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[54] METHODS AND APPARATUS FOR PROCESSING WEB-LIKE MATERIALS

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[58] Field of Search 112/102, 121.14, 121.15

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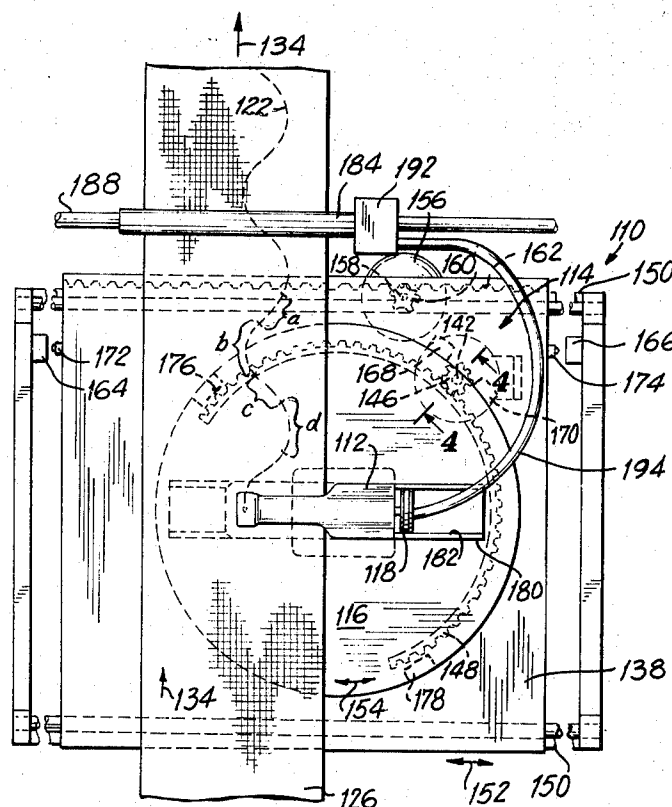
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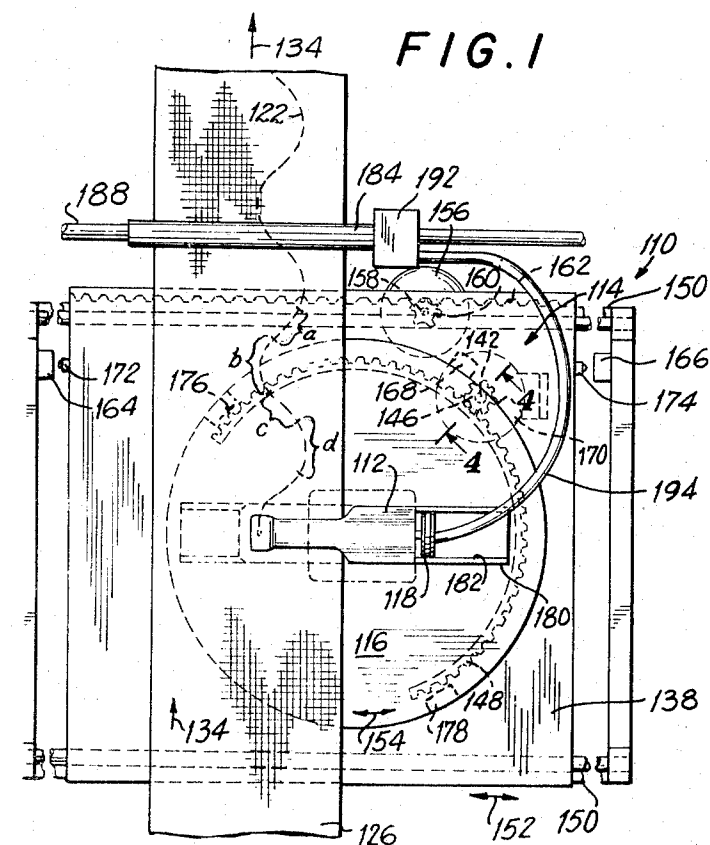
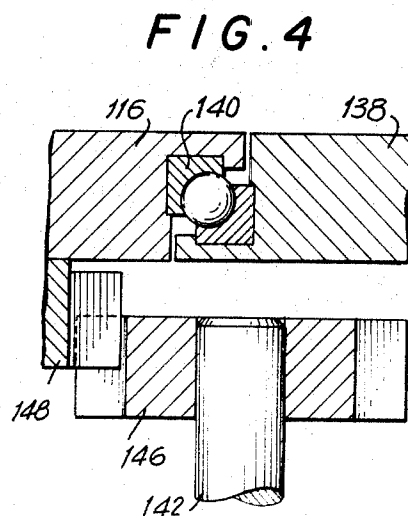
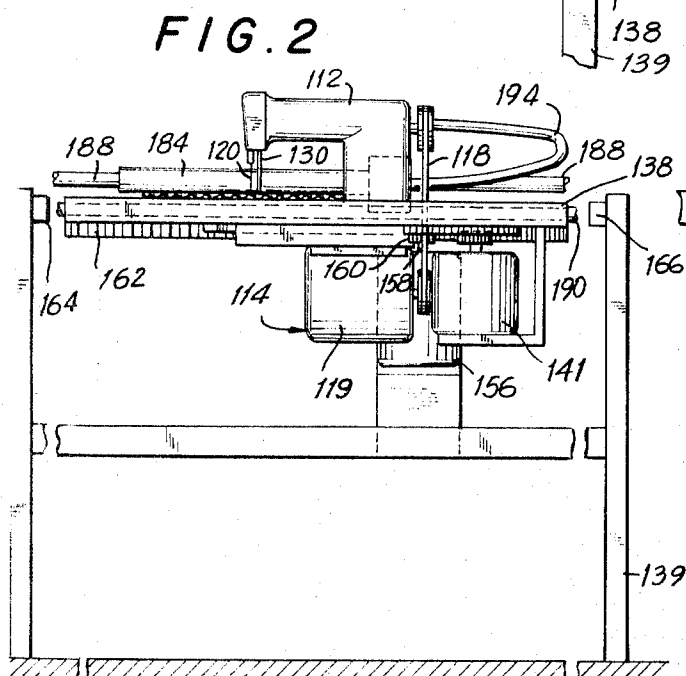
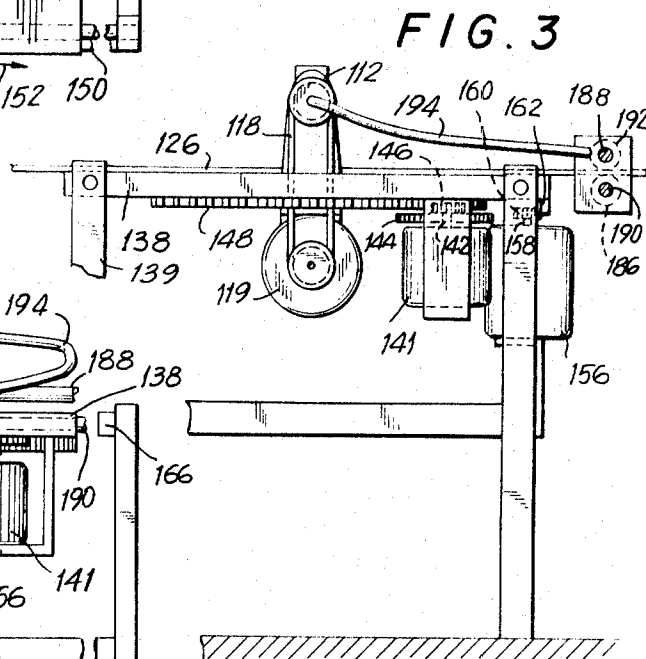
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[57] ABSTRACT

Method and apparatus for providing relative oscillatory rotation between a sewing head and a web-like material feeding therepast to enable stitching thereof along a generally wave-form like pattern.

11 Claims, 4 Drawing Figures





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METHODS AND APPARATUS FOR PROCESSING WEB-LIKE MATERIALS

This application is a continuation-in-part of co-pending application Ser. No. 711,131 filed Mar. 6, 1968 now U.S. Pat. No. 3,520,260 granted July 14, 1970 and the entire disclosure thereof is hereby incorporated herein by reference as fully and completely as if physically included herein.

This invention relates generally to methods and apparatus for stitching web-like material and, more particularly, to methods and apparatus for stitching web-like material along a variable or wave-form like pattern.

The aforesaid co-pending parent application discloses and claims apparatus for supporting a web-like material for feeding past a sewing head and rotating the material support means along an arcuate path about the stitch forming location. For certain applications, however, as, for example, where the web-like material is in the form of a large roll or is continually processed along a production line, it is advantageous to rotate the stitch forming apparatus about the stitch forming location and feed the web-like material linearly therepast.

Accordingly, it is a primary object of the present invention, in addition to each of the objects and important features set forth in the aforesaid co-pending parent application, to provide methods and apparatus for providing relative oscillatory rotation between stitch forming apparatus and web-like material feeding therepast.

Another primary object of the present invention, in addition to each of the foregoing objects, is the provision of means and apparatus for rotationally oscillating stitch forming means about the stitch forming location during feeding of material therepast.

Another primary object of the present invention, in addition to each of the foregoing objects, is the provision of methods and apparatus for varying the oscillations of such stitch forming apparatus.

Yet another primary object of the present invention, in addition to each of the foregoing objects, is the provision of methods and apparatus of the class described which are economical, efficient, reliable, and adjustable.

The invention resides in the combination, construction, arrangement and disposition of the various component parts and elements incorporated in improved apparatus for providing relative rotational oscillation between stitch forming apparatus and web or sheet-like material feeding therepast and in the methods involved and utilized therein.

The present invention will be better understood and objects and important features other than those specifically enumerated above will become apparent when consideration is given to the following details and description, which when taken in conjunction with the annexed drawing and the aforesaid co-pending parent application describes, discloses, illustrates and shows a preferred embodiment or modification of the present invention and what is presently considered and believed to be the best mode of practicing the principles thereof. Other embodiments or modifications may be suggested to those having the benefit of the teachings herein, and such other embodiments or modifications are intended to be reserved especially as they fall within the scope and spirit of the subjoined claims.

In the drawing:

FIG. 1 is a top plan view of apparatus constructed in accordance with the principles of the present invention;

FIG. 2 is a front elevational view of the apparatus of FIG. 1;

FIG. 3 is an end elevational view of the apparatus of FIG. 1; and

FIG. 4 is an enlarged cross-sectional elevational view taken along line 4-4 of FIG. 1.

With reference now to the drawing, there is shown an illustrated apparatus constructed in accordance with the principles of the present invention and designated generally by the reference character 110.

At the outset, it is to be expressly understood that while the present invention is herein shown and illustrated as applied to

apparatus for providing stitching of an elongated web of textile material in a generally sinusoidal wave-like pattern, the present invention is also utilizable for the production of substantially any desired wave-like pattern, either continuous or discontinuous, as well as being utilizable for the production of stitching following substantially any desired pattern, including the following of an irregular contour as, for example, under manual or automatic, such as numerical, control. For example, and without limitation, the present invention may produce a generally sinusoidal scalloping, sawtooth scalloping, zig-zag scalloping, concave or convex curvilinear scalloping or substantially any combination thereof as well as following substantially any irregular contour or configuration.

Further, the present invention is utilizable for the formation of elongated webs of material, as shown, either as an end product, as an intermediate product for sale or utilization in additional fabrication, for securement with a backing panel of material simultaneously with the formation thereof, or for direct application to panels, webs or sheets of material. The present apparatus may also be utilized for providing stitching along a continuous web of material, a chain or plurality of discreet pieces of material either secured one to the other in chain-like fashion or discreet pieces of material carried, for example, on a continuous backing strip or web or on a plurality of generally parallel backing strips or belts, either in roll form or in continuous conveyor form. Again, the foregoing is by way of example only, and without limitation. Yet further, the present invention is susceptible to use with stitch-forming equipment, as shown, or with substantially any other processing or fabrication equipment, such as, by way of example and without limitation, printing wheels, adhesive apparatus, cutting equipment, perforating equipment, forming equipment, or the like, as well as various stitch-forming apparatus, such as, for example, zig-zag stitch forming apparatus, chain stitch forming apparatus, lockstitch forming apparatus, faggoting stitch forming apparatus, over edge stitch forming apparatus, or the like.

The apparatus 110 shown and illustrated comprises a sewing apparatus 112 having drive means 114 drivingly associated therewith. The sewing apparatus 112 and drive apparatus 114 therefor may, for example, be adjustably structurally associated with a support platform 116 which, in turn, may be movable as hereinafter more fully described in detail, to provide movement relative to a web of material 126.

The sewing head 112 may be of substantially any desired construction and design such as is well known in the sewing machine art and further description thereof is not deemed necessary, other than that the sewing head 112 may be driven, generally at a constant speed, although the speed thereof may be varied independently. The drive means 114 may, for example, comprise a drive belt 118 extending between the drive pulley of the sewing apparatus 112 and a pulley driven by an electric motor 119. The sewing head may comprise a needle 120 driven from the drive belt 118 in the well known stitch forming manner to produce, for example, a lockstitch extending along a desired pattern relative the web of material 126, as indicated by the reference character 122. The sewing head 112 may further be provided with feed dogs, not shown, for feeding the web of material 126 relative the needle 120, as, for example, in the direction indicated by the arrow 134. There may be also provided a pressure foot 130 which acts upon the web of material 126 to hold the material against the bed or floor plate of the stitch forming apparatus. The amount of or rate of movement of the fabric 126 in the direction of the arrow 134 may be projected in a well-known manner to have a predetermined correlation of movement of the needle 120. Normally, this adjustment is made for the purpose of setting desired spacing between the stitches 122. If desired, the correlation may be further automatically adjusted or modified with reference to the apparatus 114 which, in addition to the sewing machine drive motor 119 may also comprise a table 138 upon which the platform 116 is rotatably carried with the table 138 being reciprocable generally transversely the

direction of travel of the web of material 126. Accordingly, by rotation of the platform 116 and lateral movement of the table 138, the combined rotation and movement of the sewing apparatus 112 about the processing location defined by the intersection of the needle 120 and the web of material 126, the desired wave-form like stitching without sideward drag or snagging of the web of material relative to the feed dogs will be achieved. The platform 116 which may, as shown, be generally circular in configuration may be supported upon a stand assembly 136 comprising, for example, a work surface or table 138 supported on a leg assembly 139. Means, such as a generally annular ballbearing assembly 140 adapted to resist both radial and thrust loading may be disposed between the rotatable platform 116 and the table 138, as shown particularly in FIG. 4 so that the platform 116 may freely rotate. It is to be expressly understood, however, that the particular rotational mounting means shown and illustrated is exemplary only, and without limitation, and that many diverse rotational or oscillatory mounting arrangements may be utilized without departing from the scope of the present invention. The oscillatory drive apparatus 114 may comprise, for example, a motor 141 which is preferably either of a slow speed type or a gear head type so as to provide a relatively slow speed output from a shaft 142 and is preferably electrically reversible. Structurally associated with the output shaft 142 for rotation therewith, there may be provided a gear 146 operably associated with a ring gear segment 148 operatively connected with the platform 116 so that upon rotation of the output shaft 142, the gear segment 148 will be moved therepast and the platform 116 rotated about its center of rotation. If the motor 141 is periodically reversed, the platform 116 will be oscillated around its center of rotation. Other motion transmission means, such as, for example, linkage systems, cam systems, a linear motor, hydraulic or pneumatic cylinders, segmented gears, clutch and gear drives, and the like, may be provided for rotating the platform 116 and sewing head 112 without departing from the scope of the present invention.

The motor 141 may be of a fixed or a variable speed variety and, in fact, the shaft 142 may be driven, if desired, from the motor 119 or both the sewing head 112 and the apparatus 114 may be driven from a common motor or shaft. It is believed readily obvious that variations in the speed of the motor 141 will produce variations in the period of the wave-like form pattern produced on the material 126 and that variations in the amplitude of the oscillations will produce variations in the amplitude or depth of the wave-like form pattern. Moreover, the speed control may be automatically controlled or varied to produce yet further modifications to the wave-form like pattern. Yet still further, the processing apparatus or sewing head 112 may similarly be of a variable stitch variety and automatically controlled in relation to the apparatus 114 to provide yet further modifications, variations and varieties to the wave-form like pattern produced. Moreover and yet still further, the motor 141 may, if desired, comprise a reversible actuator or control motor controlled by any one of a number of diverse means, including tape control, punch card control, computer control, pattern control, and the like, so as to produce any desired angular position and orientation of the sewing head 112 which may yet further be provided with means for providing linear actuation and movement thereof so that the needle 120 thereof may follow substantially any desired pattern of stitching.

If the web of material 126 is sufficiently flexible, mere rotation of the platform 116 during operation of the sewing head 112 may be sufficient to produce the wave-form like line of stitching without pulling, bunching, or the like, of the web of material 126. This would be particularly true if the needle 120 were at substantially the center of the platform 116 so that no relative transverse translation of the needle 120 would occur during such rotation.

For wider scalloping or for stiffer material, the flexibility of the fabric web 126, of itself, may not be sufficient to prevent bunching or pulling. To enable the sewing head 112 to

traverse during the formation of the wave-form like stitching, so that the sewing needle will follow the desired line of stitching without stressing the fabric web 126, the table 138 may be mounted on a plurality of rails 150 so as to be reciprocable back and forth generally transversely of the direction of movement of the web of fabric 126, as indicated by the arrow 152. The platform 116, as previously indicated, is rotatable relative to the table 138, as indicated by the arrow 154. The table 138 may be driven or reciprocated along the rails 150, as by means of a motor 156 having an output shaft 158 which, in turn, drives a pinion gear 160 operatively engaged with a rack 162 mounted with the table 138. The motor 156 may be attached to the table frame 139 so that upon rotation thereof, the table 138 would be driven laterally along the rails 150. The motor 156 may be of the electrically reversible type and may be controlled, for example, by means of limit switches responsive to movement of the table 138 or may be controlled by external programming means. Further, the motor 156 is preferably of a variable speed variety whose speed may be either pre-set or programmed to provide the desired wave-form pattern. Other motion transmission means, such as, for example, linkage systems, cam systems, linear motor, hydraulic or pneumatic cylinders, segmented gears, clutch and gear drives, and the like, may similarly be utilized for moving the table 138. The motor 156 may also comprise an actuator or control motor and may be controlled, for example, by any of a number of diverse means, including tape control, punchcard control, computer control, pattern control, and the like. The motors 156 and 141 may also be interconnected and controlled, for example, by limit switches controlled by the respective or opposite ones of the table 138 and platform 116. For example, a wave-form pattern such as that shown in FIG. 1 may be produced by having the platform 116, for example, initially positioned at an angular orientation corresponding to that portion of the wave-form stitching 122 designated by the reference character *a* with the motor 156 moving the table 138 toward the left, as seen in FIG. 1 so as to produce that portion of the pattern indicated by the letter *a*. At the lefthand extreme limit of the table 138, a limit switch may be provided for automatically stopping the motor 156 and starting the motor 141 so as to rotate the platform 116 in a generally counterclockwise direction so as to produce that portion of the stitch pattern 122 designated by the reference character *b*. As the platform 116 reaches the limit of its counterclockwise rotation, a limit switch can be actuated thereby to stop the rotation of the motor 141 and again energize the motor 156 in the opposite direction so as to move the table 138 toward the right, as shown in FIG. 1 to thereby form that part of the wave-form pattern 122 designated by the reference character *c*. As the table 138 reaches the extreme righthand extent of the travel, a third limit switch may be actuated thereby to again stop the motor 156 and energize the motor 141, again in the opposite direction so as to rotate the platform 116 in a clockwise direction so as to produce that portion of the wave-form pattern designated by the reference character *d*. Finally, when the platform 116 reaches the extreme limit of its clockwise travel, a fourth limit switch may be actuated thereby to stop the motor 141 and again actuate the motor 156 to again drive the table 138 toward the left, and so on, to sequentially repeat the pattern. The various limit switches may be adjustable relative to the platform 116, table 138, and rails 150, so that the pattern produced may be readily controlled. If desired, the motors need not be run only one at a time but may, depending upon the pattern to be produced, be run simultaneously or in overlapping sequence and at the same or at differing speeds.

While substantially any of a number of different types of detectors or limit switches may be utilized to control the actions of the motors 141 and 156 or, in fact, the motors 141 and 156 may be maintained operating while they are selectively connected with the respective pinion gears for forward and/or reverse driving thereof for example through clutch and transmission means, there is shown an illustrated, for exemplary

purposes only, and without limitation, a plurality of detectors or limit switches 164 and 166 for responding to transitory movement of the table 138 along the rails 150 and a second plurality of detectors or limit switches 168 and 170 for responding to rotary movement of the platform 116 relative to the table 138. The switches 164, 166, 168 and 170 may be adjustably mounted with the supports 139 and table 138 so as to be positioned for engagement, respectively, by the platform 116 and the table 138 while being positioned so as to be so contacted at the desired point of travel thereof. Further, actuator elements 172, 174, 176 and 178 may be adjustably mounted for movement with the platform 116 and table 138, respectively, so as to engage the respective ones of the controls or limit switches 164, 166, 168 and 170 when the platform 116 and table 138 have reached the desired orientations. The controls or limit switches 164, 166, 168 and 170 may, for example, comprise mechanical limit switches, capacity control switches, magnetic switches, photocell switches, pneumatic valves, hydraulic valves, and the like, without limitation, as may be suitable.

As heretofore pointed out, for the production of certain patterns of stitching it is desirable that the needle 120 of the sewing head 112 be positioned at the center of rotation of the platform 116. For other patterns of stitching, it may be desirable to position the needle 120 of the sewing head 112 eccentrically of the center of rotation of the platform 116 so that rotation of the platform 116 will produce, in addition to a change in orientation of the feed dogs of the sewing head 112, a physical translation or arcuate movement of the needle 120, particularly for generating smooth curves, as set forth above. To enable such an adjustment to be readily made, the sewing head 112 may be movably mounted with the platform 116. For example, the platform 116 may be provided with an elongated slot 180 provided with rails or ways 182 extending generally longitudinally thereof with which the sewing head 112 is adapted to be engaged and movable along. Means, such as bolts, clamps, and the like, may be provided for locking the sewing head 112 in the desired position within the slot 180.

Depending on the texture, size, and constitution of the web of material 126, feeding thereof across the apparatus 110 may be accomplished solely by means of the feed dogs of the sewing head 112, by means of a tension type takeup which would apply a gentle tension to the web of material 126 in the direction of feed which was sufficiently gentle so as to not override the feed dogs of the sewing head 112 as by being provided with, for example, a slip clutch or spring biased idler roll, or may be fed relative to the apparatus 110 by an intermittent feeding device. For example, such an intermittent feeding device may comprise a plurality of rollers 184 and 186, rotatable, for example, on a pair of spindles or shafts 188 and 190 disposed generally perpendicular the direction of travel of the web 126 with the web 126 being squeezed or engaged between the rollers 184 and 186. One or both of the rollers 184 and 186 may, for increased frictional engagement with the web 126 be provided with an elastomeric or soft cover. To provide an intermittent feed for the rollers 184 and 186, at least one of the rollers, for example, the roller 184, may be intermittently driven through an intermittent drive mechanism 192 which in turn may be synchronized and driven directly from the sewing head 112, as by means of a flexible shaft 194. Since the flexible shaft 194 drives the feed roll 184 and, in turn, is driven off the main shaft of the sewing head 112, the intermittent feeding movement of the rollers 184 and 186 may be synchronized and maintained in synchronization with the feeding movement of the feed dogs of the sewing head 112, regardless of the speed at which the sewing head 112 is driven and regardless of any slippage or stoppage of the drive belt 118 or speed variation of the motor 119.

While the invention has been described, disclosed, illustrated and shown in terms of an embodiment or modification which it has assumed in practice, the scope of the invention should not be deemed to be limited by the precise embodiment or modification herein described, disclosed, illustrated,

shown or suggested, such other embodiments or modifications as may be suggested to those having the benefit of the teachings hereof being intended to be reserved especially as they fall within the scope and spirit of the claims hereto appended.

What is claimed is:

1. Apparatus for processing web-like materials comprising, in combination, means for supporting at least a portion of such materials during movement past a processing location, means for performing a process on such material during movement thereof past such processing location, means for providing feeding movement of such material past such processing location and means for cyclically rotating said processing means so that the directional orientation of such processing means may be varied during movement of such material past said processing means, wherein said feeding means is structurally associated with said processing means so that variations in the relative rotational orientation during feeding will produce a transverse relative shifting between said feed means and the material as a result of the feeding movement and thereby a transverse shifting of the processing operation relative the material and wherein said rotating means comprises, in turn, means for cyclically oscillating said processing means to produce a wave-form-like pattern.

2. Apparatus defined in claim 1 wherein said rotational means is constructed and arranged to rotate about the processing location.

3. Apparatus defined in claim 1 wherein said rotation means is constructed and arranged to rotate eccentric the processing location.

4. Apparatus defined in claim 1 further comprising means for varying the center of rotation of said rotating means.

5. Apparatus defined in claim 1 wherein said rotating means and said support means comprise, in turn, a rotatable platform and wherein said feeding means and said processing means comprise, in turn, a sewing head mounted for movement therewith.

6. Apparatus defined in claim 5 wherein said rotating means further comprises, reversible motor means for selectively rotating said platform in either of a plurality of directions and control means for said motor means to enable intermittent cyclic reversing operations thereof.

7. Apparatus for processing web-like materials comprising, in combination, means for supporting at least a portion of such materials during movement past a processing location, means for performing a process on such materials during movement thereof past such processing location, means for providing feeding movement of such material past such processing location and means for cyclically rotating said processing means so that the directional orientation of such processing means may be varied during movement of such material past said processing means wherein said feeding means is structurally associated with said processing means so that variations in the relative rotational orientation during feeding will produce a transverse relative shifting between said feed means and the material as the result of the feeding movement and thereby a transverse shifting of the processing operation relative the material and wherein said rotating means and said support means comprise a platform, a table and a frame; said platform being rotatable supported by said table, said table being movably supported by said frame; means for rotating said platform relative said table; means for moving said table relative said frame generally transversely of the direction of material feed; and means for controlling said rotating and moving means.

8. Apparatus defined in claim 7 wherein said table moving means comprises a reversible, variable speed motor, said rotating means comprises a reversible, variable speed motor and said control means comprises means for sequentially, automatically and cyclically actuating, stopping and reversing said motors so that the process will be performed on the material in a repetitive, wave-like pattern.

9. Apparatus defined in claim 8 wherein said control means comprises table motor switch means structurally associated

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with said table for controlling said table moving motor means and actuation in response to the position of said platform and actuating motor switch means structurally associated with said frame for controlling said platform moving motor means and actuation in response to the position of said table so that said platform motor means will be automatically energized to rotate said platform when said table reaches a pre-determined position and said table motor will be automatically energized to translate said table when said platform reaches a pre-determined rotational position.

10. Apparatus defined in claim 9 wherein said table motor switch means and said platform motor switch means are constructed and arranged to reverse the respective motors upon actuation thereof.

11. Apparatus defined in claim 9 further comprising means

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for de-energizing said table motor when said platform motor becomes energized and de-energizing said platform motor when said table motor becomes energized so that a sequence of motion will be automatically and repetitiously produced whereby said table will translate to one extreme position thereof whereupon it will actuate said platform motor switch means to stop the table movement and initiate rotation of said platform to one extreme position thereof to actuate said table motor switch means to stop rotation of said platform and initiate reverse movement of said table to the other extreme position thereof for actuating said platform motor switch means to stop translation of said table and initiate rotation of said platform in the other direction of travel.

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