are filled may be spaces existing between the inner wall of the second molds and the molded product transferred from the first molds into the second molds. The second filling unit 18 may fill the second molds with a quantity of the second product according to a predetermined time fill, volumetric fill or weight fill. The second product is of a different recipe, flavor, color, texture and/or mix than the first product that is introduced by the first filling unit 7.

The product in the first molds is solidified by the time the molds reach the withdrawing and transfer mechanism 13, which is located before the end of the rotational cycle of the first molds. The warming section 27 "loosens" the solidified product in the first molds so the product can be removed by the withdrawing and transfer mechanism 13, which is located after the warming section 27 in the rotation path and at approximately the beginning of the rotational cycle of the second molds 12. To facilitate withdrawal of the frozen product 25 from the first molds, the outer surfaces of the first molds are subjected to "warming" in a manner known in the art, for example, by the aid of brine, air or other fluid at a given temperature introduced from below the molds. A warming brine spray section, through which the molds are advanced, is positioned in Figures 3 and 6 at 27.

At the withdrawing and transfer mechanism 13, the product is removed from the first molds 11 and introduced into the second molds 12 which are sized such as to receive therein the

frozen product 25 of the first molds. The transfer of first molded products, as a group, from first mold group 11 to second mold group 12 is illustrated in Figure 3B. The mechanism 13 grasps the inserted sticks 23 and withdraws the product 25 up and out of the first molds 11, waiting until the second molds 12, containing flowable second product, pass under the withdrawing and transfer mechanism 13 due to rotation of the rotating table 3, and introducing the solidified product 25 into the second molds 12 by lowering, dropping or inserting the solidified product 25 into the second molds 12, which thereby displaces the flowable second product to fill spaces between the inner surface of the second molds and the molded first product.

In another embodiment, the transfer of first molded products, as a group, from first mold group 11 to second mold group 12 is effected by grasping the inserted sticks 23 and withdrawing the product 25 up and out of the first mold 11, then shifting the product essentially concentrically, either in an advancing or retarding motion, across the upper table surface 3U to a position over the second molds 12 containing flowable second product. The product 25 is then lowered, dropped or inserted into the second molds 12, which thereby displaces the flowable second product to fill spaces between the inner surface of the second molds and the molded first product.. The mechanism is then recycled for the next mold group 11a, etc. In this latter embodiment, if the withdrawal and transfer occurs when rotational movement of the table is stopped, the transfer is essentially concentric. If, however, the transfer occurs as the table rotates, the movement by the transfer mechanism is coordinated with the table rotation such that the transfer operation is conducted according to a reciprocating time and positional sequence in correspondence with the table rotation and angular mold separation.

The molded products from the first molds 11 are sized to fit within the second molds and may or may not contact the inner walls of the second molds 12. Product from the first molds

may also have shapes with cross-sections that do not contact the inner side wall of the second molds. In this situation, mechanical supports may be provided by which the molded products from the first molds are held upright in the second molds. This allows the molded product to stand upright in the second molds while allowing the liquid or flowable second product from the second filling unit to fill the space existing between the inner wall of the second molds and the molded product from the first molds by displacement.

After the second molds are filled by the second filling unit 18, the filled molds are rotatable advanced through the solidifying section 2 to solidify the introduced second liquid product. To facilitate withdrawal of the resulting solidified multi-part confections from the second molds, the second molds are "warmed" in a manner as noted above, for example, by the aid of a spray or bath of brine or other fluid directed from below the molds in the warming section 27 through which the second molds are advanced. In another embodiment, a second warming section, independent of warming section 27, may be used to warm the second molds. Then a withdrawing mechanism 29 withdraws the confections 20 from the second molds. Withdrawing mechanism 29 essentially corresponds in structure and operation to either intermittent or continuous operation of unit 13 as described above. The confections 20 are transported to a conventional wrapping and packaging station in a manner known in the art, such as with a chute or conveyor 30.

In the embodiments discussed in this specification, including those in the examples, after the product is removed from the first molds, the first molds do not remain empty until the corresponding confection of complementary parts is withdrawn from the second molds at the end of another rotational cycle. Instead, the first molds are fairly promptly refilled by the first filling

unit 7 or filling unit 70 and the process continues as stated above for the first molds while the second molds with first molded product and second product therein are being solidified and removed during the rotational cycle. Thus the groups of molds in the inner and outer sections of the rotary machine are used at a high efficiency throughout the rotational cycle. This is an improvement in efficiency over chain-conveyor parallel row machines in which more than one half of the molds remain empty during a product forming cycle. As a consequence, the rotary machine requires fewer molds to process the same capacity of ice confections than chain-conveyor parallel row machines. In addition, the rotary machine continuously performs in a cyclical rotational cycle of the unitized circular table. Time, temperature and specific rotational cycles are determined by the hardening and/or freezing characteristics of the product introduced into the molds and can be determined by those familiar with recipe requirements.

The resulting products from the machine 1 and method as described above and shown in Figure 2 and 2A are confections of complementary parts, wherein the complementary parts consist of visually or gustatorily distinct shapes, recipes, flavors, colors, textures and/or mix inclusions. Many different variations of arbitrary shape configurations are obtainable, some of which are shown in the aforementioned '080 patent. By varying the shapes of the first and second molds, and as long as the molded product from the first molds fits within the cross-section of the corresponding second molds, many variously shaped confections of complementary parts can be formed. The confections may also be coated with chocolate and/or other coatings, by spraying or dipping the units into a final bath of a given product, as is known in the art.

As used herein, "paired" refers to the respective sequential transfer of a product from a mold to a successive mold. A "pair" is not limited to two shapes in the production of a finished

product. Figure 4 shows, in cross-section, an example in which three different shapes 51, 52 and 53 are used to form a resulting three-product confection 56. The finished product 56 is formed from a first paired product 55, which is itself a formed product of two shapes, inserted into a third shaped mold 53. Mold 53 is "paired" with the first paired shape 55, which is formed from paired molds 51 and 52.

The example shown in Figure 4 may involve red, white and blue colors, or chocolate, vanilla and strawberry flavors, corresponding to respective shapes 51, 52 and 53. In this scenario, the first paired product 55 consists of a circular product 52 molded in a second mold group around a triangular shaped product 51 formed in a first mold group. The first paired product 55 (from the first mold group of the second "pair") is inserted into a third shaped mold 56 (the second mold group of the second "pair") to form a finished product consisting of, in cross-section, a square surrounding a circle surrounding a triangle.

Having described the invention in detail, those skilled in the art will appreciate that, given the present disclosure, modifications may be made to the invention without departing from the spirit of the inventive concept herein described. Therefore, it is not intended that the scope of the invention be limited to the specific and preferred embodiments illustrated and described. Rather, it is intended that the scope of the invention be determined by the appended claims.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A machine for making hardened confections of complementary parts, including:

at least one paired group of complementary moulds, the or each paired group including a group of first moulds for producing solidified shapes which fit within corresponding moulds in a group of second moulds included in the or each paired group;

a first filling unit for introducing a first product into the first moulds;

at least one solidifying section;

drive means for successively advancing the or each paired group from the first filling unit through the at least one solidifying section and thereafter back to the first filling unit;

a first withdrawing mechanism for withdrawing solidified shapes from the first moulds of the or each paired group and for introducing the said shapes thus withdrawn into the corresponding second moulds of the same paired group;

a second filling unit for introducing a second product into the second moulds to fill spaces in the second moulds not occupied by the solidified shapes contained therein; and

a second withdrawing mechanism for withdrawing the hardened confections from the second moulds of the or each paired group before return of the said second moulds to the first withdrawal mechanism,

wherein after transfer by the first withdrawing mechanism of solidified shapes from the first moulds of the or each of the paired groups to the second moulds thereof and before withdrawal of corresponding completed confections from the second moulds of the or the same paired group, the first moulds of that paired group are returned to the first filling unit and the first filling unit introduces further first product into the first moulds of that paired group.

2. A machine according to claim 1 further including a stick inserter for inserting a stick into the product moulded in the first moulds.

3. A machine according to claim 1 or 2 wherein the drive means is adapted to advance the paired groups of moulds in a generally circular path about an axis.

4. A machine according to claim 3 wherein the paired groups of moulds are circumferentially spaced apart about the axis on a section of a circular table.

5. A machine according to claim 4 wherein the first and second groups of moulds in each paired group of moulds are spaced apart radially on the said circular table.

6. A machine according to claim 4 wherein the first and second groups of moulds in each paired group of moulds are spaced apart circumferentially on the circular table.

7. A machine according to any one of claims 4 to 6 wherein the table is horizontally disposed and unitised.

8. A machine according to any one of claims 3 to 7 wherein the first filling unit is operationally disposed at or proximate to a beginning position of a rotation cycle of said first moulds.

9. A machine according to any one of claims 1 to 8 wherein the first filling unit fills the first moulds with a quantity of the said first product according to at least one means from the group consisting of a predetermined period of time, a predetermined volumetric measure and a predetermined weight measure.

10. A machine according to any one of claims 1 to 9 wherein the second filling unit fills the second moulds with a quantity of the said second product according to at least one means from the group consisting of a predetermined period of time, a predetermined volumetric measure and a predetermined weight measure.

11. A machine according to any one of claims 2 to 10 wherein the stick inserter is located above an advancement path of said first moulds and is so positioned relative to the advancement path that sticks are inserted into the first moulds before the said first product therein fully solidifies.

12. A machine according to any one of claims 1 to 11 wherein the first withdrawing mechanism includes a first mechanism for withdrawing solidified physical shapes from the first moulds and a second mechanism for transferring the physical shapes thus withdrawn into the second moulds.

13. A machine according to any one of claims 2 to 12 wherein the first withdrawing mechanism includes means for grasping the sticks inserted into the first product in the first moulds, lifting the solidified physical shapes from the first moulds and introducing the solidified physical shapes into the second moulds when the second moulds are located below the first withdrawing mechanism.

14. A machine according to any one of claims 2 to 12 wherein the first withdrawing mechanism includes means for grasping the sticks inserted into the first product in the first moulds, lifting the solidified physical shapes from the first moulds, conveying the product to a location above the second moulds and depositing the product therein.

15. A machine according to any one of claims 1 to 14 wherein the second filling unit is so located that the said second product is introduced into the second moulds of each paired group before transfer thereinto by the first withdrawal mechanism of solidified physical shapes from the first moulds of that paired group.

16. A machine according to any one of the claims 1 to 15 wherein the second filling unit introduces a second product differing from the said first product introduced by the first filling unit.

17. A machine according to claim 16 wherein the said second product differs from the said first product in at least one way from the group of ways consisting of flavour, colour, texture and mix inclusions.

18. A machine according to any one of claims 1 to 17 further including a warming section located proximate to the first withdrawing mechanism and so as to be encountered by the or each successive group of the first moulds before the return thereof to the first withdrawing mechanism.

19. A machine according to any one of claims 1 to 18 further including a warming section located proximate to the second withdrawing mechanism and so as to be encountered by the or each successive group of the second moulds before the return thereof to the second withdrawing mechanism.

20. A machine according to any one of claims 1 to 17 further including a warming section located proximate to the first withdrawing mechanism and so as to be encountered by the or each successive paired group of moulds before the return thereof to the first withdrawing mechanism.

21. A machine according to any one of claims 18 to 20 wherein the or a said warming section includes a fluid bath and/or a fluid spray.

22. A machine for making hardened confections of complementary parts, including:

a unitised table that is horizontally disposed and operatively connected to a drive mechanism for rotationally advancing said table about a central axis;

at least one paired group of complementary moulds, the or each paired group including a group of first moulds each adapted for producing a physical shape which complementarily joins with all or part of a physical shape produced by corresponding moulds in a group of second moulds included in said the or each paired group, the or each said paired group located in a section of the table thereby to advance the said first and second moulds along circular paths as the table rotates;

a first filling unit for introducing a first product into the first moulds, the first filling unit being operationally disposed at or proximate to a position defining a beginning of one rotation cycle;

at least one solidifying section through which the or each said paired group is advanced by rotation of the table;

a stick inserter located above the circular path of the first moulds and so positioned with respect thereto that sticks are introduced into the first moulds during hardening of the first product;

a first withdrawing mechanism for withdrawing solidified physical shapes from the first moulds of the or each paired group and for introducing the physical shapes thus withdrawn into the second moulds of the same paired group;

a second filling unit for introducing a second product into the second moulds to fill spaces in the second moulds not occupied by the solidified physical shapes contained therein; and

a second withdrawing mechanism for withdrawing the hardened confections from the second moulds before return of the said second moulds to the first withdrawal mechanism,

wherein after transfer by the first withdrawing mechanism of solidified physical shapes from the first moulds of the or each paired group to the second moulds thereof and before withdrawal of corresponding completed confections from the second moulds of the or the same paired group, the first moulds of that paired group are returned to the first filling unit and the first filling unit introduces further first product into the first moulds of that paired group,

and wherein the first and second groups of moulds in each paired group are radially arranged with respect to each other on the table.

23. A machine according to claim 22 wherein the first withdrawing mechanism includes a first mechanism for withdrawing solidified physical shapes from the first moulds of the or each paired group and a second mechanism for transferring the solidified physical shapes thus withdrawn into the second moulds of that paired group.

24. A rotary machine for making unit confections of complementary parts which consist of different recipes, flavours, colours, textures and/or mix inclusions, said machine including at least one paired group of complementary moulds adjacent to each other on sections of a rotating table, wherein a group of first moulds in the or each paired group produces solidified first physical shapes which fit within and complementarily join all or part of second physical shapes produced in a group of second moulds in the or each said paired group, wherein the solidified first physical shapes produced in the first moulds in the or each paired group are produced during a complete rotation of the table and transferred to corresponding second moulds of that paired group, wherein the confections are completed by solidification of the second physical shapes in the second moulds of that group during a second rotation of the table, and wherein during that second rotation further first solidified physical shapes are produced in the first moulds of that paired group.

25. A method of making hardened confections of complementary parts, including the steps of:

providing a paired group of complementary moulds, the paired group including a group of first moulds for producing solidified physical shapes each of which fits within a corresponding one of the moulds in a group of second moulds included in the paired group;

causing the paired group to repeatedly traverse a path from a starting point at which a first filling unit fills each of the first moulds with a first product, through a solidifying section in which said first product solidifies, and back to the said starting point;

transferring solidified physical shapes of the said first product from the first moulds to corresponding second moulds before each return of the first moulds of the paired group to the first filling unit;

at a second filling unit, filling each of the second moulds with a volume of second product to fill the volume of the said each second mould not occupied by a solidified physical shape of first product transferred thereto, so that as the second moulds traverse the path the said second product is solidified as the second moulds pass through the or a further solidifying section; and

withdrawing confections from the second group of moulds after solidification of the said second product,

wherein before the said confections are removed from the second moulds of the paired group of moulds the first moulds of the paired group pass the first filling unit and are filled thereby with further first product.

26. A method according to claim 25 further including the step of inserting a stick into the said first product in each of the first moulds during progress thereof through the solidifying section.

27. A method according to claim 26 wherein the step of transferring solidified physical shapes from the first moulds to the second moulds of the paired group includes grasping the sticks inserted into the first moulds, lifting the solidified physical shapes from the first moulds, and introducing the product into the second moulds.

28. A method according to any one of claims 25 to 27 wherein the said second product is placed into the second moulds at a time which is before or during or after the step of transfer into the second moulds of the solidified physical shapes from the first moulds.

29. A method according to any one of claims 25 to 28 wherein the paired group is located on or in a unitised table, wherein the path is circular and wherein advancement of the paired group of moulds along the path is by rotation of the table by a drive means.

30. A method according to claim 29 wherein the first moulds and the second moulds of the paired group are spaced apart radially on the unitised table.

31. A method according to claim 29 wherein the first moulds and the second moulds of the paired group are spaced apart circumferentially on the unitised table.

32. A method according to any one of claims 25 to 31 wherein in the step of filling the first moulds with the first product, the quantity of the said first product placed into each of the first moulds is according to at least one of a predetermined period of filling time, a predetermined volumetric measure and a predetermined weight measure.

33. A method according to any one of claims 25 to 32 further including the step of warming the first moulds before the step of transferring solidified physical shapes from the first moulds to the second moulds.

34. A method according to any one of claims 25 to 33 further including the step of warming the second moulds before withdrawal of completed confections therefrom.

35. A machine for making hardened confections of complementary parts substantially as described herein with reference to the attached diagrams.

DATED this 3rd day of February 1999

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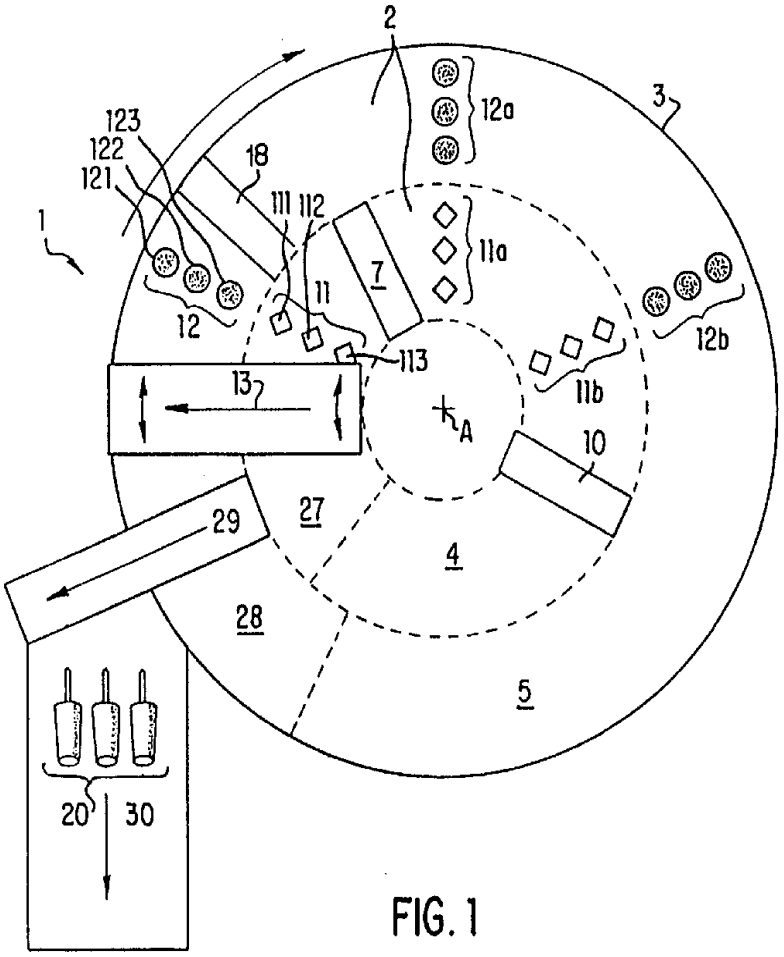


FIG. 1

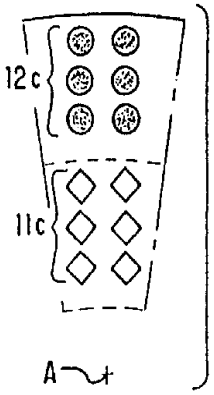


FIG. 1B

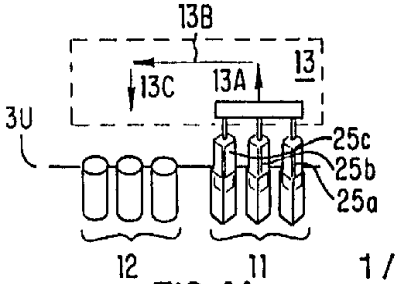


FIG. 1A

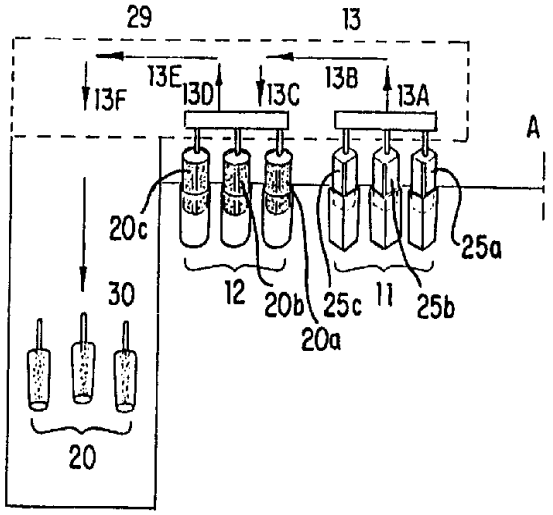


FIG. 1C

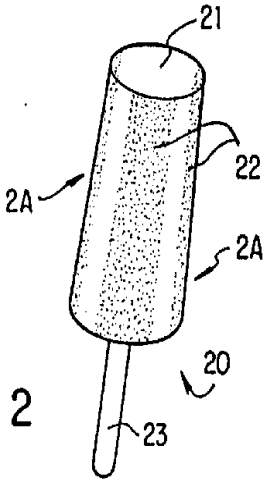


FIG. 2

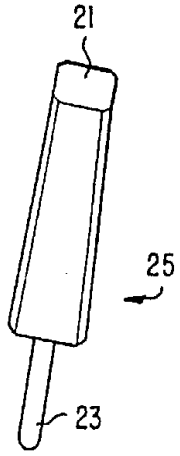


FIG. 2B

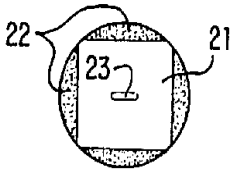
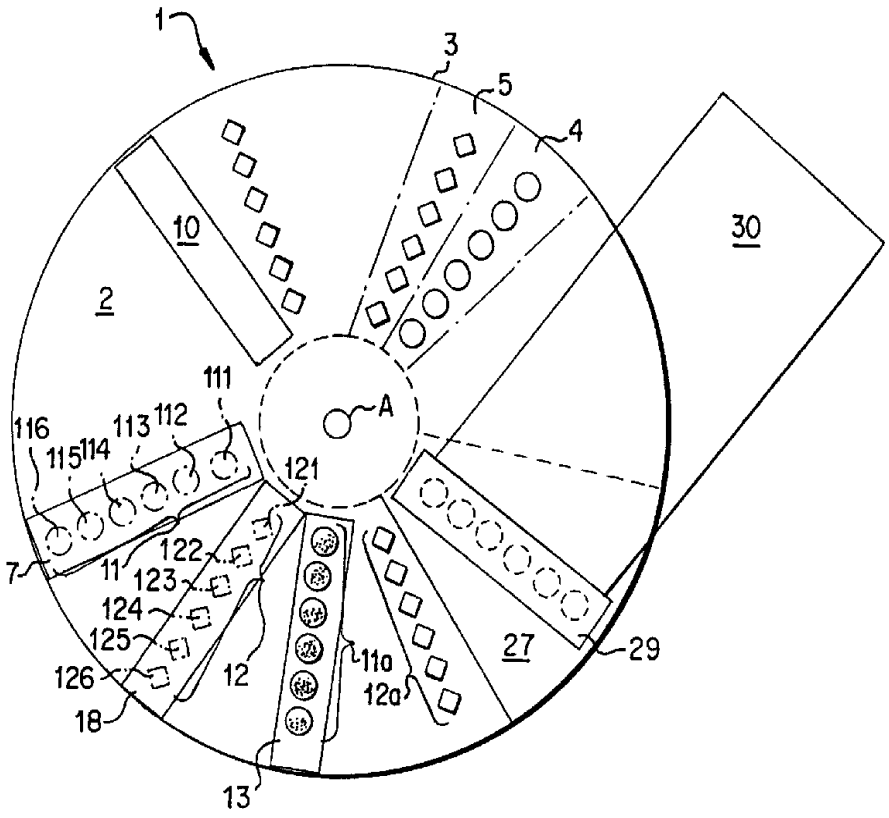


FIG. 2A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11a
12a
27
29

FIG. 3

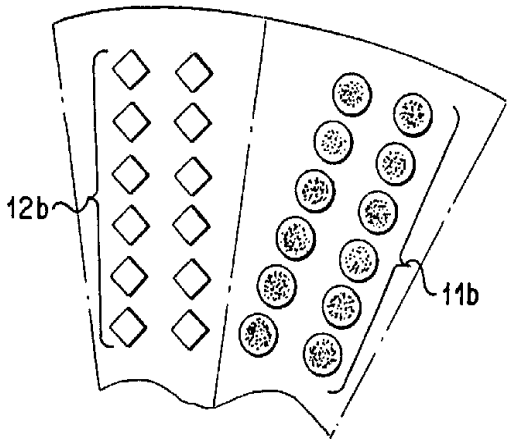

FIG. 3A

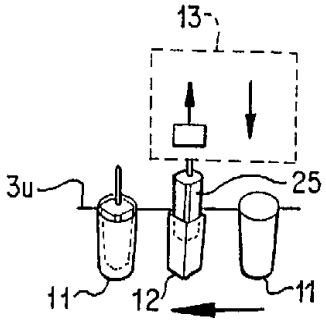

FIG. 3B

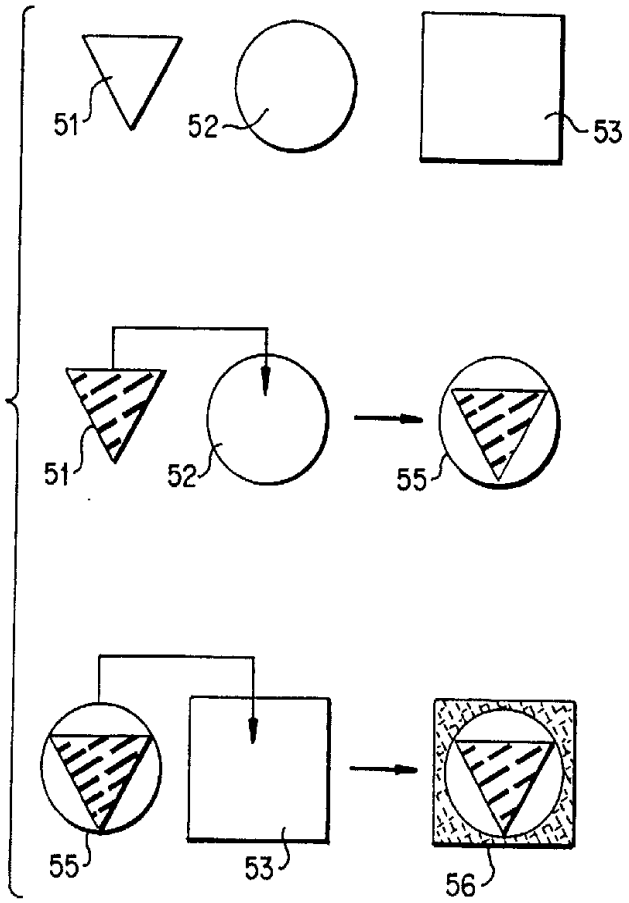

FIG. 4

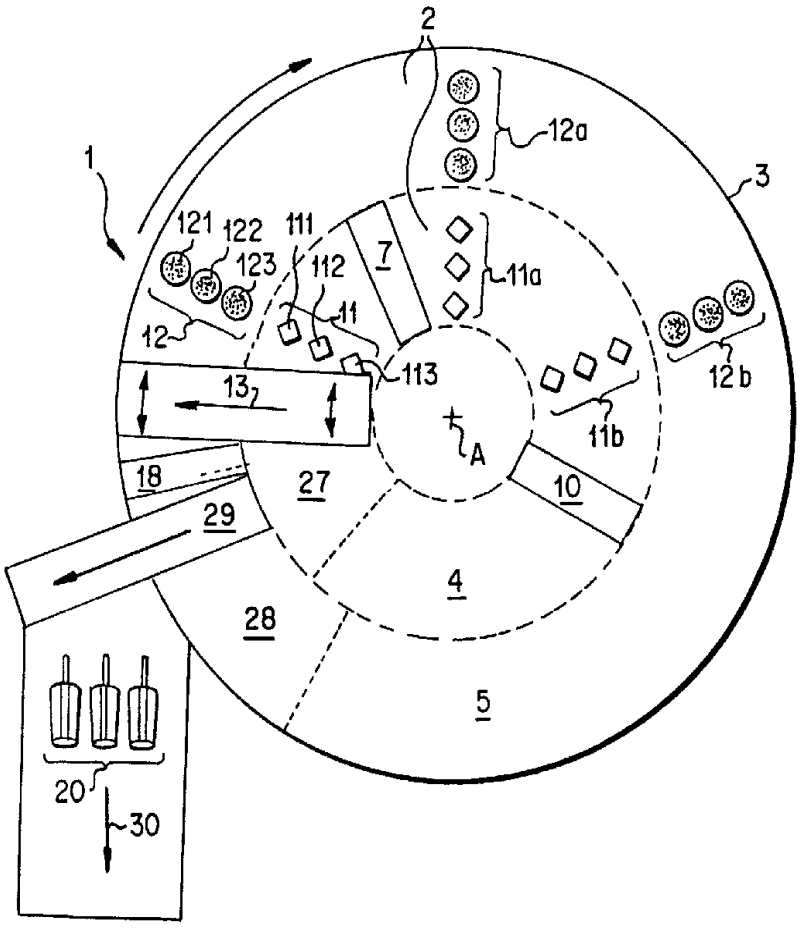
2
12a
1
3
121
122
123
111
112
11
7
11a
12
113
13
12b
11b
A
18
27
10
29
4
28
5
20
30

FIG. 5

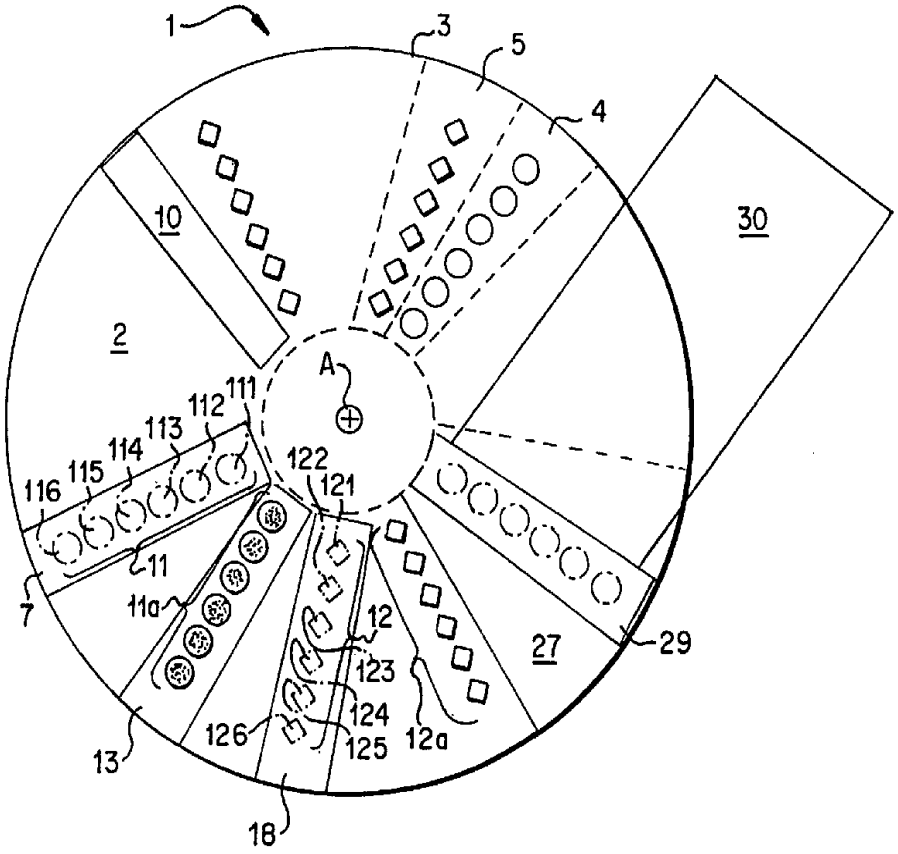

FIG. 6

SUBSTITUTE SHEET (RULE 26)