An apparatus for forming sealed pouches includes a rotatable base forming drum having a plurality of base tooling recesses in its outer surface, a base stock supply mechanism feeds a base stock web of material along a base stock path extending in part along the outer surface of the base forming drum, and a material feed mechanism feeds at least one material into the base tooling recesses. A lid stock supply mechanism feeds a lid stock web of material along a lid stock path that intersects with the base stock path downstream of the material feed mechanism, a hardenable material feed mechanism feeds a hardenable material along the base stock path or the lid stock path, and mechanism brings the base stock web and the lid stock web into contact under pressure. In one form a cooling system provides cooling to assist in cooling the hardenable material.
SYSTEM FOR FORMING PACKAGES FROM FILM MATERIAL

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application claims priority to U.S. Provisional Application Ser. No. 62/238,494, filed Oct. 7, 2015, entitled “System for Forming Packages From Film Material,” the contents of which are hereby incorporated by reference.

TECHNICAL FIELD

[0002] This disclosure relates generally to a package forming system and, more particularly, to a system utilizing a rotary drum to thermoform pouches from a continuous web and a method of forming the pouches.

BACKGROUND

[0003] Machines or systems are known for forming pouches or packages from two continuous webs in which a first or base stock film is thermoformed to define a pocket that may be filled to some extent with one or more products, materials, or substantially closed by a second or lid stock film.

[0004] To form the pouches, the base stock film is fed from a supply roll and heated to a temperature sufficient to allow thermoforming. The heated film is continuously wrapped or routed around a base forming drum or roller having a plurality of cavities along an outer surface thereof and a vacuum is applied within each cavity to pull a portion of the heated film into each cavity to form a plurality of base stock pockets as the film is fed and the drum rotated. After the base stock pockets are formed and as the base stock film is continuing to be fed and the drum rotated, each of the base stock pockets may be filled with one or more desired products or materials while the pocket is still positioned within its cavity on the drum.

[0005] As the base stock film is being fed from its supply roll, the lid stock film is fed from a supply roll towards the base forming drum and in contact with the base stock film to seal each base stock pocket after the pocket has been filled to a desired level. To do so, any combination of heat, pressure, and/or a solvent may be applied to either or both of the base stock film and the lid stock film before or as the two films are brought together to continuously seal each pocket and form each sealed pouch or package. The combined base stock and lid stock films are subsequently cut to separate the individual pouches. An example of a machine and a process for forming the pouches is described further in U.S. Pat. No. 3,218,776, which is incorporated herein by reference.

[0006] When forming pouches or packages that contain multiple materials that are to be separated (e.g., a powder and a liquid), the systems used to form the pouches may utilize three or more continuous webs. In one known system for forming pouches from three continuous webs, the base stock film is drawn from a supply roll and wrapped around or engages a heated roller and then around a base forming drum and drawn into cavities to form the pockets as described above. As the base stock film and base forming drum continue to be rotated, one or more desired first products or materials may be dispensed into the pockets formed within the cavities of the base forming drum.

[0007] As the pockets in the base stock film are being formed and filled, lid base stock film is drawn from a supply roll and wrapped around or engages a heated roller where the film is heated to a temperature sufficient to allow thermoforming. The heated lid base stock film is wrapped or routed around a lid forming drum or roller having a plurality of cavities along an outer surface thereof and a vacuum is applied within each cavity to pull a portion of the heated film into each cavity to define the pockets as the film is fed and the drum rotated. As the lid base stock film and lid forming drum continue to be rotated, one or more desired second products or materials may be dispensed into the pockets formed within the cavities of the lid forming drum.

[0008] As the pockets in the lid base stock film are being formed and filled, lid closing stock film is fed from a supply roll towards the lid base stock film to seal each pocket of the lid base stock after the pocket has been filled to a desired level. To do so, any combination of heat, pressure, and/or a solvent may be applied to either or both of the lid base stock film and the lid closing stock film before or as the two films are brought together to continuously seal each pocket and form a sealed lid sub-package or structure having products or materials sealed between the layers of film that form the lid sub-package.

[0009] The sealed lid sub-package is then routed towards the base stock forming drum and the base stock film. As described above, any combination of heat, pressure, and/or a solvent may be applied to either or both of the base stock film and the sealed lid sub-package before or as the two structures are brought together to continuously seal each base stock pocket with the lid sub-package and form a sealed pouch having multiple products or materials sealed therein. The combined base stock and lid sub-packages are then cut to separate the individual pouches.

[0010] In another known system, pouches may be formed from four continuous webs. In doing so, the system is similar to that described above that uses three continuous webs but includes an additional continuous web that is applied to seal the base stock pockets before securing together the base sub-packages and the lid sub-packages. More specifically, base stock pockets are formed and filled as described above. An additional sealing film is secured to the base stock film using a combination of heat, pressure and/or solvent to seal the base stock pockets and form base sub-packages. After the lid sub-packages are formed as described above, the base sub-packages and the lid sub-packages are secured together to form the sealed pouches having different products or materials sealed therein. In one embodiment, the base sub-packages and the lid sub-packages may be secured together using an adhesive. After securing together the base sub-packages and the lid sub-packages, the webs forming the pouches may be cut to separate the individual pouches.

SUMMARY

[0011] In one aspect, an apparatus for forming sealed pouches includes a rotatable base forming drum having an outer surface with a plurality of base tooling recesses in the outer surface, a base stock supply mechanism for feeding a base stock web of material along a base stock path with a portion of the base stock path extending along the outer surface of the base forming drum, a forming system for
displacing the base stock web into the base tooling recesses to form a pocket of base stock material within each base tooling recess, and a material feed mechanism for feeding at least one material into the base tooling recesses in the outer surface of the base forming drum. The apparatus further includes a rotatable lid forming drum having an outer surface with a plurality of lid tooling recesses in the outer surface, a lid stock supply mechanism for feeding a lid stock web of material along a lid stock path with a portion of the lid stock path extending along the outer surface of the lid forming drum and the base stock path and the lid stock path intersecting downstream of the material feed mechanism, a second forming system for displacing the lid stock web into the lid tooling recesses to form a lid recess of lid stock material within each lid tooling recess. The apparatus also includes a hardenable material feed mechanism for feeding a hardenable material into the lid tooling recesses in the outer surface of the lid forming drum, and a cooling system associated with the lid forming drum to provide cooling along a length of the lid stock path to assist in cooling the hardenable material fed by the hardenable material feed mechanism.

In another aspect, an apparatus for forming sealed pouches includes a rotatable base forming drum having an outer surface with a plurality of base tooling recesses in the outer surface, a base stock supply mechanism for feeding a base stock web of material along a base stock path with a portion of the base stock path extending along the outer surface of the base forming drum, a heater system along the base stock path for heating the base stock web, a forming system for displacing the base stock web into the base tooling recesses to form a pocket of base stock material within each base tooling recess, and a material feed mechanism for feeding at least one material into the base tooling recesses in the outer surface of the base forming drum. The apparatus further includes a lid stock supply mechanism for feeding a lid stock web of material along a lid stock path with the base stock path and the lid stock path intersecting downstream of the material feed mechanism, a hardenable material feed mechanism for feeding a hardenable material along one of the base stock path and the lid stock path, and a cooling system associated with the one of the base stock path and the lid stock path to provide cooling along a length thereof to assist in cooling the hardenable material fed by the hardenable material feed mechanism.

In still another aspect, a method of forming a sealed pouch includes providing a base stock web of material along a base stock path, heating the base stock web, forming a plurality of pockets in the base stock web, and feeding at least one material into each pocket. The method further includes providing a lid stock web of material along a lid stock path with the base stock path and the lid stock path intersecting after the material is fed into a particular pocket, feeding a hardenable material along one of the base stock path and the lid stock path, cooling the hardenable material with a cooling medium, and securing the base stock web and the lid stock web together.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic illustration of a pouch forming apparatus in which the principles disclosed herein may be used; FIG. 2 is an enlarged, fragmented view of a portion of the lid forming drum of FIG. 1 and systems associated therewith; FIG. 3 is an enlarged, fragmented view similar to FIG. 2 but illustrating a second embodiment of a cooling system associated with the lid forming drum; FIG. 4 is perspective view of a pouch that may be formed with the apparatus of FIG. 1; FIG. 5 is an end view of the pouch of FIG. 4; FIG. 6 is a schematic illustration of an alternate embodiment of systems associated with the lid forming drum of FIG. 1; and FIG. 7 is an enlarged, fragmented view of a second embodiment of the lid forming drum of FIG. 1.

DETAILED DESCRIPTION

FIGS. 2-5 depict a pouch or package 100 formed from two continuous webs of material. The pouch 100 includes a recess or pocket 101 formed from a first or base stock film or web of material. As depicted, the pocket 101 includes four sidewalls 102 that extend downward from flange 103 and are interconnected by lower surface 104. The pouch 100 is sealed by a cover or lid 110 formed from a second or lid stock film or web of material. As depicted, the lid 110 includes a pair of relatively small recesses 111 that extend upward from the flange 112 of the lid. It should be noted, however, that the lid 110 may have one or more recesses 111 and the recesses may be of identical or different sizes and shapes.

In some instances, such as when the pouches 100 are utilized for cleaning products, the film may be formed of a soluble material such as a water soluble film. In one example, the film may be formed of a polyvinyl alcohol material. Other materials are contemplated. Pocket 101 and recesses 111 may be filled with any desired products and/or materials. As depicted in FIGS. 4-5, pocket 101 is filled with a powder material 105 such as a detergent and the recesses 111 are filled with a paste or a wax-like hardenable material 113 such as another detergent.

FIG. 1 is a schematic representation of a pouch forming apparatus or system 10 for forming a plurality of the pouches 100 depicted in FIGS. 4-5. Pouch forming apparatus 10 includes a first section 20 for forming and filling the base stock film 70 and a second section 40 for forming and filling the lid stock film 75. The first section 20 includes a rotatable base forming drum 21, a heater system 25, a supply roll or continuous web 30 of material that forms the base stock film 70, and a product feed mechanism 31.

The base forming drum 21 includes a plurality of base tooling recesses or cavities 22 extending inwardly along the outer surface 23 of the drum. To increase the efficiency of the system 10, the base forming drum 21 may include a three-dimensional array of cavities 22 around the outer surface 23 so each manufacturing step operates relative to a plurality of horizontally aligned (into the page in FIG. 1) cavities 22. A vacuum system indicated generally at 35 is operatively connected to each cavity 22 to create a vacuum to draw a portion of the base stock film 70 into the cavity to form one of the pockets 101. A drive system (not shown) is operatively connected to the base forming drum 21 to rotate the drum continuously or intermittently, as desired in direction “A.”

The heater system 25 is depicted as a rotatable base stock heater roller 26 positioned adjacent the base forming
A product feed mechanism 31 is positioned generally adjacent the upper section 24 of the base forming drum 21 to supply one or more products and/or materials into each pocket 101 as the pocket together with base stock film 70 move along the upper surface of the drum. The product feed mechanism 31 may be fixed and the base forming drum 21 may be either intermittently stopped or rotated slowly as the material is fed into pocket 101. In other instances, the product feed mechanism 31 may include a drive mechanism (not shown) to permit the product feed mechanism to move with the pocket 101 as the pocket moves during rotation of the base forming drum 21. The product feed mechanism 31 may be configured to feed any type, number or combination of products and/or materials including a solid, a powder, a liquid including paste or wax-type products, pills, tablets, or even other pouched products.

The second section 40 includes a rotatable lid forming drum 41, a heater system 45, a supply roll or continuous web 50 of material that forms the lid stock film 75, a lid stock product feed mechanism 51, a cooling system 55, and a lid stock wetting system 60. The lid forming drum 41 includes a plurality of lid tooling recesses or cavities 42 extending inwardly along the outer surface 43 of the lid forming drum. As with the cavities 22 of base forming drum 21, the cavities 42 of lid forming drum 41 may be configured as a three-dimensional array around the outer surface 43 of the lid forming drum. A vacuum system indicated generally at 65 is operatively connected to each of the cavities 42 to create a vacuum within each cavity. Conduits 66 of the vacuum system 65 are depicted schematically in FIGS. 2-3. A drive system (not shown) is operatively connected to the lid forming drum 41 to rotate the drum continuously or intermittently, as desired in direction “B.”

The heater system 45 is depicted in FIG. 1 as a rotatable lid stock heater roller 46 and is positioned adjacent the lid forming drum 41 and includes an internal heater to heat the lid stock film 75 prior to it contacting the lid forming drum. The heater system 45 may be of any type and, as with the heater system 25 associated with base forming drum 21, the heater system 45 associated with lid forming drum 41 may be internal or external to roller 46.

A lid stock product feed mechanism 51 is positioned generally adjacent the upper section 44 of the lid forming drum 41 to supply one or more products or materials into each recess 111 as the recesses together with lid stock film 75 move along the upper surface of the drum. As depicted, the lid stock product feed mechanism 51 is fixed but it may include a drive mechanism (not shown) to permit the lid stock product feed mechanism to move with the recesses 111 as the recesses move along the lid forming drum 41. The lid stock product feed mechanism 51 may be configured as a hardenable material feed mechanism to feed any type of product or material in the form of a hardenable material such as a liquid, a paste or a wax-like material.

A cooling system indicated generally at 55 may be associated with the lid forming drum 41 to cool portions of the drum or a portion of a product or material therein. In one embodiment depicted in FIG. 2, the cooling system 55 may include a liquid system that internally directs a liquid through conduits 56 within the lid forming drum 41 to each of the cavities 42 of the drum to cool all or a portion of the surface (e.g., a lower surface) of the cavity. In another embodiment, the cooling system 55 may include an air or pneumatic system (or a combination of the two) that internally directs a gas through conduits 56 within the lid forming drum 41 to each of the cavities 42 of the drum to cool all or a portion of the surface of the cavity. The location and number of conduits 56 may be dependent upon the material and temperature of the lid stock film 75, the temperature of the cavities 42 of the lid forming drum 41, the amount of cooling desired, the rate at which the lid forming drum is rotated, and the flow rate and type of medium (i.e., the fluid) being used as a cooling agent.

Referring to FIG. 3, still another embodiment is depicted in which, the cooling system 55 may include an external air or pneumatic system (or a combination of the two) that directs a gas from outside the lid forming drum 41 through external conduits 57 towards or into each of the cavities 42 of the drum to cool all or a portion of the surface of the cavity, to cool a portion of the lid stock film 75, such as the formed recesses 111 within the lid stock film, and/or a material within the recesses of the lid stock film. In a further embodiment, the internal conduits 56 may be omitted from the lid forming drum 41 and the cooling system 55 is configured to utilize the external conduits 57 without the internal conduits.

If desired, the outer surface 43 of lid forming drum 41 may include an insulative material 47 thereon as depicted in FIG. 7. The insulative material may be any desired material including rubber, silicone, foam, and the like. If the insulative material 47 is a resilient material, it may function as the resilient coating or material referred to above that operates to assist in applying the desired pressure between the base forming drum 21 and the lid forming drum 41. The insulative material 47 extends along the outer surface 43 and includes openings that correspond to and are aligned with the cavities 42 along the outer surface of the lid forming drum 41.

The insulative material 47 operates to insulate the lid stock film 75 from the lid forming drum 41 except within the cavities 42. More specifically, as the heated lid stock film 75 meets the lid forming drum 41, it contacts the insulative material 47 along the outer surface 43 of the lid forming drum rather than contacting the outer surface itself. Upon applying a vacuum through conduits 66 of vacuum system 65, the heated lid stock film 75 is drawn into the cavities 42. Once the lid stock film 75 contacts the cooled cavities 42, the portions of the film that are drawn into the cavities are cooled. The portions of the lid stock film 75 that contact the insulative material 47 outside of the cavities 42 are not cooled by the cooling system 55 due to the insulative properties of the insulative material 47.

Lid stock wetting system 60 is positioned adjacent the lid forming drum 41 at a position after (i.e., downstream from) the lid stock product feed mechanism 51 and before the lid stock film 75 seals the base stock film 79 at the base forming drum 21. The lid stock wetting system 60 may apply a solvent to the lid stock film 75 to increase its tackiness to
assist in adhering the lid stock film to the base stock film 70. To do so, the solvent may be provided through a wetting system or reservoir 62 to a wetting roller 61 that engages the lid stock film 75. In an embodiment in which the base stock film 70 and lid stock film 75 are formed of a polyvinyl alcohol material, the solvent for the lid stock wetting system 60 may be water.

In an alternate embodiment depicted in FIG. 6, a lid stock wetting system 160 may be provided before or upstream of the lid stock product feed mechanism 51. The lid stock wetting system 160 includes a wetting roller 161 upstream of the lid stock product feed mechanism 51 that applies a solvent to the lid stock film 75. Such a configuration may be desirable or advantageous in situations in which the material to be applied to the recesses 111 of the lid stock film 75 extends above the surface or plane of the lid stock film. By wetting the lid stock film 75 before the material is inserted into the recesses 111, the recesses will not contaminate the wetting roller 161. In other words, in the embodiment depicted in FIG. 1, if the material within the recesses 111 extends above or is near the plane of the lid stock film 75 (i.e., the outer surface 43 of the lid forming drum 41), it may contact and contaminate the wetting roller 161.

In some instances, it may be difficult or undesirable to position the wetting system or reservoir 162 immediately adjacent the wetting roller 161. In such a case, the wetting system or reservoir 162 may be spaced from the wetting roller 161 and the solvent applied to a preliminary or transfer wetting roller 163 that engages the wetting roller 161 to transfer the solvent thereto.

The base forming drum 21 and the lid forming drum 41 are positioned adjacent each other so that after forming and filling each of the base stock film 70 and the lid stock film 75 with the desired products and/or materials, the two films may be secured together to form the pouches 100. Accordingly, one or both of the base forming drum 21 and the lid forming drum 41 may be resiliently mounted to permit relative movement between the two drums in order to apply pressure to the combined base film stock 70 and lid film stock 75 to secure the two films together. In another embodiment, one or both of the base forming drum 21 and the lid forming drum 41 may have a resilient coating or material on the outer surface.

A slitting knife 15 may be positioned after or downstream from the location at which the base stock film 70 and the lid stock film 75 are secured together to slit the combined films in a circumferential direction along the outer surface of base forming drum 21 to create a plurality of circumferential strips that each include a plurality of pouches 100. A rotary knife 16 may be positioned after or downstream from the slitting knife 15 to cut the combined films laterally relative to the direction of rotation of the base forming drum 21 to cut the combined films into the individual pouches 100. The individual pouches 100 are discharged onto a conveyor 17 for subsequent processing.

In operation, a base stock film 70 such as a polyvinyl alcohol film is fed from supply roll 30 and passes around a portion of rotatable base stock heater roller 26 and is heated to a temperature sufficient to allow thermoforming. In one example, the temperature may be approximately 160° F. but other temperatures may be utilized depending upon the material of the base stock film 70, the desired manufacturing characteristics, and the performance of the apparatus 10. The heated base stock film 70 is routed around the base forming drum 21 and a vacuum applied to each cavity 22 pulls a portion of the heated film into each cavity to form the base stock pockets 101 of the pouches 100. As the base forming drum 21 and the base stock film 70 are rotated, the product feed mechanism 31 operates to fill each base stock pocket 101 to a desired level with one or more products or materials such as powdered detergent.

As the pockets 101 in the base stock film 70 are being formed and filled, the lid stock film 75 is fed from supply roll 50 and passes around a portion of rotatable lid stock heater roller 46 and is heated to a temperature sufficient to allow thermoforming. With the example described above with respect to the base stock film 70, the lid stock film 75 may be heated to a temperature of approximately 160° F. The heated lid stock film 75 is routed around the lid forming drum 41 and is a vacuum applied to each cavity 42 pulls a portion of the heated lid stock film into each cavity to form the lid stock recesses 111 of the pouches 100.

As the lid forming drum 41 and the lid stock film 75 are rotated, the lid stock product feed mechanism 51 operates to fill each lid stock recess 111 to a desired level with a hardenable material such as a wax- or paste-like detergent in the form of a heated liquid or material. The cooling system 55 is operative to cool the hardenable material within the lid stock recesses 111 sufficiently so that the lid stock film 75 may be further processed without movement of the liquid material within the recesses. In the example in which the cooling system 55 is internally located within the lid forming drum 41, the cooling system is operative to cool the heated lid stock film 75 and the material within the recesses 111 as desired. In the example in which the cooling system 55 is located externally from the lid forming drum 41, the cooling system may direct air or another gas towards the material within the recesses 111 to provide cooling. In one example, the liquid material may be sufficiently cooled if a somewhat solidified layer or film has been formed along its outer surface such that it adheres to the lid stock film 75 and does not flow as the lid stock film rotates around the lid forming drum 41. In addition, it may be desirable for the material within the recesses 111 to be sufficiently cooled so that it does not react with the material within the pocket 101 as the base stock film 70 and the lid stock film 75 are brought together during the sealing process described below.

After the recesses 111 in the lid stock film 75 have been filled and the hardenable material cooled, the lid stock film may be wetted by the lid stock wetting system 60. In doing so, water or another solvent may be applied to the lid stock film 75 so that the film becomes sufficiently tacky to assist in securing the lid stock film to the base stock film 70. The base forming drum 21 and the lid forming drum 41 are positioned in close proximity to apply pressure and force the base stock film 70 and the lid stock film 75 into contact with sufficient pressure to cause the two films to bond together and seal the cavities 101 and form the pouches 100. The combined base stock film 70 and lid stock film 75 continues to travel around the base forming drum 21 until reaching the slitting knife 15 and the rotary knife 16 which cut the combined films into the individual pouches 100. The individual pouches 100 may then be discharged along conveyor 17 for further processing.
Various alternative embodiments and modifications are contemplated. For example, while pouch forming system 10 is configured to form pouches 100 having recesses 111 formed in the lid 110 and the hardenable material 113 in the recesses 111, recesses may also or alternatively be formed in the lower surface 104 of the pocket 101. In other words, the lower surface 104 of the pocket 101 may include recesses into which hardenable material 113 is inserted. To do so, the cavities 22 of the base forming drum 21 may include recesses in the lower surface thereof that correspond to the recesses of the lower surface 104. Upon vacuum forming the pocket 101, the recesses in the lower surface 104 may also be formed. A product feed mechanism similar to the lid stock product feed mechanism 51 may also be provided to feed a hardenable material into the recesses in the lower surface 104. A cooling system similar to the cooling system 55 may also be provided or associated with the base forming drum 21 to cool and harden the hardenable material.

If desired, an insulative material (not shown) may be applied to the outer surface 23 of the base forming drum 21. The insulative material may be similar or identical to insulative material 47 described above that may be applied to the lid forming drum 41 and the description thereof is not repeated.

After the hardenable material has been inserted into or applied to the recesses in the lower surface 104, additional or other products and/or materials may be inserted into pocket 101. After the pocket 101 has been filled, a lid 110 may be applied to seal the pocket 101 such as with lid stock film.

If the pouch 100 has recesses in the lower surface 104 and recesses 111 in the lid 110, the pouch forming system may include a hardenable material feed mechanism and a cooling system associated with each of the base forming drum 21 and the lid forming drum 41. The hardenable material feed mechanism associated with the base forming drum 21 is positioned upstream of the product feed mechanism 31 so that the hardenable material may be inserted or applied and cooled to a desired state prior to inserting additional products and/or materials into the pocket 101.

If the pouch 100 has recesses in the lower surface 104 but not in the lid 110, the pouch forming system includes a hardenable material feed mechanism and may include a cooling system, each being associated with the base forming drum 21, and the lid forming drum 41 may be replaced by a lid stock supply roller (not shown) that routes or directs the lid stock film to the desired location for subsequent sealing of the pockets 101.

In some embodiment, the hardenable material may be applied to or on top of material within the pocket 101. For example, after inserting material into pocket 101 to partially or even completely fill the pocket, hardenable material may be applied on top of the material already within the pocket. In such case, it may be desirable to cool the hardenable material prior to adding additional material within the pocket 101 or sealing the pocket 101 with lid 110. To cool the hardenable material, a cooling system similar to that depicted in FIG. 3 may be utilized with the cooling conduits providing a cooling gas to the pocket 101.

Although the lid 110 is depicted with two distinct recesses 111 that include hardened material therein, the lid may include any number of recesses with hardened material therein including one or more. In addition, in some instances (such as when the hardenable material is located within the pocket 101), the lid 110 may not include any recesses 111 with hardened material therein. Further, such lid may include another type of product or material such as a pill or tablet affixed thereto.

It will be appreciated that the foregoing description provides examples of the disclosed system and technique. However, it is contemplated that other implementations of the disclosure may differ in detail from the foregoing examples. All references to the disclosure or examples thereof are intended to reference the particular example being discussed at that point and are not intended to imply any limitation as to the scope of the disclosure more generally. All language of distinction and disparagement with respect to certain features is intended to indicate a lack of preference for those features, but not to exclude such from the scope of the disclosure entirely unless otherwise indicated.

Recitation of ranges of values herein are merely intended to serve as a shorthand method of referring individually to each separate value falling within the range, unless otherwise indicated herein, and each separate value is incorporated into the specification as if it were individually recited herein. All methods described herein can be performed in any suitable order unless otherwise indicated herein or otherwise clearly contradicted by context.

Accordingly, this disclosure includes all modifications and equivalents of the subject matter recited in the claims appended hereto as permitted by applicable law. Moreover, any combination of the above-described elements in all possible variations thereof is encompassed by the disclosure unless otherwise indicated herein or otherwise clearly contradicted by context.

1. An apparatus for forming sealed pouches comprising:
   a rotatable base forming drum having an outer surface with a plurality of base tooling recesses in the outer surface;
   a base stock supply mechanism for feeding a base stock web of material along a base stock path, a portion of the base stock path extending along the outer surface of the base forming drum;
   a system for displacing the base stock web into the base tooling recesses to form a pocket of base stock material within each base tooling recess;
   a material feed mechanism for feeding at least one material into each said pocket of said base stock web, a rotatable lid forming drum having an outer surface with a plurality of lid tooling recesses in the outer surface;
   a lid stock supply mechanism for feeding a lid stock web of material along a lid stock path, a portion of the lid stock path extending along the outer surface of the lid forming drum;
   a system for displacing the lid stock web into the lid tooling recesses to form a lid recess of lid stock material within each lid tooling recess;
   a hardenable material feed mechanism for feeding a hardenable material into each said lid recess of said lid stock web; and
   mechanism bringing said base stock web and said lid stock web into contact under pressure.

2. The apparatus of claim 21, wherein the cooling system includes cooling conduits within the lid forming drum and provides cooling to the lid tooling recesses.
3. The apparatus of claim 2, wherein the cooling system directs liquid through the cooling conduits.

4. The apparatus of claim 2, wherein the cooling system directs a gas through the cooling conduits.

5. The apparatus of claim 21, wherein the cooling system includes cooling conduits to direct a gas towards the lid tooling recesses of the lid forming drum.

6. The apparatus of claim 5, wherein the cooling conduits are positioned downstream of the hardenable material feed mechanism.

7. The apparatus of claim 21, further including an insulating material adjacent the outer surface of the lid forming drum to provide an insulative layer between the lid stock web and the outer surface of the lid forming drum.

8. The apparatus of claim 21, wherein said base stock material feed mechanism is a hardenable material feed mechanism for feeding a hardenable material into each said Docket of said base stock web, and a cooling system associated with the base forming drum to provide cooling along a length of the base stock path to assist in cooling the hardenable material in said pockets.

9. The apparatus of claim 8, further including an insulating material adjacent the outer surface of the base forming drum to provide an insulative layer between the base stock web and the outer surface of the base forming drum.

10. The apparatus of claim 21, wherein the material feed mechanism sequentially feeds the material into said pockets and the hardenable material feed mechanism sequentially feeds the hardenable material into said lid recesses.

11. The apparatus of claim 21, wherein the systems for displacing said base stock web and said lid stock web includes a vacuum system for generating a vacuum within the base drum recesses to draw the base stock web into the base tooling recesses to form the pocket within each base recess, and a vacuum system for generating a vacuum within the lid tooling recesses to draw the lid stock web into the lid tooling recesses to form the lid recess within each lid tooling recess.

12. The apparatus of claim 21, wherein the base stock path and the lid stock path intersect at a location at which the base forming drum and the lid forming drum are adjacent each other and said mechanism bringing said lid stock web and base stock web into contact under pressure forms said sealed pouches.

13. An apparatus for forming sealed pouches comprising: a rotatable base forming drum having an outer surface with a plurality of base tooling recesses in the outer surface; a base stock supply mechanism for feeding a base stock web of material along a base stock path, a portion of the base stock path extending along the outer surface of the base forming drum; a heater system along the base stock path for heating the base stock web; a forming system for displacing the base stock web into the base tooling recesses to form a pocket of base stock material within each base tooling recess; a material feed mechanism for feeding at least one material into the base tooling recesses in the outer surface of the base forming drum; a lid stock supply mechanism for feeding a lid stock web of material along a lid stock path, the base stock path and the lid stock path intersecting downstream of the material feed mechanism; a hardenable material feed mechanism for feeding a hardenable material along one of the base stock path and the lid stock path; and mechanism bringing said base stock web and said lid stock web into contact under pressure.

14. The apparatus of claim 21, wherein the hardenable material feed mechanism feeds hardenable material into the base tooling recesses and the cooling system is associated with the base forming drum and provides cooling to the base tooling recesses.

15. The apparatus of claim 27, wherein the lid stock supply system includes: a rotatable lid forming drum having an outer surface with a plurality of lid tooling recesses in the outer surface, a portion of the lid stock path extending along the outer surface of the lid forming drum; a heater system along the lid stock path for heating the lid stock web; a forming system for displacing the lid stock web into the lid tooling recesses to form a lid recess within each lid tooling recess; and wherein the hardenable material feed mechanism feeds hardenable material into the lid tooling recesses and the cooling system is associated with the lid forming drum and provides cooling to the lid tooling recesses.

16. A method of forming a sealed pouch comprising: providing a base stock web of material along a base stock path; heating the base stock web; forming a plurality of pouches in the base stock web; feeding at least one material into each pocket; providing a lid stock web of material along a lid stock path, the base stock path and the lid stock path intersecting after the material is fed into a particular pocket; feeding a hardenable material along one of the base stock path and the lid stock path; cooling the hardenable material with a cooling medium; and securing the base stock web and the lid stock web together.

17. The method of claim 16, further including forming a plurality of recesses within one of the base stock web and the lid stock web, and the feeding step includes feeding the hardenable material into the plurality of recesses.

18. The method of claim 16, further including: heating the lid stock web; forming a plurality of lid recesses in the lid stock web; and the feeding step includes feeding the hardenable material into the plurality of lid recesses.

19. The method of claim 16, further including cutting the base stock web and the lid stock web after the securing step to separate the sealed pouches.

20. (canceled)

21. An apparatus for forming sealed pouches as claimed in claim 1, further comprising: a cooling system associated with the lid forming drum to provide cooling along a length of the lid stock path to assist in cooling the hardenable material fed by the hardenable material feed mechanism.

22. The apparatus of claim 1, wherein the system for displacing said base stock web and said lid stock web includes a vacuum system for generating a vacuum within the base drum recesses to draw the base stock web into the base tooling recesses to form the pocket within each base
recess, and a vacuum system for generating a vacuum within the lid tooling recesses to draw the lid stock web into the lid tooling recesses to form the lid recess within each lid tooling recess.

23. The apparatus of claim 1, including a base stock heater to heat said base stock web and a lid stock heater to heat said lid stock web.

24. The apparatus of claim 1, including a lid stock wetting system to apply a solvent to the lid stock film.

25. The apparatus of claim 1, wherein the base stock path and the lid stock path intersect at a location at which the base forming drum and the lid forming drum are adjacent each other and said mechanism bringing said lid stock web and said base stock web into contact under pressure forms said sealed pouches.

26. The apparatus of claim 25, wherein said apparatus includes cutting mechanism to cut said webs to form individual pouches.

27. The apparatus of claim 13 further comprising a cooling system associated with the one of the base stock path and the lid stock path to provide cooling along a length thereof to assist in cooling the hardenable material fed by the hardenable material feed mechanism.