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Ultrasonic welding system

Abstract

An ultrasonic welding system for assembling materials is provided. The system may comprise a feeding device, a fabrication system, a product uniformer, and a finalization system. The feeding device may include pace feeders, position feeders, and one or more of a retention member. The pace feeders may carry and supply product materials to be distributed by the position feeders and layered by the retention member. The fabrication system may include a main retention member, attachment apparatuses, anvils, and an aperture generator. The attachment apparatuses and anvils may be utilized to crate one or more of an attachment point on the layered product materials, and the aperture generator may be utilized to create at least one through-hole ending through at least a portion of the layered product materials. The finalization system may comprise a product separator and a motion inducer. The product separator may separate the layered product materials.

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Background/Summary

RELATED APPLICATIONS (1) This application claims priority under 35 U.S.C. § 119(e) of U.S. Provisional Patent Application Ser. No. 63/445,905, and titled ULTRASONIC WELDING SYSTEM AND ASSOCIATED METHODS, the entire contents of which is incorporated herein except to the extent where the contents therein conflicts with the contents herein.

FIELD OF THE INVENTION
(1) The present invention relates to systems and methods for assembling materials by ultrasonic stitching into a finished product.

BACKGROUND OF THE INVENTION

(2) Systems utilized to manufacture goods are well known in the art. Traditional manufacturing system may allow for productive and precise assembling of a variety of goods. However, no known system allows for finished products to be continuously made by layering the materials, attaching one or more layers together, creating an aperture in one or more of the layers, and separating portions of the layered materials to create the finished product and with little to no manual action needed throughout the operation of the system from start to finish of the product's assembly. Therefore, there exists a need for an effective system to advantageously create finished products with little to no manual action required for finished products requiring layering, attachment, through-holes, and separation of product materials during its assembly.

(3) This background information is provided to reveal information believed by the applicant to be of possible relevance to the present invention. No admission is necessarily intended, nor should be construed, that any of the preceding information constitutes prior art against the present invention.

SUMMARY OF THE INVENTION

(4) With the above in mind, the present invention is directed to an ultrasonic welding system for assembling materials. The system may include a feeding device comprising. The feeding device may comprise a plurality of pace feeders. Each of the plurality of pace feeders may be configured to carry and supply product material. The feeding device may also comprise a plurality of position feeders. Each of the position feeders may be configured to receive and distribute the product material from the pace feeders. The feeding device may also include retention members to receive, distribute, and layer the product material from the position feeders to form a layering of product materials.

(5) The system may also include a fabrication system. The fabrication system may include a main retention member to receive and distribute the layering of product materials along a path of travel. The fabrication system may also include attachment apparatuses positioned on a first side of the path of travel. The fabrication system may further include anvils positioned on a second side of the path of travel opposite the first side. Each of the anvils are positioned adjacent to one of the attachment apparatuses to define a contact point between the anvils and the attachment apparatuses. The fabrication system may still further include an aperture generator to create a through-hole that extends through at least a portion of at least one layer of the layering of product materials. At least one portion of the layering of product materials is pressed to create an attachment point at the contact point to attach layers of the layering of product materials.

(6) The system may also include a product uniformer to receive and distribute the layering of product materials. The product uniformer may also grip and move the layering of product materials along the path of travel. The system further includes a finalization system. The finalization system includes a product separator to cut the layering of product materials into a plurality of finished products. The finalization system further includes a motion inducer to eject each of the finished products from the product separator.

(7) The system may also include pace resisters that are each attached to the pace feeders. The product materials may be provided as a roll of product materials. Each of the pace feeders may rotatably move about an axis to supply the roll of product materials. The pace resistors may selectively apply a resistance force that opposes the rotational movement of the pace feeders to apply a tension force to the product materials when moved by the product uniformer. The position feeders may selectively actuate along a longitudinal axis to receive and dispense the product materials at a predetermined position relative to the retention member.

(8) The system may further include position sensors that are positioned adjacent to the position feeders. Each of the position sensors may detect the position of the product materials. Further, each of the position sensors may emit a product position signal related to the position of the product material along the position feeder. The product position signal is received by a feeding device controller, and the feeding device controller is configured to control the actuation of the position

feeders based on the product position signal. The feeding device may be positioned to be separate and spaced apart from the fabrication system. Each of the product materials that are to be used in connection with the system may have a different size and shape.
(9) The aperture generator may create a plurality of through-holes that may be arranged in a predetermined pattern. The system may also be configured to create a plurality of attachment points that are formed in a predetermined pattern. The attachment apparatuses may include an attachment generator to generate an ultrasonic frequency to generate heat at the contact point to create the attachment points. The attachment apparatuses may also include a horn attached to the attachment generator to transfer the ultrasonic frequency to the contact point. The heat generated at the contact point by the ultrasonic frequency causes the layering of product materials to melt locally at the contact point to create the attachment point.
(10) The attachment apparatuses may actuate relative to the anvils to press the portion of the layering of product materials against the anvils. Each of the anvils may include a plurality of anvil teeth positioned along a curved surface of the anvil. The anvils can be rotatably moved to position the plurality of anvil teeth at the contact point to press the portion of the layering of product materials against the attachment apparatuses.
(11) The aperture generator may be provided by a laser, a puncher, or a cutting instrument. The product materials may be provided by a material that can be melted when exposed to ultrasonic frequencies having an amplitude range of about 30 to 125 microns.
(12) The product separator may include a separation platform and a cutting implement. The cutting implement may actuate relative to the separation platform to cut the layering of product materials into one of the finished products. The separation platform may include a division area that travels through a length of a surface of the separation platform to actuate the cutting implement to cut the layering of product materials without coming into contact with the separation platform.
(13) The system may further include a main system controller to control the feeding device, the fabrication system, the product uniformer, and the finalization system. The system may still further include a product reporter in communication with a reporter sensor. The reporter sensor may detect when each of the finished products are ejected and emits a product count signal. The product reporter may also display a product count based on the product count signal. The system may also include shielding positioned to enclose a portion or all of the fabrication system. The shielding may include a laser light filtering window.

Description

BRIEF DESCRIPTION OF THE DRAWINGS
(1) Some embodiments of the present invention are illustrated as an example and are not limited by the figures of the accompanying drawings, in which like references may indicate similar elements.
(2) FIG. **1** is a perspective view of an ultrasonic welding system according to an embodiment of the present invention with a feeding device, a fabrication system, and a finalization system.
(3) FIG. **2** is a perspective view of two attachment apparatuses and a respective number of attachment rollers according to an embodiment of the present invention.
(4) FIG. **3** is a side elevation view of the two attachment apparatuses and respective number of attachment rollers according to FIG. **2**.
(5) FIG. **4** is a perspective view (photograph) of the feeding device shown in FIG. **1**.
(6) FIG. **5** is a partial perspective view (photograph) of the fabrication system shown in FIG. **1**.
(7) FIG. **6** is another partial perspective view (photograph) of the fabrication system shown in FIG. **1**.
(8) FIG. **7** is a perspective view (photograph) of a product uniformer of the ultrasonic welding system illustrated in FIG. **1**.

(9) FIG. **8** is a perspective view of fabrication controllers and a filter system of the ultrasonic welding system illustrated in FIG. **1**.
(10) FIG. **9** is a perspective view of the finalization system shown in FIG. **1**.
(11) FIG. **10** is a graphical user interface product reporter of the ultrasonic welding system illustrated in FIG. **1**.
(12) FIG. **11** is a perspective view of a control unit that may be used in connection with the ultrasonic welding system illustrated in FIG. **1**.
(13) FIG. **12** is a schematic diagram of components of an ultrasonic welding system according to an embodiment of the present invention.
(14) FIG. **13** is a schematic diagram of the fabrication system according to FIG. **1**, showing a product uniformer.
(15) FIG. **14** is a top plan view of an exemplary product that may be assembled using an embodiment of the present invention.
(16) FIG. **15** is a schematic diagram of the finalization system shown in FIG. **1**.

DETAILED DESCRIPTION OF THE INVENTION

(17) The present invention will now be described more fully hereinafter with reference to the accompanying drawings, in which preferred embodiments of the invention are shown. This invention may, however, be embodied in many different forms and should not be construed as limited to the embodiments set forth herein. Rather, these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the invention to those skilled in the art. Those of ordinary skill in the art realize that the following descriptions of the embodiments of the present invention are illustrative and are not intended to be limiting in any way. Other embodiments of the present invention will readily suggest themselves to such skilled persons having the benefit of this disclosure. Like numbers refer to like elements throughout.
(18) Although the following detailed description contains many specifics for the purposes of illustration, anyone of ordinary skill in the art will appreciate that many variations and alterations to the following details are within the scope of the invention. Accordingly, the following embodiments of the invention are set forth without any loss of generality to, and without imposing limitations upon, the invention.
(19) In this detailed description of the present invention, a person skilled in the art should note that directional terms, such as “above,” “below,” “upper,” “lower,” and other like terms are used for the convenience of the reader in reference to the drawings. Also, a person skilled in the art should notice this description may contain other terminology to convey position, orientation, and direction without departing from the principles of the present invention.
(20) Furthermore, in this detailed description, a person skilled in the art should note that quantitative qualifying terms such as “generally,” “substantially,” “mostly,” and other terms are used, in general, to mean that the referred to object, characteristic, or quality constitutes a majority of the subject of the reference. The meaning of any of these terms is dependent upon the context within which it is used, and the meaning may be expressly modified.
(21) An embodiment of the invention, as shown and described by the various figures and accompanying text, provides an ultrasonic welding system **100** that may be used to assemble, create, and/or fabricate various products from one or more product materials **200**. As described above and throughout below, the ultrasonic welding system **100** may have a plurality of configurations and a plurality of embodiments that may be implemented to assemble and/or crate a respective variety of products.
(22) Initially referring to FIGS. **1** and **11-12**, the system **100** may include a feeding device **120**, a fabrication system **140**, and a finalization system **160**. The feeding device **120** may carry one or more product materials **200**. The feeding device **120** may feed the product materials **200** towards and into the fabrication system **140** at which the product materials **200** may be fed/pulled at a predetermined and/or controlled rate of speed, and/or at a speed that may be computationally

determined and maintained by the feeding device **120**, a feeding device controller **123**, a product uniformer **161**, a main system controller **162**, a control unit **180**. In some embodiments of the present invention the product uniformer **161** may be the main component that pulls and pushes the product materials **200** through and out of the system **100**. The feeding device **120** may also organize and/or assemble the product materials **200** before and/or during feeding the product materials **200** to the fabrication system **140**. Further detail on the product uniformer **161** follows further below.

(23) Now additionally referring to FIG. **4**, the feeding device **120** may include a feeder frame structure **125** and pace feeders **121**, retention members **122**, position feeders **124**, and/or feeding device controllers **123**. The pace feeders **121** may be connected to and/or carried by the feeder frame structure **125**. More specifically, the pace feeders **121** may be connected to and/or carried by an upper portion of the feeder frame structure **125**. The pace feeders **121** may be adapted to carry product materials **200** that may comprise rolls of material. The pace feeders **121** may be configured to release, distribute, and/or extrude the product materials **200** at a predetermined rate, or at a computationally determined rate. The pace feeders **121** may comprise of elongated members that rotate and are configured to engage a roll of product materials **200**. The pace feeders **121** may be adapted to automatically adjust and maintain the rate at which the product materials **200** are fed/pulled into the fabrication system **140** with the assistance of respective pace resistor **129** based on detected events and/or by manually made inputs into the feeding device controllers **123** and the main system controller **162**. The pace resistors **129** may be in connected to a respective pace feeder **121** and configured to apply a resistance force opposing the rotational force applied to the pace feeders **121** by the product materials **200** being pulled from the pace feeder **121**. Further details on the feeding device controllers **123**, and the main system controller **162** follows further below.

(24) For example, and without limitation, the pace feeders **121** may be configured to detect when product materials **200** are being released too fast and/or being released too slow based on a tension force applied to the pace feeders **121** by the product materials **200** that are released from the pace feeders **121**, which may be defined as a tension value. Also, those skilled in the art will appreciate that the product material being released too fast or too slow may be caused by any number of factors. More specifically, the pace feeders **121** may detect when the product materials **200** being released are applying a tension force to the pace feeders **121** that is greater than a predetermined tension value and may cause a predetermined action to take place. For example, if the product materials **200** are applying a rotational force to the pace feeders **121** greater than the predetermined tension value, then the pace feeders **121** may increase the rate at which the product materials **200** are released by reducing the amount of resistance force applied to the pace feeders **121** by the pace resistors **129**. Additionally, the pace feeders **121** may detect when the product materials **200** being released are applying a force to the pace feeders **121** that is less than a predetermined tension value and may decrease the rate at which the product materials **200** are released by increasing the resistance force applied to the pace feeders **121** by the respective pace resistor **129**. Further details on the predetermined tension value follows further below.

(25) The position feeders **124** may be carried by the feeder frame structure **125** and may be positioned in proximity to the pace feeders **121**. Preferably, the position feeders **124** are positioned on a lower portion of the feeder frame structure **125** relative to the to the position of the pace feeders **121**. Those skilled in the art, however, will appreciate that the position feeders **124** may be positioned in another location relative to the pace feeders **121**. Further, those skilled in the art will appreciate that the number of position feeders **121** equal the number of pace feeders **124**. In other words, for every pace feeder **121**, there is a respective position feeder **124**. The position feeders **124** may comprise elongated rollers that may be configured to actuate relative to the feeder frame structure **125**. The position feeders **124** may be configured to rotate about an axis that extends longitudinally through a center of the position feeder **124**.

(26) The position feeders **124** may also be configured to assist the pace feeders **121** in releasing the

product materials **200**, and the position feeders **124** may be configured to ensure that the product materials **200** do not become positioned and/or oriented in an undesirable way. For example, and without limitation, when the product materials **200** are a flat paper-sized-like material, it may be desirable to retain the released product materials **200** in a uniform flat-like state such that the product materials **200** do not fold as it is being released and maintains a desired layout. It is also important to ensure that the product material **200** remains taut while being fed/pulled through the feeding device **120**. The position feeders **124** are positioned to ensure that the product material **200** remains taut as it is being fed/pulled through the feeding device to advantageously prevent any folds in the material as it is being fed/pulled. The maintenance of the desired layout may also be assisted by one or more retention members **122** positioned along the route that the product materials **200** are released by the pace feeders **121** and pulled/pushed by the product uniformer **161** through the fabrication system **140** and through the finalization system **160**.

(27) As mentioned above, the position feeders **124** may be configured to move and/or actuate relative to the feeder frame structure **125** to move and/or maintain the released product materials **200** at a predetermined position relative to the fabrication system **140** (illustrated in FIGS. **5** and **6** and described in greater detail below). For example, and without limitation, the position feeders **124** may be configured to determine the position of the product material **200** that is adjacent to the respective position feeder **124** relative to the fabrication system **140** and/or a retention member **122** or the main retention member **144** to which the product materials **200** are being released towards. Based on the position of the product materials **200** detected by the position feeders **124**, the position feeder **124** may actuate to maintain the releasing the product material **200** at and/or towards the predetermined positioning of the product material **200** relative to the fabrication system **140** and/or the retention member **122** or main retention member **144** that the product materials **200** are being released towards.

(28) Continuing to refer to FIG. **4** and referring additionally to FIG. **12**, a feeding device controller **123** may be carried by the feeder frame structure **125**. The feeding device controllers **123** may be in communication with the pace feeders **121** and in communication with the position feeders **124**. In some embodiments where more than one feeding device controller **123** is used, the feeding device controllers **123** may be in communication with one another. The feeding device controllers **123** may manage, control, and monitor the operation and status of the pace feeders **121** and the position feeders **124**. The feeding device controllers **123** may include a feeder user interface that allows a user to control the pace feeders **121** and the position feeders **124** based on inputs made by the users. For example, the feeder user interface of the feeding device controllers **123** may allow inputs for a user to control the output/feed speed and tension values of the product material **200** by the feeding device **120** such that a predetermined speed and a predetermined tension value may be selected by a user via one or more of the feeding device controllers **123**.

(29) The user interface of the feeding device controllers **123** may also allow a user to input parameters of the product materials **200** by the feeding device **120**. For example, without limitation, the user interface of the feeding device controllers **123** may include controls to allow a user to input the trim, diameter, taper, and/or taper percent of the product material **200** that is carried by and/or released by the feeding device **120**.

(30) Some embodiments of the present invention may include position sensors **128**. The position sensors **128** may be positioned adjacent to the product materials **200** following a respective position feeder **124** relative to the path of travel of the product materials **200** through and/or in the feeding device **120**. The position sensors **128** may be in communication with a respective feeding device controller **123**. The position sensors **128** may sense and/or detect the position of the product materials **200** following the position feeders **124** relative to the position sensor **128**. The position sensors **128** may comprise a camera, trip laser, and/or an air break.

(31) The position sensors **128** may emit a product position signal relating to the position of the product materials **200** relative to the position of the position sensor **128**. The feeding device

controllers **123** may receive the product position signal and cause the position feeders **121** to actuate to adjust the position of the product materials **200** that are in contact with the relevant position feeder **121**. For example, and without limitation, feeding device controller **123** receiving a product position signal that the product materials **200** are positioned too far off in a direction from a predetermined position sensor **128** position, the feeding device controller **123** may cause the respective positioned feeder **121** to actuate in that direction in order to correct the product materials **200** to move the product materials **200** back towards the predetermined position sensor **128** position.
(32) In some embodiments of the present invention, the feeding device **120** may comprise one or more pace feeders **121** and a respective number of position feeders **124**. For example, without limitation, three pace feeders **121** and three position feeders **124** as illustratively shown in FIGS. **1** and **4**. The pace feeders **121** and the position feeders **124** may work in conjunction to feed each pace feeder's **121** respective supply of product material **200** to a predetermined point, such as, towards a retention member **122**. In some embodiments of the present invention, the pace feeders **121** may carry and/or feed product materials **200** that are different materials and/or sizes and work in conjunction with the respective position feeders **124** to layer the product materials **200** to be overlaying one another. For example, as illustratively shown in FIGS. **4** and **14**, each of the three pace feeders **121** may carry and release product material **200** that is at a different size/width from the other pace feeders **121** with the different product materials **200** being laying with each other to make a three-layered sheet of product materials **200**.
(33) It is contemplated and well understood that the number of pace feeders **121** and the number of position feeders **124** is dependent upon the number of product materials **200** that are required to create a selected final product, such as, the final product illustratively shown in FIG. **14** that requires three layers of product materials **200** to create. Thus, it is contemplated and well understood that embodiments of the present invention may comprise different numbers of pace feeders **121** and their respective position feeders **124** based upon the number of product material **200** layers that are needed to create the selected final product. Some embodiments of the present invention may be configured to allow a user to install and to uninstall pace feeders **121** and position feeders **124** so that the desired number of product material **200** layers can be made to create a selected final product.
(34) Now referring to FIGS. **1**, **5-6**, and **12-14**, the fabrication system **140** may include a support structure **151**, one or more retention members **122**, a main retention member **144**, attachment apparatuses **141**, aperture generators **142**, actuators **150**, and anvils **145**. The main retention member **144** may be positioned apart from, but adjacent to, the feeding device **120**. The main retention member **144** may be positioned above the last retention member **122** of the feeding device **120** that the product materials **200** come in contact with as the product materials **200** travel through the feeding device **120**.
(35) The product materials **200** may be led into the fabrication system **140** from the feeding device **120** by the main retention member **144**. In some embodiments of the present invention the main retention member **144** may alternatively comprise a retention member **122**. The product materials **200** may comprise a layering of multiple product materials **200**. The main retention member **144** may receive product materials **200** from the feeding device **120** as layered product materials **200** that may comprise of product materials **200** that vary in size and shape from one another. For example, and without limitation, the product materials **200** may have widths that are different from one another. The product materials **200** may move in a path of travel through the system **100** and the fabrication system **140** designated by the arrow located shown within the product materials **200** illustratively shown in FIG. **13**.
(36) Some embodiments of the present invention may include a feed sensor **156** (see FIGS. **12** and **13**). The feed sensor **156** may be configured to sense and detect when product materials **200** are being fed into the fabrication system **140**. The feed sensor **156** sensor may be in communication

with the main system controller **162**. The feed sensor **156** may emit a product detection signal relating to the presence of product material **200**, and the product detection signal may be receivable by the main system controller **162**. Upon the main system controller **162** receiving the product detection signal, the main system controller **162** may cause a predetermined action to take place. For example, without limitation, upon the main system controller **162** receiving a product detection signal informing that there is no product material **200** detected by the feed sensor **156**, the main system controller **162** may cause the attachment system **141** and/or the aperture generator **142** to stop and/or stand by. In some embodiments of the present invention, the feed sensor **156** may include an alarm that may sound when the feed sensor **156** detects that no product material **200** is present.

(37) Referring now back to FIGS. **2-3**, the attachment apparatuses **141** may be attached to the support structure **151**. The attachment between the attachment apparatuses **141** may be via an actuator **150**, such that actuation movements of the actuator **150** may actuate the respective attachment apparatus **141** that is connected to the actuator **150** and actuate the attachment apparatus **141** relative to the support structure **151**. The attachment apparatuses **141** may be configured to attach, sew, weld, and/or connect product materials **200** together. Preferably, the attachment apparatuses **141** attach, sew, weld, and/or connect product materials **200** together via ultrasonic vibrations/frequencies that cause a generation of heat in product materials **200** which come in contact with the attachment apparatus **141** at a contact point **152**.

(38) The contact point **152** may be defined as when and where the product materials **200** are pressed between the attachment apparatus **141** and an anvil **145** and/or one or more anvil teeth **146** positioned on the anvil **145**. The heat generated in the product materials **200** at the contact point **152** may cause the product material **200** to melt locally at that contact point **152**, and once the melted portions of the product materials **200** cool, the product material **200** may have had an attachment formed (attachment point **159**) at the cooled portions which may attach the product material **200** to itself and/or to other product materials **200** as illustratively shown in FIG. **14**. More details on the anvil **145** and the anvil teeth **146** follows further below.

(39) As perhaps best illustrated in FIG. **5**, the attachment apparatuses **141** may include an attachment generator **149**, a power attacher **147** and/or a horn **148**. In some embodiments of the present invention, the attachment generator **149** may be connected to and/or inserted into the power attacher **147**, with a horn **148** attached to the power attacher **147** at a lower portion of the power attacher **147** that is opposing the attachment generator **149**. In some embodiments of the present invention the attachment generator **149** may be directly attached to the horn **148** as illustratively shown in FIG. **6**. In some embodiments of the present invention, the horn **148** may comprise a sonotrode. The attachment generator **149** may be configured to create and/or generate an ultrasonic frequency which may be at a predetermined amplitude that may be pre-set by a user and may be variable. Although, it is contemplated and well understood that the attachment generator **149** may create/generate frequencies other than ultrasonic frequencies and may create/generate frequencies at a range of amplitudes such as, and without limitation, amplitudes in the range of 30-125 microns.

(40) In some embodiments of the present invention, the attachment generator **149** may comprise ceramic disks configured to vibrate at a certain frequency when charged with electrical power. For example, and without limitation, the ceramic disks may be configured to vibrate at 20 kilohertz when charged with electrical power. However, those skilled in the art will notice and appreciate that the ceramic disks may be interchangeable with different ceramic disks of different sizes and composition in order to generate a different and/or desired frequency when the disks are charged with electrical power depending on the desired final product and the type of product material **200** used.

(41) The ultrasonic frequency generated by the attachment generator **149** may be a predetermined ultrasonic frequency, and the amplitude of the ultrasonic frequency generated by the attachment generator may be a predetermined amplitude. The predetermined amplitude may be chosen by a

user via a main interface **163** of the main system controller **162**. The predetermined amplitude may be chosen by a user based upon the type of product materials **200** that are being fed into the fabrication system **140**. The product materials **200** may comprise any material that may be heated/melted by being exposed to certain kinetic frequencies that may be considered ultrasonic frequencies, including, without limitation, thermoplastics, metals, textiles, and synthetic fabrics.

(42) Some embodiments of the present invention may include the attachment generator **149** generating a variety of amplitudes, such as different amplitudes generated in a pattern to create attachment points **159**, and/or different sized attachment points **159**, on product materials **200** that may comprise of different types of materials and/or different sizes or thicknesses of materials, which may vary as the product materials **200** are fed/pulled through the system **100**. For example, and without limitation, in some embodiments of the present invention the attachment generator **149** may be configured to generate relatively larger amplitudes for portions of product materials **200** that are relatively thicker/stronger and then generate amplitudes that are relatively lower for portions of product materials **200** that are relatively thinner/weaker. The power and timing of the amplitudes generated by the attachment generator **149** may be controlled by the main system controller **162** and/or the fabrication controller **143**, which may be predetermined amplitudes and predetermined timing of the frequencies selected by a user via the main system controller **162** and/or the fabrication controller **143**. Further detail about the predetermined ultrasonic amplitudes follows further below along with the discussion of an attachment sensor **157**.

(43) The attachment generator **149** may transfer the generated ultrasonic frequency to a respective power attacher **147** and/or horn **148** that the attachment generator **149** is attached with. An anvil **145** may be positioned below the horn **148**, with the product materials **200** positioned traveling between the horn **148** and the anvil **145**. The anvil **145** may comprise an elongated cylinder configured to rotate about a horizontal axis that extends longitudinally through the center of the cylinder.

(44) The anvil **145** may include a motor in communication with the main system controller **162**, and the motor may be configured to rotate the anvil **145** at a speed determined by the main system controller **162**. The speed at which the motor rotates the anvil **145** may be a speed equal to the rate at which the product material **200** are being fed/pulled through the system **100** or may be any other speed as inputted by a user into the main interface **163** and/or as automatically determined by the main system controller **162**. The anvil **145** may include one or more anvil teeth **146** positioned on the curved surface of the anvil **145**. The anvil teeth **146** may be positioned on the anvil **145** in a predetermined pattern so that a desired pattern of contact points **152** and attachment points **159** are created on the product materials **200**.

(45) The predetermined pattern of the anvil teeth **146** may be selected by a user so that a desired pattern of attachment points **159** may be created at the contact points **152** for a desired final product to be created. The anvil teeth **146** may also vary in size and shape depending upon what size and shape is desired for the attachment points **159** for a given product material **200** to be developed into a desired final product. The anvil **145** may be configured to rotate about its horizontal axis at a predetermined rate which may be chosen to obtain a desired pattern of attachment points **159** on the product materials **200**. Such as, without limitation, the pattern of attachment points **159** illustratively shown in FIG. **14**.

(46) The attachment apparatuses **141** may be actuated relative to their respective anvil **145** by a respective actuator **150**. The actuator **150** may actuate the attachment apparatus **141** to and away from the anvil **145** such that the horn **148** abuts/presses the product materials **200** against the anvil teeth **146** of the anvil **145** to transfer the ultrasonic frequency generated by the attachment generator **149** to the product materials **200**. The amount of movement and/or the pressure applied by the attachment apparatus **141** on the product materials **200** against the anvil teeth **146** of the anvil **145** may be manually controlled by a user and/or computationally controlled by the main system controller **162**, by a control unit **180**, and/or by an attachment sensor **157**. Further detail on

the main system controller **162**, control unit **180**, and the attachment sensor **157** follows further below.

(47) In some embodiments of the present invention, the attachment apparatuses **141** may be directly connected to the support structure **151** such that the attachment apparatuses **141** are not actuated and are in a fixed position relative to the support structure **151** such that the anvil teeth **146** of the anvil **145** will move, push, and/or press the product materials **200** towards and against the horn **148** of the attachment apparatus **141** to create a contact point **152** and attachment points **159** without having to actuate the attachment apparatus **141** with an actuator **150**.

(48) Some embodiments of the present invention may include an aperture generator **142** (illustrated in FIG. **6**). The aperture generator **142** may be configured to create through-holes **130** that extend partially into and/or all the way through a portion of one or more product materials **200**. The aperture generator **142** may be attached to the support structure **150** and positioned directed towards the product materials **200** fed into the fabrication system **140**. The aperture generator **142** may comprise, without limitation, a laser, a puncher, a cutting instrument, and/or any other component capable of creating an incision or through-hole **130** in product materials **200** as understood by those skilled in the art. In preferred embodiments of the present invention, the aperture generator **142** comprises a laser capable of creating through-holes **130** in various product materials **200**.

(49) The aperture generator **142** may be configured to create a through-hole **130** that extends through only a portion of the product material **200** without the through-hole extending all the way through the product material **200**. The aperture generator **142** may also be configured to create through-holes in layers of product material **200** that extend only through only a select layer or number of layers of product material **200** that is layers with other product materials **200**. It is also contemplated and well understood that the aperture generator **142** may also create through-holes in layered product materials **200** that extend all the way therethrough.

(50) The aperture generator **142** may be manually controllable by a user and/or automatically controllable by the main system controller **162** or another input interface/controller in communication with the aperture generator **142**. A user may enter inputs regarding the desired extent, pattern, and size of the through-holes to be created in the product materials **200** by the aperture generator **142** via the main system controller **162** or the other input interface/controller in communication with the aperture generator **142**. In the case where the aperture generator **142** comprises a laser, the pattern, size, shape, depth, and/or extent of the through-holes **130** created by the aperture generator **142** in the product materials **200** may be controlled by regulating the length of time and/or the intensity of the laser when the laser is activated based on inputs made by a user via the main system controller **162** or another input interface/controller in communication with the aperture generator **142**.

(51) Some embodiments of the present invention may include shielding **154**. The shielding **154** may comprise an enclosure surrounding all of, or at least a portion of, the fabrication system **140**. The enclosure of the shielding **154** may comprise at least one barrier that filters or prevents light passing therethrough. For example, without limitation, the enclosure may include laser filtering windows that prevent lasers and portions of light from passing through the enclosure of the shielding **154** for increased safety.

(52) An aperture sensor **157** (illustrated in FIG. **13**) may be positioned adjacent to, or following, the aperture generator **142** relative to the path of travel of the product material **200** travels through the fabrication system **140**. The aperture sensor **157** may be configured to sense and determine the parameters of the through-holes **130** created by the aperture generator **142** in the product materials **200**. The aperture sensor **157** may send an aperture detection signal related to the parameters of the detected through-holes **130** to the main system controller **162**, the aperture generator **142**, or the other input interface/controller that is in communication with the aperture sensor **158**. A user may input the desired parameters of the through-holes **130** to be created in the product materials **200** by

the aperture generator **142** via to the main system controller **162**, the aperture generator **142**, or the other input interface/controller that is in communication with the aperture sensor **157** and in communication with the aperture generator **142**.

(53) Upon the main system controller **162**, aperture generator **142**, and/or other input interface/controller receiving the aperture signal from the aperture sensor **158**, it may determine whether the through-holes **130** created by the aperture generator **142** are the same and/or about the same as the parameters of the through holes **130** inputted by the user. Based on the aperture signal received from the aperture sensor **158** to the main system controller **162**, the aperture generator **142**, or the other input interface/controller may cause the aperture generator **142** to make a predetermined action. For example, without limitation, when the main system controller **162**, the aperture generator **142**, or the other input interface/controller receive an aperture signal and determine that the through-holes **130** are above a predetermined length, width, depth, and/or size from the selected parameters of the user, the aperture generator **142** may be caused to decrease the length, width, depth, and/or size of the through-holes made in the product materials **200** and vice versa.

(54) Some embodiments of the present invention may include one or more attachment sensors **157**. The attachment sensor **157** may be positioned following one or more of the attachment apparatuses **141** with respect to the movement of the product materials **200** through the fabrication system **140**. The attachment sensor **157** may be in communication with a main system controller **162** and/or one or more of the attachment apparatuses **141** or fabrication controllers **143**. The attachment sensor **157** may be configured to sense and/or determine the parameters of the attachments points **159** created on the product materials **200** by the attachment apparatuses **141**.

(55) The attachment sensor **157** may also be configured emit an attachment signal regarding the parameters of a detected attachment point **159**. The attachment signal may be received by the main system controller **162**, fabrication controller **143**, and/or by the relevant attachment apparatus **141** that created the detected attachment point **159**. The parameters of the detected attachment point **159** may include the size, geometric area, depth, and/or the transparency of the detected attachment point **159**.

(56) In some embodiments of the present invention, the main system controller **162**, fabrication controller **143**, and/or the attachment apparatus **141** may be configured to determine the parameters of the attachment points **159** based upon the attachment signal received from the attachment sensor **157** and may be configured to cause the relevant attachment generator **149** to take a predetermined action based upon the determined parameters. For example, and without limitation, upon the attachment apparatus **141**, fabrication controller **143**, and/or the main system controller **162** receiving an attachment signal generated by the attachment sensor **157** that the attachment points **159** are more transparent than a predetermined transparency, or that there are apertures extending through the attachment points **159**, then the relevant attachment apparatus **141** that created that attachment point **159** may be caused to decrease the amplitude that the attachment generator **149** generates the ultrasonic frequency to reduce the amount of heat produced in the product materials **200** at the contact points **152**.

(57) Another example, without limitation, upon the attachment apparatus **141**, fabrication controller **143**, and/or the main system controller **162** receiving and an attachment signal from the attachment sensor **157** informing that the attachment points **159** are shallower than a predetermined depth, then the relevant attachment apparatus **141** that created the attachment points **159** may be caused to increase the amplitude that the attachment generator **149** generates the ultrasonic frequency.

(58) Now additionally referring to FIG. **11**, some embodiments of the present invention may include a control unit **180** that may be in communication with the actuators **150**, which may include fluid communication. The control unit **180** may comprise a pneumatic pump, hydraulic pump, and/or an electronic controller. The actuators **150** may comprise a pneumatic actuator, hydraulic actuator, magnetic actuator, and/or an electronic actuator. The control unit **180** may be configured

to control, manage, and operate the actuation movements of the actuators **150**. The control unit **180** may be manually operable by a user to set a select range and/or a select timing of the actuation movements of the actuators **150**.

(59) In some embodiments of the present invention, the control unit **180** may be in communication with the attachment sensors **157**, and the control unit **180** may be configured to receive the attachment signals from the attachment sensors **157**. Upon the control unit **180** receiving an attachment signal from the attachment sensor **157** regarding the attachment points **159** created by an attachment apparatus **141**, the control unit may cause the relevant actuator of the attachment apparatus **141** to take a predetermined action.

(60) For example, without limitation, upon the control unit **180** receiving an attachment signal informing that the attachment points **159** created by an attachment apparatus **141** are more transparent than a predetermined transparency, or that the attachment points **159** have apertures present therethrough, the control unit **180** may cause the relevant actuator **150** to decrease the selected range of actuation movement to reduce the pressure caused at the contact point **152** on the product materials **200**. Another example, without limitation, upon the control unit **180** receiving an attachment signal informing that the attachment points **159** created by an attachment apparatus **141** are shallower than a predetermined depth, the control unit **180** may cause the relevant actuator **150** to increase the selected range of actuation movement to increase the pressure cause at a contact point **152** of the product materials **200**.

(61) Now referring to FIG. **8**, in some embodiments of the present invention that include a control unit **180** that comprise a pneumatic pump, and/or actuators **150** that comprise pneumatic actuators, may include an air cleanser device **153**. The air cleanser device **153** may be in fluid communication with the control unit **180** and/or the actuators **150**. The air cleanser device **153** may remove moisture, particulate matter, dust, and/or debris from the air used by the control unit **180** to pneumatically operate the actuators **150**.

(62) Now referring to FIGS. **1**, **6-7**, and **12-14**, some embodiments of the present invention may include a product uniformer **161**. The product uniformer **161** may be positioned following the fabrication system **140** relative to the flow of the product materials **200** moving in to and out from the fabrication system **140**. The product uniformer **161** may control the rate at which the product materials **200** are pulled/passed through the system **100**. The product uniformer **161** may also press the product materials **200** together as they flow out from the fabrication system **140** to ensure that the product materials **200** maintain a relatively uniform and are about flat along a longitudinal plane, and/or to ensure that the attachment points **159** of the product materials **200** are flattened and/or maintain a good attachment of the product materials **200** to each other.

(63) The product uniformer **161** may include a number of product uniformer rollers **169** that compress and grasp the product materials **200** as the product materials **200** pass through the product uniformer **161** from the fabrication system **140** to the finalization system **160**. The product uniformer rollers **169** may have a surface configured to grip and/or grasp the product materials **200** as the product materials **200** pass through the product uniformer **161**. For example, and without limitation, the surface of the product uniformer rollers **169** may comprise rubber, metals, plastics, and/or composites (which may have a textured finish) to increase the grip of the product materials **200** by the product uniformer rollers **169**. In some embodiments of the present invention, the product uniformer rollers **169** may comprise nip rollers.

(64) Nip rollers are traditionally used to pull materials of a single thickness, such as, a single thickness of product material **200**. However, some embodiments of the present invention that include having the product uniformer **161** pulling/pushing product material **200** comprising materials having different thicknesses and/or widths such that the height of the product material **200** is less than uniform. To solve this problem, those skilled in the art will notice and appreciate that some embodiments of the present invention may include a uniformer roller **169** comprising a variable thickness nip roller. The variable thickness nip roller of may include an attachment and/or

layering adhesive tape, which may comprise adhesive-backed Teflon tape. The adhesive tape may be attached and/or layered in a predetermined pattern onto the curved surface of the nip roller, which may be positioned along a central longitudinal axis of the nip roller. The predetermined pattern and quantity of tape may be positioned/layered on the curved surface of the nip roller such that the nip roller may about match and/or abuttingly engage a majority (>50%) of a surface area of the product material **200** which comprises materials having different thicknesses and/or widths such that the height of the product material **200** is less than uniform.

(65) Alternatively, the predetermined pattern of the adhesive tape attached and/or layered onto the nip roller may be positioned in a spiral pattern on the curved surface of the along a central longitudinal axis of the nip roller. The adhesive tape may decrease the likeliness of slippage between the uniformer roller **169** and the product material **200** due to a less than uniform height of the product material **200**. In embodiments of the present invention not including the adhesive tape on the uniformer roller **169**, a portion of the product material **200** may become slack while another portion of the product material **200** may become tight, which may cause the product material **200** to move back and forth longitudinally along the uniformer roller **169** in the product uniformer **161**. The spiral pattern of the adhesive tape may act like a rotating screw that may pull the product material **200** taut along a width of the product material **200**.

(66) The product uniformer rollers **169** may include motors to cause and control rotational movement of the product uniformer rollers **169** about a longitudinal axis that is at a center of the respective product uniformer roller **169**. The product uniformer rollers **169** may be in communication with the main system controller **162** and the control unit **180**. The main system controller **162** and/or the control unit **180** may monitor, control, and maintain the speed at which the product uniformer rollers **169** are rotated by the motors such that the speed at which the product materials **200** are moved through the system **100** are thus maintained and controlled by the main system controller **162** and/or the control unit **180**. The speed at which the product uniformer rollers **169** and that the product materials **200** are moved at may be controlled by a user selecting a speed, which may be defined as a predetermined product speed, into a main interface **163** of the main system controller **162**.

(67) The main system controller **162** may be in communication with the control unit **180**, and the main system controller **162** may emit a predetermined product speed related to the predetermined product speed entered by a user into the main interface **163**. The predetermined product speed signal may be receivable by the control unit **180**. Upon the control unit **180** receiving the predetermined product speed signal, the control unit **180** may cause the product uniformer rollers **169** to rotate at the predetermined product speed.

(68) Some embodiments of the present invention may include material monitors **126** and pace resistors **129**. The material monitors **126** may be positioned facing a respective pace feeder **121** and/or the product materials **200** carried by a respective pace feeder **121**. The material monitors **126** may be in communication with the main system controller **162**, the control unit **180**, and/or the pace resistors **129**. The material monitors **126** may sense, detect, and/or monitor the amount of product materials **200** carried by its respective pace feeder **121**. The pace resistors **129** may be attached to a respective pace feeder **121**. The pace resistors **129** may apply a resistance force opposing the rotational movement of the respective pace feeder **121** that the pace resistor **129** is attached to. For example, and without limitation, the pace resistors **129** may comprises a drum brake, disk brake, and/or a magnetic brake. The pace resistors **129** may be in communication with the main system controller **162**, the control unit **180**, and/or a respective material monitor **126**.

(69) The material monitors **126** may emit a product material amount signal relating to the amount of product material **200** sensed and/or detected carried by a respective pace feeder **121**. The product material amount signal may be received by the main system controller **162**, the control unit **180**, and/or the pace resistors **129**. Based upon the main system controller **162**, the control unit **180**, and/or the pace resistors **121** receiving the material amount signal, the main system controller **162**,

the control unit **180**, and/or the pace resistors **121** may cause the respective pace feeder **121** to change and/or maintain the speed at which the pace feeder **121** rotationally moves, and thus change and/or maintain the speed at which the product materials **200** are released from the pace feeder **121**. Those skilled in the art will notice and appreciate that when the product materials **200** comprise a roll of material that unravels as the product materials **200** are unraveled, as the diameter of the roll of material changes, the rotational speed of the rotation of the respective pace feeder **121** must be adjusted to maintain the release of the product materials **200** at a predetermined speed selected by a user input at the main system controller **162**.

(70) Upon the main system controller **162** receiving a product amount signal that the product material **200** of a respective pace feeder **121** that the diameter of the product material **200** is at a present diameter value, the main system controller **162** may determine and/or calculate what resistance force the pace resistors **129** must maintain in order to cause the product material **200** to be released from the respective pace feeder **121** in order to release the product material **200** at the predetermined product material speed selected by the user. Upon the main system controller **162** determining the resistance force the respective pace resistor **129** must maintain, the main system controller **162** may cause the respective pace resistor **129** to apply and/or maintain that determined resistance force, which may be done via the main system controller **162** communicating with the control unit **180** to cause the control unit **180** to control the relevant pace resistor **129** to apply and/or maintain that determined resistance force.

(71) Now additionally referring to FIG. **9**, as the product materials **200** exit the fabrication system **140** and/or the product uniformer **161**, the product materials **200** may flow into the finalization system **160**. The finalization system **160** may include a main system controller **162**, a product separator **164**, a grasping device **165**, and a motion inducer **167**. The grasping device **165** may be positioned abutting the motion inducer **167**. The grasping device **167** and the motion inducer **167** may be positioned to accept the product materials **200** as they exit the fabrication system **140** and/or the product uniformer **161**. The grasping device **165** may comprise a roller and may include a motor that is in rotational communication with the roller to cause the roller to rotate about a longitudinal axis. The motion inducer **167** may comprise a conveyor belt or other device with similar capabilities as a conveyor belt as understood by those skilled in the art.

(72) The grasping device **165** and the motion inducer **167** may, in conjunction, grasp the product materials **200** as they exit the fabrication system **140** and/or the product uniformer **161**, and may apply a force on the product materials **200** directed away from the fabrication system **140**. The product separator **164** may be positioned adjacent to the fabrication system **140** and/or the product uniformer **161**, and the product separator **164** may carry the grasping device **165**. The product separator **164** may be configured to separate the product materials **200** as the product materials **200** exit the fabrication system **140** and/or the product uniformer **161** by creating a separation in the product material **168**. The product separator **164** may comprise of a cutting implement that is sized to be at least the same length as a longitudinal width of the product materials **200**.

(73) The product separator **164** may also comprise a separation platform **166** to which the grasping device **165** may be carried by. The separation platform **166** may include one or more surfaces that are at least the same width as the product materials **200**, and the separation platform **166** may include a division area that travels through a length of a surface of the separation platform **166**. The division area may be sized to allow the cutting implement to separate the product materials **200** without the cutting implement coming into contact with the separation platform **166**.

(74) The product separator **164** may be configured to actuate so that the cutting implement of the product separator **164** creates a cut that separates the product materials **200** from one another. The product separator **164** may also comprise a separation platform **166** to which the grasping device **165** may be carried by. The separation platform **166** may include one or more surfaces that are at least the same width as the product materials **200**, and the separation platform **166** may include a division area that travels through a length of a surface of the separation platform **166**. The division

area may be sized to allow the cutting implement to separate the product materials **200** without the cutting implement coming into contact with the separation platform **166**.

(75) The product separator **164** may also be configured to move between a reset state and a separation state. The reset state may be defined as when the product separator **164** is positioned in adjacent proximity to the fabrication system **140** and/or the product uniformer **161**. The separation state may be defined as when the separation platform **166** is overlaying at least a portion of the motion inducer **167**.

(76) The product separator **164** may be configured to move from the reset state to the separation state at the same rate of movement as the product materials **200** is exiting the fabrication system **140** and/or the product uniformer **161** so that the product separator **164** is matching the speed and direction of movement of the product materials **200** for the cutting implement to separate the product materials **200** where attachment points **159** are located. The grasping device **165** and/or the motion inducer **167** may rotationally move to eject and/or move the product materials **200** in a direction away from the finalization system **160** once the product materials **200** have been separated by the product separator **164**.

(77) Now referring to FIGS. **1**, **4-6**, and **13**, the one or more retention members **122** may be positioned occasionally following the path of travel that the product materials **200** travel through the system **100**. The retention members **122** may comprise cylinders which may be configured to be readily moveable about a horizontal axis that travels longitudinally through a center of the retention member **122** by an application of force against the retention member **122**. In some embodiments the retention members **122** may include a respective motor in mechanical communication with the retention member **122**. The motor may be configured to cause the retention members **122** to rotationally move at a predetermined speed that may be chosen by a user or by the main system controller **162**, the feeding device controllers **123**, and/or the main system controller **162**.

(78) Now referring to FIGS. **10**, **12**, and **15**, some embodiments of the present invention may include a product reporter **170**. The product reporter **170** may be in communication with a reporter sensor **171**. The product reporter **170** may include a display configured to display a graphical user interface. The reporter sensor **171** may be positioned facing the motion inducer **167**, and the reporter sensor **171** may be configured to detect when a product material **200** has been ejected by the motion inducer **167** after the product material **200** has been separated by the product separator **164**. Upon the reporter sensor **171** detecting that a product material **200** has been ejected by the motion inducer **167**, the reporter sensor **171** may emit a product count signal regarding the detection of the product material **200** being ejected by the motion inducer **167**.

(79) The product count signal may be received by the product reporter **170**. Upon the product reporter **170** receiving the product count signal, the product reporter **170** may display the number of product material **200** ejected from the motion inducer **167** since a predetermined period of time on the graphical user interface. In some embodiments of the present invention, the product separator **164** may be in communication with the product reporter **170** and the product separator **164** may emit the product count signal each time the product separator **164** actuates to separate the product material **200**. In other embodiments of the present invention, the main system controller **162** may be in communication with the product reporter **170** and the product separator **164** may emit the product count signal each time the product separator **164** actuates to separate the product material **200** with the main system controller **162** forwarding the product count signal to the product reporter **170**.

(80) Now referring to FIG. **12**, an embodiment of the present invention may include a power source **300** that is in communication with any and/or all of the above mentioned components of the system **100**. The power source **300** may provide, emit, and/or regulate power to and for the system **100**. The power source **300** may comprise a battery, electric generator, power plug-in, and any other device or supply of power that can be used for the power supply **300** as understood by those skilled

in the art.
(81) Some of the illustrative aspects of the present invention may be advantageous in solving the problems herein described and other problems not discussed which are discoverable by a skilled artisan.
(82) While the above description contains much specificity, these should not be construed as limitations on the scope of any embodiment, but as exemplifications of the presented embodiments thereof. Many other ramifications and variations are possible within the teachings of the various embodiments. While the invention has been described with reference to exemplary embodiments, it will be understood by those skilled in the art that various changes may be made and equivalents may be substituted for elements thereof without departing from the scope of the invention. In addition, many modifications may be made to adapt a particular situation or material to the teachings of the invention without departing from the essential scope thereof. Therefore, it is intended that the invention not be limited to the particular embodiment, or particular embodiments, disclosed as the best or only mode contemplated for carrying out this invention, but that the invention will include all embodiments falling within the description of the invention. Also, in the drawings and the description, there have been disclosed exemplary embodiments of the invention and, although specific terms may have been employed, they are unless otherwise stated used in a generic and descriptive sense only and not for purposes of limitation, the scope of the invention therefore not being so limited. Moreover, the use of the terms first, second, etc. do not denote any order or importance, but rather the terms first, second, etc. are used to distinguish one element from another. Furthermore, the use of the terms a, an, etc. do not denote a limitation of quantity, but rather denote the presence of at least one of the referenced items.
(83) Thus the scope of the invention should be determined by the appended claims and their legal equivalents, and not by the examples given.

Claims

1. An ultrasonic welding system for assembling materials, the system comprising: a feeding device comprising: a plurality of pace feeders, each one of the plurality of pace feeders configured to carry and supply a respective product material; a plurality of position feeders, each one of the plurality of position feeders configured to receive and distribute the respective product material from a respective one of the plurality of pace feeders; and at least one retention member to receive, distribute, and layer the respective product materials from the plurality of position feeders with one another to form a layering of product materials; a fabrication system comprising: a main retention member to receive and distribute the layering of product materials along a path of travel; a plurality of attachment apparatuses positioned on a first side of the path of travel; a respective plurality of anvils positioned on a second side of the path of travel opposite the first side, each one of the respective plurality of anvils positioned adjacent to a respective one of the plurality of attachment apparatuses to define a contact point between the anvils and the attachment apparatuses; and an aperture generator to create at least one through-hole that extends through at least a portion of at least one layer of the layering of product materials; wherein at least one portion of the layering of product materials is pressed to create at least one attachment point at the contact point to attach at least two layers of the layering of product materials; a product uniformer to receive and distribute the layering of product materials and to move the layering of product materials along the path of travel; and a finalization system comprising: a product separator to cut the layering of product materials into a plurality of finished products; and a motion inducer to eject each of the plurality of finished products from the product separator.
2. The system of claim 1, further comprising a plurality of pace resisters that are each attached to the respective plurality of pace feeders; wherein the respective product materials comprise a roll of product materials; wherein each of the plurality of pace feeders rotatably move about an axis to

supply the roll of product materials; and wherein the pace resistors selectively apply a resistance force that opposes the rotational movement of the respective plurality of pace feeders to apply a tension force to the product materials when moved by the product uniformer.

3. The system of claim 1, wherein the position feeders selectively actuate along a longitudinal axis to receive and dispense the product materials at a predetermined position relative to the at least one retention member.

4. The system of claim 3, further comprising a plurality of position sensors that are positioned adjacent to the respective position feeders; wherein each of the plurality of position sensors detects the position of the respective product materials of the respective position feeder that the position sensor is adjacent to; wherein each one of the plurality of position sensors emits a product position signal related to the position of the respective product material along the respective position feeder; and wherein the product position signal is received by a feeding device controller.

5. The system of claim 4, wherein the feeding device controller is configured to control the actuation of at least one of the plurality of position feeders based on the product position signal received.

6. The system of claim 1, wherein the feeding device is separate and spaced apart from the fabrication system.

7. The system of claim 1, wherein at least one of the respective product materials has a size and shape that is different from the other respective product materials.

8. The system of claim 1, wherein the aperture generator creates a plurality of through-holes; and wherein the plurality of through-holes define a predetermined pattern of through-holes.

9. The system of claim 1, wherein the at least one attachment point defines a plurality of attachment points that are formed in a predetermined pattern.

10. The system of claim 1, wherein each of the plurality of attachment apparatuses comprise an attachment generator to generate an ultrasonic frequency to generate heat at the contact point to create the at least one attachment point.

11. The system of claim 10, wherein at least one of the plurality of attachment apparatuses comprises a horn attached to the attachment generator to transfer the ultrasonic frequency to the contact point.

12. The system of claim 10, wherein the heat generated at the contact point by the ultrasonic frequency causes the layering of product materials to melt locally at the contact point to create the at least one attachment point.

13. The system of claim 1, wherein the plurality of attachment apparatuses actuate relative to the respective plurality of anvils to press the at least one portion of the layering of product materials against the respective plurality of anvils.

14. The system of claim 1, wherein the each of the plurality of anvils comprise a plurality of anvil teeth positioned along a curved surface of the anvil; and wherein each of plurality of anvils rotatably move to position the plurality of anvil teeth at the contact point to press the at least one portion of the layering of product materials against the attachment apparatuses.

15. The system of claim 1, wherein the aperture generator comprises at least one of a laser, a puncher, and a cutting instrument.

16. The system of claim 1, wherein the product materials comprise a material that can be melted when exposed to ultrasonic frequencies having an amplitude range of about 30 to 125 microns.

17. The system of claim 1, wherein the product separator comprises a separation platform and a cutting implement; wherein the cutting implement actuates relative to the separation platform to cut the layering of product materials into one of the finished products; and wherein the separation platform includes a division area that travels through a length of a surface of the separation platform to actuate the cutting implement to cut the layering of product materials without coming into contact with the separation platform.

18. The system of claim 1, further comprising a main system controller utilized to control the

feeding device, the fabrication system, the product uniformer, and the finalization system.

19. The system of claim 1, further comprising a product reporter in communication with a reporter sensor; wherein the reporter sensor detects when each of the finished products are ejected and emits a product count signal; and wherein the product reporter displays a product count based on the product count signal.

20. The system of claim 1, further comprising shielding positioned to enclose at least a portion of the fabrication system; and wherein the shield comprises a laser light filtering window.