

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
31 January 2008 (31.01.2008)

PCT

(10) International Publication Number
WO 2008/014443 A2

(51) International Patent Classification:
B65B 9/00 (2006.01)

(21) International Application Number:
PCT/US2007/074569

(22) International Filing Date: 27 July 2007 (27.07.2007)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
60/833,740 27 July 2006 (27.07.2006) US

(71) Applicant (for all designated States except US): **PPI TECHNOLOGIES GLOBAL** [US/US]; 1610 Northgate Blvd., Sarasota, FL 34234 (US).

(72) Inventor; and

(75) Inventor/Applicant (for US only): **MURRAY, R., Charles** [US/US]; 7019 Portmarnock Place, Lakewood Ranch, FL 34202 (US).

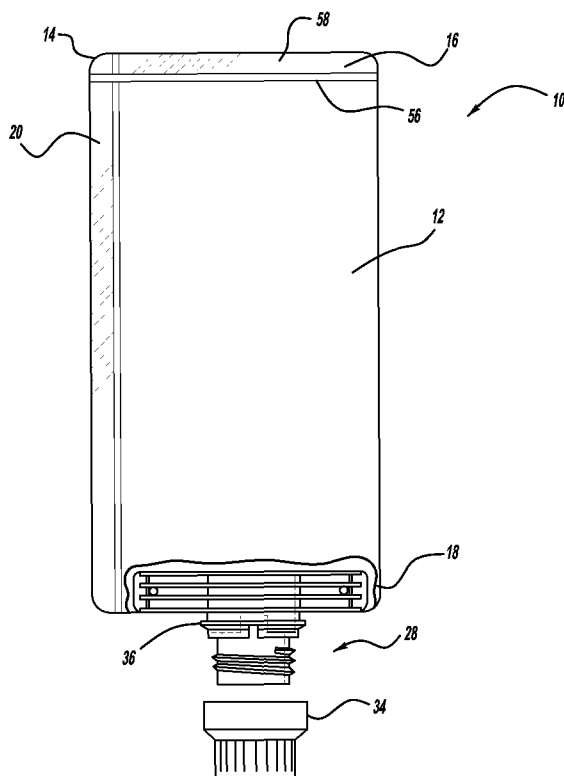
(74) Agents: **ANDERSON, Thomas, E.** et al.; Gifford, Krass, Sprinkle, Anderson & Citkowski, PC, 2701 Troy Center Drive, Suite 330, Post Office Box 7021, Troy, MI 48007-7021 (US).

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI,

[Continued on next page]

(54) Title: INTERMITTENT AND CONTINUOUS MOTION HIGH SPEED POUCH FORM-FILL-SEAL APPARATUS AND METHOD OF MANUFACTURE



(57) Abstract: A high speed, flexible pouch form-fill-seal machine includes a form line having a plurality of pouch forming stations that conducts an operation to form a body of the pouch. An intermittent transport means transports the laminate material between each of the pouch forming stations, and stops at each station so that the corresponding pouch forming operation can be performed. The machine includes a fill-seal line having a plurality of pouch fill-seal stations arranged sequentially along the fill-seal line that conducts an operation to open, fill and seal the flexible pouch. A continuous transport means transfers the pouch between the plurality of pouch fill-seal stations, and the continuous transport means moves continuously between the each of the pouch fill-seal stations so that the corresponding pouch fill-seal operation can be performed. A transfer means transfers the formed flexible pouch from the fill line to the fill-seal line.



FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, MT, NL, PL,
PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM,
GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

Published:

- *without international search report and to be republished upon receipt of that report*

INTERMITTENT AND CONTINUOUS MOTION HIGH SPEED POUCH
FORM-FILL-SEAL APPARATUS AND METHOD OF MANUFACTURE

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims priority of United States Provisional Patent Application
5 Serial No. 60/833,740 filed on July 27, 2006, which is incorporated herein by reference.

FIELD OF THE INVENTION

[0002] The present invention relates generally to an apparatus for forming, filling and
sealing a flexible pouch for packaging a product and, more specifically, to an intermittent and
continuous motion, high speed form-fill-seal machine for packaging a product in a flexible
10 pouch, and a method of manufacturing the same.

DESCRIPTION OF THE RELATED ART

[0003] Various types of disposable, portable containers are known in the art for storing a
fluid or dry product, such as a liquid, granular material, powder or the like. Examples of
containers include a cup, a metal can, a plastic bottle, a glass bottle or a flexible pouch.
15 Consumers prefer the convenience of flexible pouches over other types of containers due to
their shape, size, shelf life and storage adaptability. Manufacturers recognize the packaging
benefits of a flexible pouch, since the pouch can be formed and filled on the same
manufacturing line. An example of a method and apparatus for filling a flexible pouch with a
product is disclosed in commonly assigned U.S. Patent No. 6,199,601, which is incorporated
20 herein by reference.

[0004] The flexible pouch is formed using a forming machine from a flexible material,
preferably a laminate composed of sheets of plastic or aluminum or the like. The formed pouch
is then filled with the intended product and sealed using a fill-seal machine. The flexible pouch
may be formed on one machine and filled on another fill-seal machine, or formed, filled and
25 sealed on the same machine. Various types of form or fill-seal or form-fill-seal machines are
available, such as a form-fill-seal machine with a single lane or multiple lanes, a flat bed pre-
made pouch machine, a form-fill machine, or the like. Conventionally known form-fill-seal
machines have a number of stations, and a particular operation is performed at that station
before transfer to the next station in an intermittent, "stop and go" manner.

[0005] While the above-described form-fill-seal machine works well for producing a completed flexible pouch, the line speed and resultant rate of finished pouch production is limited. Thus, there is a need in the art for a flexible pouch form-fill-seal machine with improved line speed, and an improved method for accomplishing the same.

5

SUMMARY OF THE INVENTION

[0006] Accordingly, the present invention is an improved high speed, flexible pouch form-fill-seal machine and an improved method of making the flexible pouch. The machine includes a form line having a first frame and a plurality of predetermined pouch forming stations arranged sequentially along the form line. Each of the pouch forming stations conducts an operation to form a body of the pouch from a roll of laminate material. The body of the pouch includes a panel having an inner surface and an outer surface, and an upper edge, an opposed lower edge and two side edges extending therebetween. An intermittent transport means is secured to the frame for transporting the laminate material between each of the pouch forming stations, and the transport means stops and at each of the stations so that the corresponding pouch forming operation can be performed. The machine includes a fill-seal line having a second frame and a plurality of predetermined pouch fill-seal stations arranged sequentially along the fill-seal line. Each of the pouch fill-seal stations conducts an operation to open, fill and seal the flexible pouch. A continuous transport means is secured to the second frame for transferring the pouch between the plurality of pouch fill-seal stations, and the continuous transport means moves continuously between the each of the pouch fill-seal stations, so that the corresponding pouch fill-seal operation can be performed. A transfer means transfers the formed flexible pouch from the fill line to the fill-seal line.

[0007] One advantage of the present invention is that an improved high speed form-fill-seal pouch making apparatus for a filled flexible pouch is provided using an integrated machine with intermittent motion between forming stations and continuous motion between fill-seal stations. Another advantage of the present invention is that the fill-seal machine can be cleaned independent of the form machine. Yet another advantage of the present invention is that the flexible pouch is more cost effective to manufacture due to increased line speed, resulting in an increased number of pouches that can be simultaneously formed, filled and sealed. A further advantage of the present invention is that the sealed flexible pouch can be automatically transferred to another automated line, such as a line for packing a container, or for a secondary process. Still a further advantage of the present invention is that the formed flexible pouch is

transferred to the fill-seal side of the machine using a transfer means, such as a robot. Other features and advantages of the present invention will be readily appreciated, as the same becomes better understood after reading the subsequent description taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] FIG. 1 is an elevational view of a filled flexible pouch, according to the present invention.

[0009] FIG. 2 is an elevational view of an unfilled flexible pouch, according to the present invention.

[0010] FIG. 3 is an elevation view of another flexible pouch, according to the present invention.

[0011] FIG. 4 is a flowchart of a method of forming, filling and sealing the flexible pouch, according to the present invention.

[0012] FIG. 5 is an elevational view of an example of a machine for forming, filling and sealing the flexible pouch, according to the present invention.

[0013] FIG. 6 is an elevational view of another example of a form-fill-seal machine, according to the present invention.

[0014] FIGS. 7A-7E are plan views of examples of arrangements of a form line and fill-seal lines for the machine, according to the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0015] Referring to FIGS. 1-3, a flexible pouch 10 is illustrated. The pouch 10 is filled with a product 90 and sealed. The type of product is unlimited, and could have a solid or a liquid form. The product may be a food item, or a non-food item. It is contemplated that the pouch may contain a single portion or multiple portions of the product. The filled pouch 10 may assume various shapes, such as cylindrical, cube, conical or the like. The type of product and usage of the pouch may influence the shape and features associated with the pouch. The pouch 10 may have one compartment for the product. Alternatively, the pouch 10 may include multiple discrete compartments. The compartments may be separated by a frangible seal to allow mixing of the contents of each compartment, or by a permanent seal to prevent mixing. An example of such a pouch is disclosed in commonly assigned U.S. Patent Application Serial No. 11/367,613, which is incorporated herein by reference.

[0016] The flexible pouch 10 is preferably formed from a roll of flexible, preprinted laminate material. The choice of laminate material is nonlimiting, and may be influenced by factors such as the product contained in the pouch 10, the shape of the pouch or the anticipated use of the pouch, or the like. For example, the laminate may be a three, four or five or more gauge material. The outer layer may be preprinted. It should be appreciated that a portion of the material may be a clear laminate 98, in order to view the contents 90 of the pouch. For example, the laminate material may include at least one layer of virgin polyethylene terephthalate (PET) and at least one layer of aluminum foil (AL) and another layer such as EVOH, PET, polyethylene, or polypropylene or nylon or the like. The laminate may also include a metalized foil paper layer laminated to a cast polypropylene layer and another layer of PET, polyethylene or EVOH. It should be appreciated that there may be a fourth layer of nylon. Another material example includes a cast polypropylene (CPP) layer, a polyethylene (PET) layer, a foil (AL) layer, a nylon (ONO) layer and another CPP layer. Another example of a material structure is the use of nylon, foil, nylon, and cast polypropylene (ONO/AL/ONO/CPP) or CPP/NY/AL/CPP. A further example of a laminate material structure is CPP/AL/ONO/PE. This structure works well when the product has a short shelf life, and the nylon eliminates stretching or cracking of the AL layer. Advantageously, a pouch 10 made using the cast polypropylene laminate material retains its filled shape even as the product is removed from the pouch 10. It should be appreciated that if a filled carbonated pouch is stored at ambient temperature, the laminate will start to creep after a period of time, such as ten days. The laminate material may include an extrusion layer to contain "creepage" or "stretch" of the film after filling due to carbonation expansion, if the product is carbonated. In addition, the selected material may be organoleptic compliant in order to avoid the transfer of odor contaminants to the product, or product contamination during the shelf life period of the product.

[0017] The pouch 10 itself is defined by a panel, which may be formed using one or more sheets of material. In this example, the pouch 10 includes a front wall 12 and a back wall 14, and the edges are joined along a seam. With one sheet of material, it is folded so that the outer edges are joined together to form one seam. Alternatively, the pouch may be formed from two facing panels of material that are joined together along corresponding side edges.

[0018] Further, the pouch is generally defined by an upper edge 16, an opposed lower edge 18, and at least one side edge 20 extending therebetween the upper and lower edges 16, 18. The edges of the pouch 10 are sealed using heat or ultrasonically or by a combination of heat and ultrasonically. The pouch sealed edges form a seam. The seam may be a fin-style seam, or a

flat seam or the like. One of the seams may include an opening means, to be described, sealed between the walls of the pouch.

[0019] The pouch 10 may include an insert, sidewall or gusset 26. The gusset 26 may be integrally formed in the panel by folding the panel, or a separate piece of material disposed between the walls. For example, the gusset 26 may be disposed between the front and back walls 12, 14, and positioned between the side edges of the walls, the lower edges, the upper edges, or any desired combination. It should be appreciated that the shape of the gusset 26 is non-limiting. For example, the gusset 26 may be generally wider at one end and taper upwardly towards the opposite end. The gusset 26 may also be of a uniform width. The use of the gusset 26 may be functional, i.e. it may allow the pouch 10 to acquire another shape, such as cylindrical, or to stand upright. The gusset 26 also enhances the strength and rigidity of the pouch 10 during filling and processing. A side gusset is advantageous since it allows the walls of the pouch to expand as the internal pressure within the pouch increases. A gusset 26 positioned between the lower edges 18 of the pouch 10 may form a base, enabling the pouch 10 to stand upright unsupported.

[0020] Similarly, the pouch may include an insert (not shown). The insert is a generally planar member that is inserted between the walls 12, 14 of the pouch 10. The shape of the insert is non-limiting, i.e. square, round or oval or rectangular, and generally influences the shape of the flexible pouch. The insert may be positioned internally within the pouch or externally. Various materials may be utilized for the insert, such as foil, cardboard, plastic, nylon, laminate or the like. Further, the insert may be formed from a printed material, or it may be clear. In one example, the insert is inserted between the lower edges of the panel and sealed to the walls of the panel. The seal may be an ultrasonic seal or a heat weld or a combination of both or the like. The pouch may contain two inserts. The insert may include an integral opening means, such as a fitment. The insert may allow the pouch to acquire a shape, such as cylindrical or the like, or to stand upright.

[0021] The pouch 10 incorporates an opening means 28 for accessing the contents of the pouch. Various types of opening means 28 are known in the art for this purpose, and is non-limiting. It should be appreciated that the opening means 28 may be incorporated into the pouch 10 prior to filling the pouch 10. One example of an opening means is a tear-off portion. The tear-off portion 30 usually has an integral tear notch 32. The tear notch 32 is typically formed near an outermost edge of a seam, for initiating the removal of the tear-off portion, such as a side edge. A further example of an opening means 28 is a pull tab covering an opening in

the pouch. Yet another example of an opening means 28 is a resealable zipper 46, which provides a hermetic seal. Another example of an opening means 28 is a weakened straw pierceable portion in the pouch for receiving a straw.

[0022] Still a further example of an opening means 28 is a fitment such as a removable and replaceable cap 34 secured to a spout 36, or a tap, or the like. Various types of caps and spouts are available. For example, the cap 34 can be the traditional round shape, or have an elongated oval shape. An oval shape may support the pouch is that it can stand up on its own. The cap 34 and spout 36 can be made from a variety of materials. For example, the cap 34 may be made from plastic, such as reground resins. The spout may be made of polypropylene (PP), depending on the product. The spout is sealed into the upper edges of the panel using a sealing means, such as an ultrasonic seal or a heat weld, or the like.

[0023] It should be appreciated that the fitment may be applied to the pouch prior to filling the pouch, or after filling. The fitment is sealed between the edges of the pouch using a sealing technique, such as an ultrasonic or heat seal or the like. The pouch 10 may be filled through open edges or through the spout. The spout fitment may have a tamper-evident means. For example, the spout may include a removable seal to prevent leakage of the product or evidence of tampering. If the product is a carbonated product, the spout fitment may include a carbonation insert and oxygen scavenger to reduce oxygen in the head space.

[0024] It should be appreciated that the flexible pouch 10 may advantageously include other features that are known in the art. For example, the pouch may include a tracking device 38 feature integrally located within the pouch 10 that includes electronic tracking information relevant to the pouch 10, as described in commonly assigned U.S. Patent Application Serial Number 11/686,666, which is incorporated by reference. In an example, the tracking device 38 may be secured within an airspace or air pocket 40 formed in a sealed portion 42 of the pouch 10 formed during the manufacturing process. The tracking device 38 may be an electronic tag, such as a Radio Frequency Identification (RFID) transmitter. The tracking device 38 can store a predetermined amount of electronic information. An example of the information is unique tracking information for a particular package 10. For example, the tracking device 38 can provide information about the status of the pouch 10, such as physical location of the pouch 10, or age of the pouch 10 or the like. In addition, the tracking device 38 can be utilized for inventory control, delivery, purchase behavior, returns, pricing, and other tracking purposes. The tracking device 38 is in communication with a receiver (not shown) for reading the information. The receiver may be a computer system having a memory and a processor, a

handheld device for receiving an RFID signal, or any other type of device capable of electronic communication with the tracking device 38. The receiver may be a transceiver capable of emitting a radio signal that initiates transmission of information from the tracking device 38. Although the packages are individually read, the RFID tag may be advantageously read at a faster rate than using a barcode in conjunction with a barcode scanner, since the packages are not physically scanned on an individual basis. In addition, the signal from the RFID tag may be advantageously read through an outer layer of material, such as a packaging material, or under various environmental conditions. Another advantage is that the tracking of the physical location of the package may be electronically monitored within a predetermined geographical range.

[0025] The tracking device 38 may be integrally embedded in the pouch 10. For example, a plurality of apertures 44 may be punched in the folded area of the gusset 26 to reduce the amount of material in the gusset 26. The tracking device 38 may be inserted in an air pocket 40 formed within one of the gusset apertures 44. The inclusion of the tracking device 38 in the air pocket 40 is advantageous because it improves the signal strength of the tracking device 38. Alternatively, the tracking device 38 may be inserted in a sealed portion of the pouch 42, and an air pocket 40 is formed around the tracking device 38 during application of the seal. The tracking device may be integrally formed in the opening means.

[0026] The pouch 10 may include a feature such as an angled top seal 50 extending between a first side edge 20 and a predetermined location on the upper edge 16 of the pouch. The angled top seal 50 facilitates the removal of product from the pouch 10 by directing the flow of the product towards the opening means. An example of such a pouch is disclosed in commonly assigned U.S. Patent Application No. 11/683,133 which is incorporated herein by reference.

[0027] The pouch 10 may include a feature such as a hanging aperture 52 located within an edge, such as an upper edge or side edge. The aperture 52 may have various shapes, such as round or curved. The pouch 10 may be supported by a support means, such as a hook that extends through the aperture 52. The pouch 10 may be hung for display or storage purposes. The positioning of the hanging aperture 52 above the angled top seal 50 or within a sealed portion 42 prevents the contents of the pouch from leaking out through the aperture 52.

[0028] The pouch may include a feature such as a dimple (not shown) for receiving a straw. Another feature is a weakened portion adjacent the opening means, to facilitate opening the pouch. Still another feature is a straw (not shown) attached to the pouch 10. In still another

example, the flexible pouch 10 may include a guide pocket 24 formed in a wall 14, 16 of the pouch 10 prior to filling and sealing, to facilitate the separation of the front and back walls 14, 16 prior to the filling of the pouch 10. An example of such a pouch is disclosed in commonly assigned U.S. Patent Application No. 10/310,221. In a further example, the pouch may contain
5 a rib that adds strength or support or form to the pouch. The rib may be thermoformed.

[0029] The pouch may include a features such as an integral vent means. The vent means, such as a valve, functions to exhaust a gas from the pouch. The gas may be formed within the package while heating the pouch. The valve may also be operable to respire gas formed in the compartment 36 for other reasons, such as gas formed by decaying food or during freezing or
10 the like. The valve remains tightly closed, until pressure from the gas, such as steam, reaches a predetermined pressure value. An example of a predetermined pressure is approximately 3 mbar. The valve opens and remains open, to release the gas from the package in a controlled manner. Various types of valves are contemplated. For example, a tape may be used to cover a hole in the wall. Alternatively, a pressure relief device, such as that manufactured by PPI
15 Technologies, Sarasota, Florida model number P00T, may be utilized. Another example of a valve is disclosed in commonly assigned U.S. Patent Application Nos. 10/228,430 and 10/967,547 and PCT Patent Application No. PCT/US2004/34361.

[0030] The pouch may include a feature such as an ergonomic shape. An example of an ergonomically shaped pouch for a carbonated beverage is disclosed in commonly assigned U.S.
20 Patent Application Serial No. 11/454,241 which is incorporated by reference. The ergonomic shape may be achieved through carbonation as the pouch 10 is filled with a carbonated product, since the carbonation causes the pressure within the pouch to increase.

[0031] The flexible pouch 10 may include a feature such as an outer layer or sleeve covering the outer surface of the pouch. The sleeve may be a label containing information
25 about the product, such as a barcode or the like. The sleeve may cover only a portion of the pouch outer surface. Preferably, the sleeve is shrunk over the outer surface of the pouch 10 after the pouch 10 is formed and filled with the product. The sleeve is advantageous because it covers the side seam. It also adds one or more layers of material to strengthen the pouch and improve its durability. Various types of material may be utilized for the sleeve, such as paper or
30 plastic including PET or PVC and the choice is non-limiting.

[0032] It is contemplated that these are merely examples of features and the flexible pouch 10 may incorporate any of the above-described features or any other feature, in any combination. For example, the pouch 10 may include an insert in the bottom portion of the

pouch and a tapered top portion, or an insert in the bottom portion of the pouch and a spout 36 and cap 34 in the top portion of the pouch. In addition, the finished pouch may assume various shapes, such as cylindrical, cubical, and conical, hourglass or the like, as influenced by the type of product and intended usage of the pouch. It should further be appreciated that the upper edge and lower edge may be interchangeable and is merely for reference purposes.

[0033] It is contemplated that the pouch 10 may undergo a secondary process after it is filled with the product. This process may take place on a separate line than the form-fill-seal line. For example, the filled pouch may be refrigerated, frozen or otherwise modified for an extended shelf life. Alternatively, the filled pouch may be pasteurized for increased shelf life. Examples of pasteurized food products include dairy products such as milk, or meat products such as chicken or the like.

[0034] Referring to FIG. 4, a method for forming and filling and sealing the flexible pouch 10 using a unitary high-speed machine is illustrated. The pouch being formed is transported between forming stations in an intermittent manner, with a stop at each station. The method begins in block 100 at a first forming station with the step of preparing the material to form the body of the pouch. For example, a roll of laminate material, as previously described, is unrolled along a horizontally oriented plane. The initial width of the roll of material is determined by the desired finished size of the pouch 10 and the number of pouches obtained from the width. For example, two to four pouches, representing four to eight panels, can be obtained from a width of the roll of material on a two lane machine, three lane machine or four lane machine, respectively. The film may pass through an ultraviolet light chamber without reflection to remove pathogen and microbiological contaminants. The material is aligned. A precise alignment is advantageous, especially at a higher machine speed, because the seam tolerance is more precise. A tighter tolerance reduces the amount of material required. An example of an alignment method is disclosed in commonly assigned U.S. Patent Application Serial No. 11/674,923, which is incorporated by reference.

[0035] For example, to align the material, the planar orientation of the unrolling material 204 is changed from a horizontal orientation to a vertical planar orientation. In an example, the machine 200 utilizes an angled roll bar to modify the planar orientation of the unrolling material. The vertical orientation is advantageous in aligning the unrolling material 204 prior to cutting. An optical reading means may be utilized, such as an optical scanner or the like to identify a predetermined location of the material, such as an edge of the material or a registration mark.

[0036] The determined alignment of the unrolling material may be used to automatically correct the alignment of the unrolling material. In this example, a moveable roller is utilized to adjust the alignment of the material along a vertically oriented axis. For example, the adjustment movement is ± 2 degrees from the vertically oriented axis.

5 **[0037]** The material may include preprinted information such as labeling information that describes the product contained within the pouch. In an example, the layer of preprinted information is located on an outer layer of the material. One layer of the material may also be preprinted with a tracking device 38, such as the RFID transmitter previously described. Alternatively, the RFID transmitter may be secured on the material so that it is located in an air
10 pocket when the pouch is formed at a later step.

[0038] The methodology advances to block 105 and a feature is optionally positioned between the unrolling sheets of material. An example of a feature is a vent valve inserted into one of the panels, such as the front panel. The valve provides for the venting of gas formed in the pouch, such as by heating or cooling. An example of such a value is disclosed in commonly
15 assigned U.S. Patent Application Serial Nos. 10/567,215 and 10/967,547, which are incorporated by reference. The valve is preferably placed in an upper corner of the pouch. Various techniques are contemplated for insertion of the valve. For example, a valve aperture may be cut into the panel, and the valve is inserted into the aperture in the panel. The valve is welded to the panel. Various processes are available, such as a heat weld or an ultrasonic seal,
20 to obtain an airtight seal around the valve.

[0039] Another example of a features is a gusset 26 inserted between the sidewalls of the pouch. Alternatively, the gusset 26 or pleat is formed in the panel using a folding operation to fold the panel. In one example, the folded pouch has a “V” shape to form the gusset 26. In another example, the folded pouch has a “W” shape. A plurality of apertures 44 are formed in
25 the gusset 26, such as by using a punch. The plurality of apertures 44 are positioned in the gusseted portion of the material, so as to reduce the amount of material in the gusseted portion of the pouch for sealing purposes. The tracking device 38 is advantageously positioned in the air pocket 40 formed by the gusset aperture 44.

[0040] In another example of a pouch 10 with one seam, a fold may be formed along an
30 edge in the sheet of material. An example of this type of pouch is disclosed in commonly assigned U.S. Patent Application Serial Nos. 11/195,906 and 11/551,075 which are incorporated herein by reference.

[0041] An opening means may also be added in this operation. The opening means 28 may be located on the pouch 10 in a variety of locations, such as mounted on a bottom, or a top, or a side portion of the pouch. Various types of opening means 28 are contemplated, as previously described. For example, if a reclosable pouch is desired, a zipper, such that manufactured by
5 Zip Tight may be inserted. This type of zipper is easily opened from the outside, however, it provides resistance to pressure on the inside, and the greater the pressure on the inside, the tighter the zipper is sealed. Another example is a spout fitment 36. In another example, an opening means such as a straw hole, patch or tear notch or spout may be applied. It should be appreciated that the cap or spout fitment may have a tracking device embedded therein

10 [0042] The methodology advances to block 110 and the edges of the panel are sealed. It is contemplated that the side edges 20, 20 may be sealed, a lower edge 18, or an upper edge 16, depending on the configuration of the pouch 10. Various techniques are known in the art for sealing the edges together. For example, an ultrasonic sealing process may be used. Another technique is a heat weld that includes the application of heat and compression. The seal may be
15 a heat weld process which includes the application of heat and compression in a two-step welding operation.

[0043] In another example, the edges of the panel may be sealed using a seal bar. An example of a seal bar is a generally rectangular member conforming to the desired seal shape. The seal bar may include a cavity, such as to create an air pocket. A tracking device 38 may be
20 contained in the air pocket.

[0044] One edge of the pouch may be left open for filling purposes. In this example, the open edge is designated the upper edge, for reference purposes. Alternatively, all of the edges are sealed and the pouch 10 is filled through a spout. Another seal, such as the angled top seal 50, may also be applied at this time. Advantageously, the seals may be shaped so as to avoid
25 sharp radiuses at the interior corners of the pouch. A rounded interior shape facilitates removal of the product.

[0045] In still another example, the edges are sealed using a seal bar or forming plate having a plasma coating. One advantage of the plasma coating is that the line speed may increase. Another advantage is that the coating makes the surface of the seal bar or forming
30 plate more resilient. When the seal bar is heated, the coating expands due to this resiliency. The shear stress on the inner edge of the seal is reduced; resulting in reduced creepage of the material and greater durability of the seal. The plasma coating reduces the opportunity for potential damage to the material during the sealing step. In this example, the plasma coating is

a smooth, hard plastic that mimics glass. Since the outer layer of material is not weakened, there is no creepage of the outer layer. This seal bar may also include the previously described seal bar recess for forming an air pocket.

[0046] In still another example of a sealing technique, the side seal is a two-step seal formed using more than one seal bar. One seal bar may include the previously described seal bar cavity for forming an air pocket in the sealed portion. An example of a two-step seal is disclosed in commonly assigned U.S. Patent Application No. 11/551,071. The two-step seal advantageously avoids the generation of ketones due to application of heat to the material. The first or inner seal is a low temperature seal. The second or outer seal is a high temperature seal.

The second seal is spaced apart from the first seal by a predetermined distance, to create an air gap. The first seal is a tack seal, such as 6 mm wide, and is of a sufficient temperature so as to melt the layers of material and tack the edges together. The predetermined distance between the first and second seal is $\frac{1}{2}$ -1 mm. The second seal is applied at a higher temperature and pressure than the first seal. As a result, any gas, such as steam, ketones, aromatics or the like are pushed in an outwardly direction, out through the open edges of the panels, and not into the pouch. Thus, the first seal prevents entry of contaminants into the pouch to avoid organoleptic contamination.

[0047] Another technique is a heat weld that includes the application of heat and compression. The heat weld may include a heat weld followed by a cold weld. For example, a seam defining each of the pouches 10 in the roll width of material is formed in the aligned first and second unrolling sections of material. In this example, the seam is a side section. The lower edge of each pouch may also be sealed at this time. For example, a seal is applied to the combined first and second unrolling sections of material to form each of the side seams joining each front panel to each back panel in a heat-sealing operation. An example of a width of the side seal seam for each individual pouch is approximately 4 ± 1 mm. It should be appreciated that two side seal seams may be adjoining, and the seal width increased to 8 ± 1 mm. Advantageously, the precise alignment of the roll of material prior to cutting out the sections used to form the pouch panels allows for a decrease in the width of the side seal.

[0048] The methodology advances to block 115, and the pouches 10 are separated into individual pouches 10 along a cutting line. For example, each section of material may be first separated along its width, or the side seam of the pouches. The section is then separated into individual pouches 10. In this example, the width of unrolling material represents the side seams. The material is cut into a pouch 10 using a known cutting apparatus, such as a laser or

punch or the like. The cutting apparatus forms a single cut in the material to separate the pouches. The size of the pouch 10 is controlled by the distance between the cuts.

[0049] Alternatively, two consecutive pouches 10 are separated using a double cutting process, whereby two cuts are made at the same time to separate the upper and lower edges of two pouches at the same time from the sheet of material. Advantageously, forming two pouches during the cutting operation effectively doubles the assembly line speed.

[0050] It should be appreciated that the upper edge or lower edge may be further trimmed. For example, the end of the pouch may be trimmed to accommodate a fitment. In another example, two legs are formed during the trimming operation, in order to recess the fitment.

[0051] A feature, such as an opening means 28, may also be applied to the pouch 10 at this time. For example, a spout fitment 36, as previously described, may be sealed within the walls of the pouch 10, such as between the upper edges 16. The spout fitment 36 may be sealed using an ultrasonic seal, or a heat weld, or by a combination of ultrasonic seal and heat weld. An example of an ultrasonic seal for a spout fitment is disclosed in commonly assigned U.S. Patent Application No. 11/195,906, which is incorporated herein by reference. Accordingly, the base portion of the fitment is sealed between the walls of the pouch using an ultrasonic seal, a heat seal, and then a cool seal. The heat seal melts a layer of the pouch material, and the material flows around the sealing ribs on the base portion, and fills in any void between the base portion and the wall of the pouch. The cool seal sets the seal and provides an attractive finish to the overall seal. Advantageously, fewer stations are required to seal the spout fitment between the walls of the pouch, since a tack seal is eliminated.

[0052] In addition, an insert 24 may be likewise applied to the pouch 10 at this time. The insert 24 may be positioned at a lower edge of the pouch, an upper edge, or both an upper and lower edge. The methodology advances to block 120.

[0053] In block 120, the individual pouches 10 are finished. For example, an outermost edge of the pouch 10 may be trimmed to shape, i.e. the corners may be angled or edges trimmed to accommodate a fitment. The pouch corners may be shaped to have a radius, to eliminate right angles at the corners. A hanging aperture 52, if present, may be formed at this time. This operation may be performed using a cutter or a die cut or the like. In addition, a tear notch 32 may be cut out of an outermost edge of the pouch to facilitate opening of the pouch.

[0054] In another example of a finishing operation, a crease or guide pocket 24 may be formed in a top portion of each wall 12, 14 in a creasing operation, in order to facilitate opening and filling of the pouch. An example of a method of forming a crease 24 in a wall to facilitate

opening the pouch is disclosed in commonly assigned U.S. Patent Application No. 10/310,221, which is incorporated herein by reference. It should be appreciated that the shape of the finished pouch is non-limiting, and may be round, square, oval, triangular or the like. In still another example of a finishing operation, the sleeve is applied over the individual pouch and shrunk to fit using an application of heat to the pouch. In a further example of a finishing operation, a rib may be added to the pouch. The rib may be thermoformed, and may provide the pouch 10 with shape or structure.

[0055] The methodology advances to 125, and the formed pouch 10 is removed from the form line. In block 130, the pouch is placed on a fill-seal line, that is integral with the form line, using a transfer means 250. For example, a line worker could pick up the pouch 10 and place it in a carrier 260 on the fill-seal line 270. In another example, a robotic transfer means 252 is used to transfer the pouch from the intermittent form line 210 to the continuous fill-seal line 270. The robotic transfer means 252 can be a robotic device having an arm 254 and a gripping means 256 that picks up an individual pouch from the form line 210 and places it in a pouch carrier 260 that moves between the fill-seal stations in a continuous manner, with no stops in between stations. Various types of pouch carriers 260 are available, such as a holder 262 or a gripper or the like. The pouch carrier moves continuously between fill-seal stations. An example of a holder is a cup-shaped member, as disclosed in commonly assigned U.S. Patent Application Serial No. 10/336,601, which is incorporated herein by reference. Alternatively, the pouch 10 may be held using grippers (not shown) as is known in the art. The pouches are arranged on the carrier in a transverse manner as shown at 262.

[0056] The methodology advances to block 135 and the pouch 10 is opened in an opening operation. Various techniques are conventionally known in the art for opening the pouch 10. For example, the guide pocket 24 formed by the crease in the front wall 12 and back wall 14 facilitates opening of the pouch. A nozzle may be mechanically lowered into the guide pocket 24 to direct a stream of compressed gas into the guide pocket, to force the walls of the pouch 10 away from each other. An example of a gas is carbon dioxide or nitrogen. The blowing station may include a manifold, with a hood extending over the top of the edges of the pouch as known in the art. The manifold has rows of apertures formed above the upper edges 16 of the pouch 10. The hood is placed over the pouch 10 to assist in maintaining the air pressure in the pouch 10. The supply of pressurized gas is directed through the aperture to form a plurality of jets of pressurized gas or air. The jets are directed downwardly at the diamond-shaped openings formed at the upper edges 16 to assist in overcoming the surface tension of the pouch and assist

in separation of the walls 12, 14. A diving rod (not shown) may then be used to make sure the pouch 10 is fully opened. If the pouch has a fitment, the gas is injected through the spout fitment. After the pouch is opened, it may be injected with super-saturated steam to eliminate any pathogens or the like

5 **[0057]** In block 140, the pouch 10 is filled with the product in a filling operation. For example, a fill tube (not shown) is lowered into the opened pouch 10 and the product is dispensed into the open pouch 10. The pouch may be filled through an open edge, or through the fitment, as previously described. If the pouch is large, the pouch may be filled at more than one station.

10 **[0058]** If the product is naturally carbonated, such as a sparkling wine or the like, the pouch is preferably filled while immersed in a nitrogen or carbon dioxide atmosphere. If the product is not naturally carbonated and carbonation is desirable, it is immersed in a carbonator to introduce carbon dioxide into the product. For example, carbon dioxide is introduced into cold water or
15 juice to provide a carbonated beverage. The product may contain a mixture of up to four volumes of carbon dioxide. It should be appreciated that the carbon dioxide masks any undesirable taste from ketones and other solvents released during the sealing process. The carbon dioxide also increases the pressure within the product so that the walls of the pouch are rigid after the top is sealed. The product is preferably filled at a temperature ranging from 29°F to ambient temperature. The filled pouch may have the oxygen removed from the pouch. For
20 example, the pouch may be flushed with carbon dioxide. Any gas in the head space of the pouch is removed. For example, oxygen may be removed by applying a vacuum.

25 **[0059]** In block 145, the pouch is sealed. Various techniques are available for sealing the pouch 10. The seal technique depends on the product contained in the pouch, the pouch shape, or type of opening means or how the pouch is filled. For example, a closing seal may be a heat weld, or an ultrasonic seal or ultra pulse seal.

30 **[0060]** For example, if the pouch is filled through the open edges with a carbonated product, or product having an alcoholic content, the open edges of the pouch are closed by applying a first closing seal 56. The first closing seal 56 may be an ultrasonic seal, or an ultra pulse seal. An example of a closing seal for a pouch containing a carbonated beverage, is described in commonly owned PCT Patent Application No. PCT/US03/034396 which is incorporated herein by reference.

[0061] In another example, the pouch 10 is filled through the spout fitment 36 and the cap 34 is applied to close the pouch 10. The cap 34 contains the product in the filled pouch, to

prevent leakage of the product from the pouch 10. The cap 34 may be a tamper-evident cap for a carbonated product. For a carbonated product, the complementary arrangement of threads and grooves in the cap and spout provides for the controlled release of pressure from the pouch, as disclosed in commonly assigned U.S. Patent Application No. 11/195,906, which is incorporated
5 herein by reference.

[0062] A second seal 58 may be applied a predetermined distance apart from the first seal 56. The second seal 58 may be a heat weld or a cosmetic seal or an ultrasonic seal or the like. For a carbonated product, the location of the second seal 58 is selected so that some of the product is trapped between the first and second seals 56, 58. This is advantageous since
10 eliminates the potential for gas in the head space, i.e. the region between the product and the heat seal. In this example the second seal is spaced outboard of the first seal. Another advantage of the location of the second seal 58 is that the overall length of the pouch may be reduced, resulting in less pouch material. The first closing seal 56 is a tack seal, and the second closing seal 58 is a high pressure, high temperature seal. A cosmetic seal may applied with
15 respect to the first and second closing seals, or the second seal 58 may be a cosmetic seal.

[0063] The methodology advances to block 150 and the pouch 10 is finished in a finishing operation. For example, the edges of the pouch 10 are trimmed to achieve a predetermined shape. In addition, the pouch 10 may be cooled at a cooling station, where the pouch 10 is cooled using a conventionally known cooling technique. Optionally, the sleeve may be placed
20 over the filled pouch and shrunk to fit over the pouch by applying heat. The sleeve layer forms an outer layer of the pouch. The methodology advances to block 155.

[0064] In block 155 the filled pouch 10 is discharged from the machine. A plurality of pouches may be placed in a package for sales or shipping purposes.

[0065] It should be appreciated that the pouch 10 may undergo other processing steps, such
25 as such as an upstream oxygen purging station, downstream oxygen purging station, pasteurization or the like. For example, the filled pouch 10 may be pasteurized in integral retort chamber (not shown) that heats and then cools the pouch 10. The pouch 10 may be tested, such as burst testing or the like prior to packaging for shipping. These additional processing steps may take place at a station on the form/fill/seal apparatus, or on another apparatus.

[0066] It should be appreciated that the order of steps may vary depending on the pouch 10
30 and its features. Also, a particular manufacturing station may perform one or a plurality of operations, to enhance the efficiency of the methodology and apparatus.

[0067] It should be appreciated that the methodology may include other steps, such as an upstream oxygen purging station, a downstream oxygen purging station, or the like. In addition, a manufacturing station may perform one or a plurality of operations, to enhance the efficiency of the methodology and apparatus. It is also contemplated that the order of implementing the steps may vary to facilitate the manufacturing process.

[0068] Referring to FIGS. 4-6, an automated machine 200 having operations for forming, filling and sealing a flexible pouch is illustrated. The machine 200 includes a form line 210 and a fill-seal line 270. The machine operations associated with each line are illustrated are by way of example, and other operations may be utilized. It should be appreciated that a particular manufacturing station may perform one or more operations. It should also be appreciated that the order of operations may vary. The form-fill-seal machine 200 may include various configurations, such as a flat bed, a conveyor, a rotary turret, or the like. In addition, multiple arrangements of the form line 210 and fill-seal line 270 are available, several of which are illustrated in FIGS. 6A-6E by way of example.

[0069] The machine 200 includes a form line that includes a plurality of stations 214 for forming the pouch 10. It should be appreciated that a conveyor belt 212 transfers the material 204 between stations 214 in an intermittent manner. For example, the conveyor 212 carrying the material 204 is operated by a cam driven servo that stops at each station 214 for a predetermined period of time, in order to perform an operation. It should also be appreciated that the machine 200 may include multiple form lines 210 that empty into one or more fill-seal lines 270. Various arrangements of the form lines 210 are contemplated, such as perpendicular to one another, or parallel to one another, or the like. The form lines 210 are generally arranged so that the formed, unfilled pouch 202 emerging from each line is placed on an adjacent fill-seal line 270. It should be appreciated that the form line 210 may include multiple lanes. Multiple lanes are advantageous since it provides for increased production capacity. In addition, a manufacturing station may perform one or a plurality of operations, to enhance the efficiency of the methodology.

[0070] It should be appreciated that the intermittent form portion of the machine may operate at a different line speed than that of the fill-seal portion of the machine. An example of a form line speed is 800 pouches per minute. An example of a fill-seal line speed is 500 pouches per minute. Therefore, the addition of another line of form stations or fill-seal stations further increases the capacity of the machine. The line speed of the form portion of the line and

the line speed of the fill-seal portion of the line are coordinated so that productivity of the machine is selectively enhanced.

[0071] The machine includes a base 216 and a transport means 212, such as a conveyor, that transports the material through the various stations. The roll of material is mounted along a horizontally oriented axis, and is unrolled along at a material feed station 218. The machine 200 may include a plurality of rollers that changes the orientation of the unrolling material from a horizontal orientation to a vertical orientation at a material turning station 220.

[0072] The unrolling material may pass through an optical reader 222, for alignment purposes. As previously described, the optical reader reads a predefined point with respect to the material. This predefined point may be a registration mark on the material, or the edge of the material.

[0073] The machine utilizes the registration marks to automatically adjust the orientation of the unrolling material position along a vertically oriented axis. For example, rollers may be used to adjust the position of the unrolling material ± 2 degrees relative to a vertically oriented center axis.

[0074] The machine includes a pouch forming station 224 where the aligned material is cut into a predetermined number of sections, which in this example are two. One of the sections may be rotated 180 degrees, and the first and second sections of this example are positioned such that inner sides face one another. The sections are used to form the front panel and back panel of the pouch, respectively.

[0075] It should be appreciated that a feature, as previously described, may be added between the facing sheets at an appropriate station, such as the fitment insert station shown at 226. The facing sections are transferred along the conveyor to a sealing station 228. The sealing station 228, as previously described, forms the seams joining the facing sections of material and delineating each pouch. In this example, the side edges of each of the pouches along the width of material are heat-sealed in this operation. Because of the precise alignment of the material sheets, the width of the side edge seam may be reduced, such as 4 mm, with a tolerance of ± 1 mm or the like.

[0076] The machine includes a cutting station 230, and the material is cut into individual pouches. For example, the pouch is cut along the side seam. It should also be appreciated that the pouches may be separated into individual pouches in a single cut or double cut process. The use of a double cut efficiently improves line speed.

[0077] The machine includes a transfer station 232. The transfer station 232 uses a transfer means 250 to pick up a finished, unfilled pouch 202 and place the pouch 202 in a pouch carrier 260 on the fill-seal line 270. The choice of transfer means 250 is non-limiting. An example of a transfer means 250 is a human operator. Another example of a transfer means 250 is a mechanically operated robotic device 252. The robotic device 252 picks up a pouch 202 from the form portion of the line and places it on the fill-seal portion of the line 270.

[0078] An example of a robotic device 252 is a robot that includes a base member 251. The base member 251 may be stationary or movable. The robotic device 252 also includes a processor 258, which may be disposed within the base member 251. The processor 258 controls the operation of the robotic device 252. The robotic device 252 includes at least one arm 254 extending from the base member 251. The operation of the arm 254 is controlled by the processor. An outer end of the arm 254 includes a gripping means 256 for picking up the pouch 202 from the form line 210 and placing it on the fill-seal line 270. Various types of gripping means 256 are available, such as a gripper, a vacuum, or a suction cup or a finger or a combination of these means or the like. The gripping means 256 picks up the pouch 202 and places it in a carrier 260 associated with the fill-seal portion of line 270. The robot 252 may include more than one arm 254, to more efficiently move a plurality of pouches between the form line 210 and the fill-seal line 270.

[0079] The line speed between the intermittent form line 210 and the continuous fill-seal line 270 can be coordinated, and such coordination may increase the overall pouch production rate. In the example of FIG. 5, the line speeds of the two form lines 210 is coordinated with the fill-seal line 270 to output filled pouches at a predetermined rate. The robotic means improves the cost effectiveness of the machine and enhances the accuracy of placement of the pouch within the carrier. An example of a form line rate is about 800 pouches per minute. An example of a fill line rate is 300 pouches per minute.

[0080] The machine 200 includes a fill-seal line 270 that adjoins the form line. In an example, all of the operations of the fill-seal line occur from above the pouch. The fill-seal line 270 includes a pouch carrier 260 that simultaneously moves a plurality of pouches, arranged in a predetermined manner, such as transversely in a row, in a continuous manner through each of the stations in the fill-seal portion of the line. The pouch carrier 260 is operatively connected to a conveyor 272 that moves along a second frame 274. In an example, the conveyor 272 is chain driven for continuous motion. For example, eight pouches arranged transversely are filled and sealed at a time to improve the efficiency of the machine 200.

[0081] The stations 276 of the form-fill line 270 of the machine 200 may be arranged in a linear manner, such as on a linear transport table. Further the pouches may be arranged in a circular manner, such as on a rotational transport table. The linear stations may be further arranged transversely or vertically.

5 **[0082]** The fill seal line 270 of the machine 200 includes an opening station 278, in order to separate the upper edges of the pouch. Various techniques are conventionally known in the art for further opening the pouch 10. For example, suction cups or grippers or the like may be utilized to open the pouches. In addition, a nozzle may be mechanically lowered into the pouch to direct a stream of compressed gas downwardly into the pouch to force the walls of the pouch
10 away from each other to further open an upper edge of the pouch. An example of a gas is carbon dioxide or nitrogen. The pouch 10 is then fully opened.

[0083] In addition, the opening station 278 may include a manifold, with a hood extending over the top of the edges of the pouch. The manifold has rows of apertures (not shown) formed above the upper edges of the walls of the pouch. The hood is placed over the pouch to assist in
15 maintaining the air pressure in the pouch. The supply of pressurized gas is directed through the aperture to form a plurality of jets of pressurized gas or air. The jets are directed downwardly at the diamond-shaped openings formed at the upper edges to assist in overcoming the surface tension of the walls and assist in separation of the walls. A diving rod may then be used to make sure the pouch is fully opened. Steam or another type of sterilizer may be utilized to clean
20 an inside wall of the opened pouch.

[0084] The opened pouch moves without stopping to a filling station 280, and the pouch 202 is filled with the product. For example, a nozzle dispenses a predetermined amount of product into the opened pouch. The product may be dispensed into the opened edges of the pouch 202 or through a fitment. In this example, the fill nozzle is lowered into the opened
25 pouch, and the product is dispensed into the open pouch. Depending on the size of the pouch, there may be additional fill nozzles. In this example, there are three rows of nozzles at the filling station.

[0085] If the product is naturally carbonated, such as beer or soda or the like, the pouch is preferably filled while immersed in a nitrogen atmosphere. If the product is not naturally
30 carbonated, it is immersed in a carbonator to introduce carbon dioxide into the product. For example, carbon dioxide is introduced into cold water or juice to provide a carbonated beverage. The product may contain a mixture of up to four volumes of carbon dioxide. It should be appreciated that the carbon dioxide masks any undesirable taste from ketones and other solvents

released during the sealing process. The carbon dioxide also increases the pressure within the product so that the walls of the pouch 10 are rigid after the top is sealed. The product is preferably filled at a temperature ranging from 29°F to ambient temperature. The carbonation is advantageous as a microbiocide which can enhance the flavor or prevent mold or contamination.

[0086] The pouch 10 may move continuously without stopping to a gas removal station for removing any oxygen from the pouch. Various techniques are known in the art for removing the gas. This can be done by providing a hood or diving nozzle where oxygen is either evacuated or replaced with carbon dioxide or nitrogen into the pouch to displace the oxygen. A diving nozzle is used to inject the gas or liquid nitrogen.

[0087] The pouch is then transferred continuously without stopping to a sealing station 282 and if filled through the open edges of the pouch, the open edges of the pouch are first sealed. The first seal may be a thermal seal. For example, a heat-sealing member extends through the slots in the sides of the cup to seal the upper edge of the pouch. As previously described, the heat sealing member may have a plasma coating. In another example, the lifting surface ends, causing the lever arms to return to their original position, and the pouch to close. The filled pouch may return to a partially closed position due to the product contained therein.

[0088] Another example of a first seal 56 for a product utilizes an ultrasonic sealing process. The ultrasonic seal may include sound waves and is formed using a horn and anvil. A second seal, if utilized, is applied at a second sealing station 284. The second seal 58 may be applied using a heat seal means to form a second heat seal spaced apart a predetermined distance from the first seal 56. It should be appreciated that the second seal 58 may be spaced slightly outboard of the first seal 56. The second heat-sealing station is conventional and utilizes heat or a combination of heat and pressure to form the seal. The second seal 58 may also be a cosmetic seal or another type of seal, such as ultrasonic, ultra pulse or the like. The first and second seals are applied for a carbonated product as disclosed in commonly assigned Patent Application No. PCT/US03/34396, which is incorporated herein by reference.

[0089] If the pouch is filled through the fitment, the pouch is closed by securing a cap to the fitment. The cap may have a tamper-evident feature. In addition, the cap may contain a tracking device.

[0090] The pouch is transferred to a finishing station 286 for finishing and removal from the filling machine. For example, a hanging aperture 52 may be formed at this time. Similarly, a tear notch 32 may be formed in the pouch 10 to facilitate opening the pouch to access the

product in the pouch. In another example of a finishing operation, the edges of the pouch 10 are trimmed to achieve a desired shape.

[0091] The machine may include a removal station 288 for removing the pouches from the machine. A gripper may be utilized to transfer the pouches. The grippers grab the pouch and lift the pouch from the pouch carrier 260. The carriers 260 may then be moved by the conveyor through a rinsing station and returned to the other side of the machine for reuse.

[0092] The finished pouches 10 may be transferred to a packaging machine. For example, grippers may be utilized to move the finished pouches. In an example, the packaging machine may be integral with the form-fill-seal machine or a separate line.

[0093] It should be appreciated that the automated machine may include other operations. For example, the filled pouch may be transferred to another conveyor belt, or otherwise collected. Alternatively, other stations may include a straw pierceable opening station, an upstream oxygen purging station, downstream oxygen purging station, or the like.

[0094] If desired, the pouch may be transferred to a pasteurization station. Pasteurization enhances the shelf life of the product. The pouch is inserted into an enclosed chamber. For example, a combination of steam and water is used to heat the pouch to a predetermined temperature for a predetermined period of time to pasteurize the product contained within the pouch. The package is then cooled. In this example, recirculated water surrounds the pouch to cool the pouch. In certain instances, it may be desirable to apply steam to sterilize the pouch and to wet the inner surface of the walls to facilitate handling.

[0095] The present invention has been described in an illustrative manner. It is to be understood that the terminology which has been used is intended to be in the nature of words of description rather than of limitation.

[0096] Many modifications and variations of the present invention are possible in light of the above teachings. Therefore, the present invention may be practiced other than as specifically described.

CLAIMS

1. A machine for forming, filling and sealing a flexible pouch comprising:

a form line, wherein the form line includes a first frame;

a plurality of predetermined pouch forming stations arranged sequentially along the form
5 line that perform an operation to form a body of the pouch from a roll of laminate material,
wherein the body of the pouch includes a panel having an inner surface and an outer surface,
and an upper edge, an opposed lower edge and two side edges extending therebetween;

an intermittent transport means secured to the frame for transporting the laminate
material between each of the pouch forming stations, wherein the intermittent transport means
10 stops at each of the forming stations so that the corresponding pouch forming operation can be
performed;

a fill-seal line, wherein the fill-seal line includes a second frame;

a plurality of predetermined pouch fill-seal stations arranged sequentially along the fill-
seal line, wherein each of the pouch fill-seal stations performs an operation to open, fill and seal
15 the pouch;

a continuous transport means secured to the second frame for transferring the pouch
between the plurality of pouch fill-seal stations, wherein the continuous transport means moves
continuously between the each of the pouch fill-seal stations so that the corresponding pouch
fill-seal operation can be performed; and

20 a transfer means for transferring the formed pouch from the fill line to the fill-seal line.

2. The machine as set forth in claim 1 wherein the form line has a linear orientation.

3. The machine as set forth in claim 2 wherein the form line includes:

25 a material feed station for unrolling the roll of laminate material along a horizontal
plane;

an alignment station for checking an alignment of the unrolling material, wherein the
alignment station includes an optical reading means that identifies a registration mark on the
material and uses the registration mark to determine if the material is in alignment with respect
30 to a vertically oriented axis, and adjusting the alignment of the unrolling material with respect to
the vertically oriented axis;

a cutting station for cutting the width aligned material into sections having an inner surface and an outer surface, and positioning a first section on top of a second section, wherein the first section inner surface faces the second section outer surface;

5 a sealing station for forming a side seam defining adjacent pouches in the aligned sections; and

a cutting station for separating the panel of material into individual pouches along an outermost edge of the side seam, wherein each pouch includes a front panel, a back panel, and each panel has an upper edge and a lower edge.

10 4. The machine as set forth in claim 3 further comprising an opening means insertion station for adding an opening means to the pouch used to access the product in the pouch.

15 5. The machine as set forth in claim 1 wherein the fill-seal line has a linear orientation.

6. The machine as set forth in claim 5 wherein the fill-seal line includes:
an opening station for opening the pouch;
a fill station for filling the pouch with a product;
20 a seal station for sealing the pouch; and
a finishing station for finishing the filled pouch.

7. The machine as set forth in claim 1 wherein the machine includes a plurality of form lines that feed a corresponding fill-seal line.

25 8. The machine as set forth in claim 1 further comprising an unloading station for removing the pouch from the form line intermittent transport means and placing the pouch on the fill-seal line continuous transport means.

30 9. The machine as set forth in claim 1 wherein the transfer means is a robot.

10. The machine as forth in claim 9 wherein the robot includes an arm with a gripping means for picking up the formed flexible pouch from the form line and placing the formed flexible pouch on the fill-seal line.

5 11. The machine as set forth in claim 1 further comprising a pouch carrier operatively attached to the continuous transport means for transporting the pouch between stations.

10 12. The machine as set forth in claim 1 wherein a plurality of transversely arranged pouches move across the fill-seal line stations.

13. A machine for forming, filling and sealing a flexible pouch comprising:
a form line, wherein the form line includes a first frame;
a plurality of predetermined pouch forming stations arranged linearly along the form line
15 that perform an operation to form a body of the pouch from a roll of laminate material, wherein the body of the pouch includes a panel having an inner surface and an outer surface, and an upper edge, an opposed lower edge and two side edges extending therebetween;

an intermittent transport means secured to the frame for transporting the laminate material between each of the pouch forming stations, wherein the intermittent transport means
20 stops at each of the forming stations so that the corresponding pouch forming operation can be performed;

a fill-seal line having a linear orientation, wherein the fill-seal line includes a second frame;

25 a plurality of predetermined pouch fill-seal stations arranged linearly across the fill-seal line, wherein each of the pouch fill-seal stations performs an operation to open, fill and seal the pouch;

a continuous transport means secured to the second frame for transferring the pouch between the plurality of pouch fill-seal stations, wherein the continuous transport means moves continuously between the each of the pouch fill-seal stations so that the corresponding pouch
30 fill-seal operation can be performed; and

a transfer means for transferring the formed flexible pouch from the fill line to the fill-seal line, wherein the transfer means is a robotic device.

14. The machine as set forth in claim 13 wherein the form line includes:

a material feed station for unrolling the roll of laminate material along a horizontal plane;

5 an alignment station for checking an alignment of the unrolling material, wherein the alignment station includes an optical reading means that identifies a registration mark on the material and uses the registration mark to determine if the material is in alignment with respect to a vertically oriented axis, and adjusting the alignment of the unrolling material with respect to the vertically oriented axis;

10 a cutting station for cutting the width aligned material into sections having an inner surface and an outer surface, and positioning a first section on top of a second section, wherein the first section inner surface faces the second section outer surface;

a sealing station for forming a side seam defining adjacent pouches in the aligned sections;

15 a cutting station for separating the panel of material into individual pouches along an outermost edge of the side seam, wherein each pouch includes a front panel, a back panel, and each panel has an upper edge, a lower edge; and

an unloading station for removing the pouch from the form line intermittent transport means and placing the pouch on the fill-seal line continuous transport means.

20 15. The machine as set forth in claim 14 further comprising an opening means insertion station for adding an opening means to the pouch used to access the product in the pouch.

16. The machine as set forth in claim 13 wherein the fill-seal line includes:

25 an opening station for opening the pouch;
a fill station for filling the pouch with a product;
a seal station for sealing the pouch; and
a finishing station for finishing the filled pouch.

30 17. The machine as set forth in claim 13 wherein the machine includes a plurality of form lines that feed a corresponding fill-seal line.

18. The machine as forth in claim 13 wherein the robotic device is a robot that includes an arm with a gripping means for picking up the formed flexible pouch from the form line and placing the formed flexible pouch on the fill-seal line.

5 19. The machine as set forth in claim 13 further comprising a pouch carrier operatively attached to the continuous transport means for transporting the pouch between stations.

10 20. A method of forming, filling and sealing a flexible pouch on a unitary form- fill-seal machine, said method comprising the steps of:

providing a fill line having a transport means for transporting a laminate material between a plurality of pouch forming stations, wherein the transport means stops and at each of the pouch forming stations so that the corresponding pouch forming operation can be performed;

15 unrolling a roll of laminate material at a material feed station;

aligning the laminate material at an alignment station for checking the alignment of the unrolling material;

20 cutting the aligned material at a cutting station into sections having an inner surface and an outer surface, and positioning a first section on top of a second section, wherein the first section inner surface faces the second section outer surface;

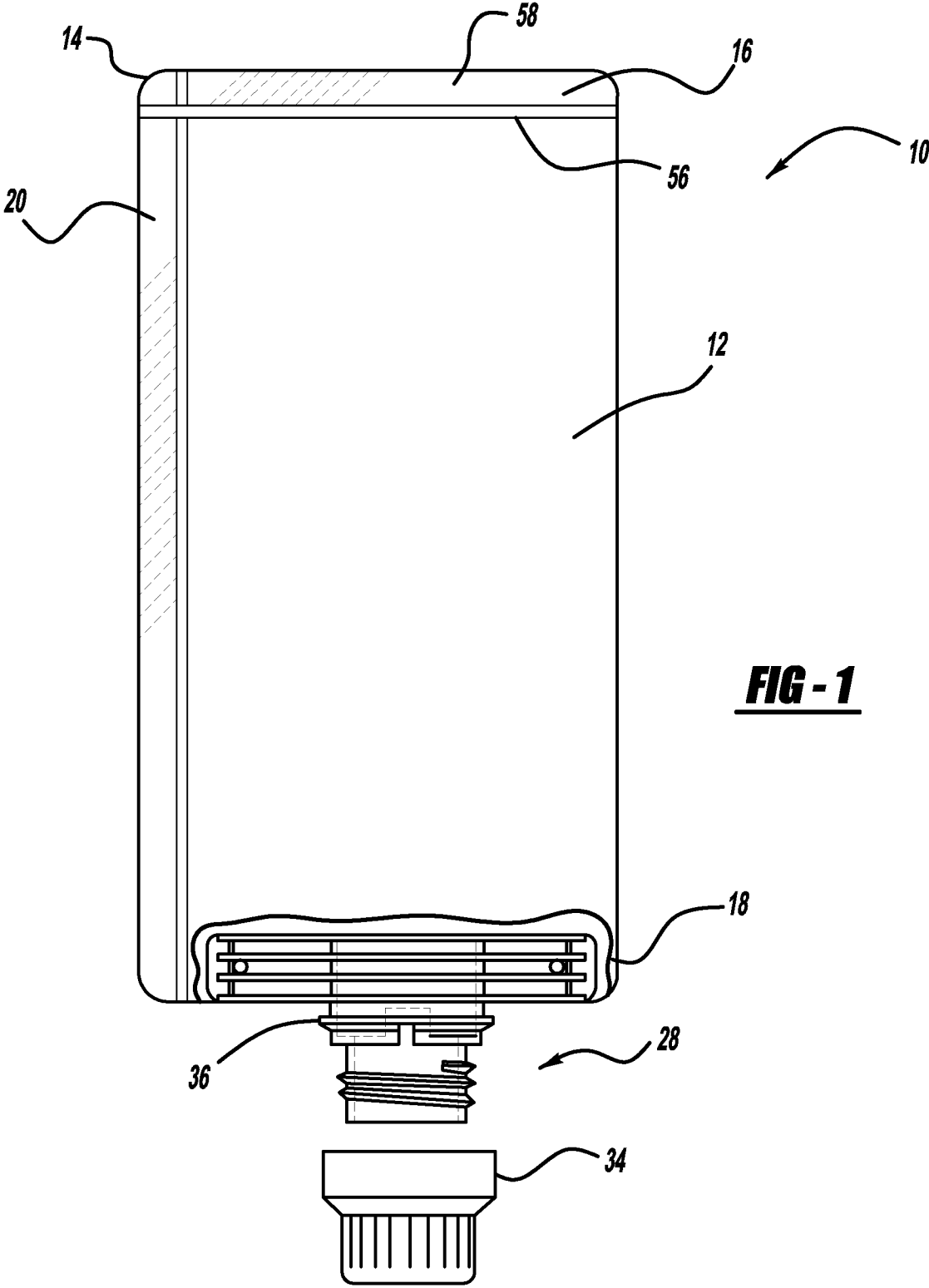
sealing a seam at a sealing station for forming a seam defining adjacent pouches in the aligned sections;

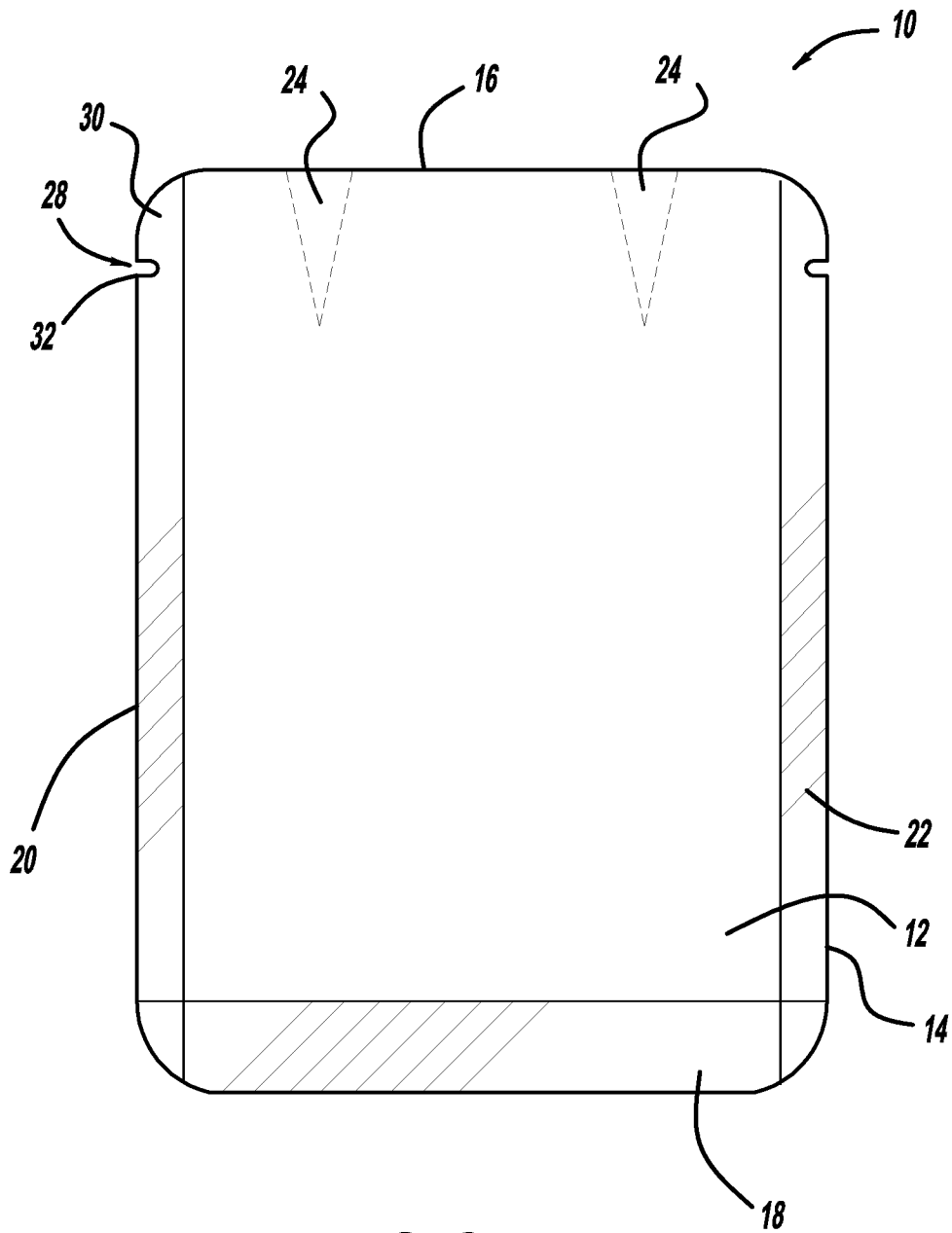
25 separating the panel into individual pouches at a cutting station, wherein the panel is separated along an outermost edge of the seam, and each formed pouch includes a front panel, a back panel, and each panel has an upper edge, a lower edge;

removing the pouch from the form line using a transfer means and placing the pouch on a fill-seal line transport means, wherein the fill-seal line transport means moves continuously; and

30 providing a plurality of predetermined pouch fill-seal stations arranged sequentially along the fill-seal line that perform an operation to open, fill and seal the flexible pouch and the continuous transport means continuously moves the pouch between an opening station for opening the pouch, a fill station for filling the pouch with a product, and a closing station for sealing the pouch.

21. The method as set forth in claim 20 wherein the robotic device is a robot that includes an arm with a gripping means for picking up the formed flexible pouch from the form line and placing the formed flexible pouch on the fill-seal line.



**FIG - 2**

