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Singh

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(54) **SYSTEM AND METHOD FOR PRODUCING CORELESS FABRIC ROLLS**

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(52) **U.S. Cl.** **242/527**; 242/530.1; 242/531; 242/533.4; 242/542; 242/542.3
(58) **Field of Search** 242/527, 530.1, 242/531, 533.4, 533.6, 542, 542.3

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(57) **ABSTRACT**

A system for producing coreless fabric rolls includes a feed station **(12)** operable to supply a leading edge of a fabric web **(24)** from a parent roll **(18)**. The system includes a first tucking station **(132)** operable to position the leading edge of the fabric web **(24)** adjacent one of a plurality of spindles **(48, 50, 52)** coupled to a turret **(46)**. The system also includes a winding station **(38)** comprising a winding roller **(36)**. The winding station **(38)** is operable to receive the leading edge in a nip defined by the spindle **(48, 50, 52)** and the winding roller **(36)** and wind the fabric web **(24)** into a fabric roll about the spindle **(48, 50, 52)**. The system also includes a cutting station **(40)** operable to separate the fabric roll from a remaining portion of the fabric web **(24)**. The system also includes a second tucking station **(42)** operable to receive the spindle **(48, 50, 52)** from the winding station **(36)** and wind a trailing edge of the fabric roll about the fabric roll.

39 Claims, 6 Drawing Sheets

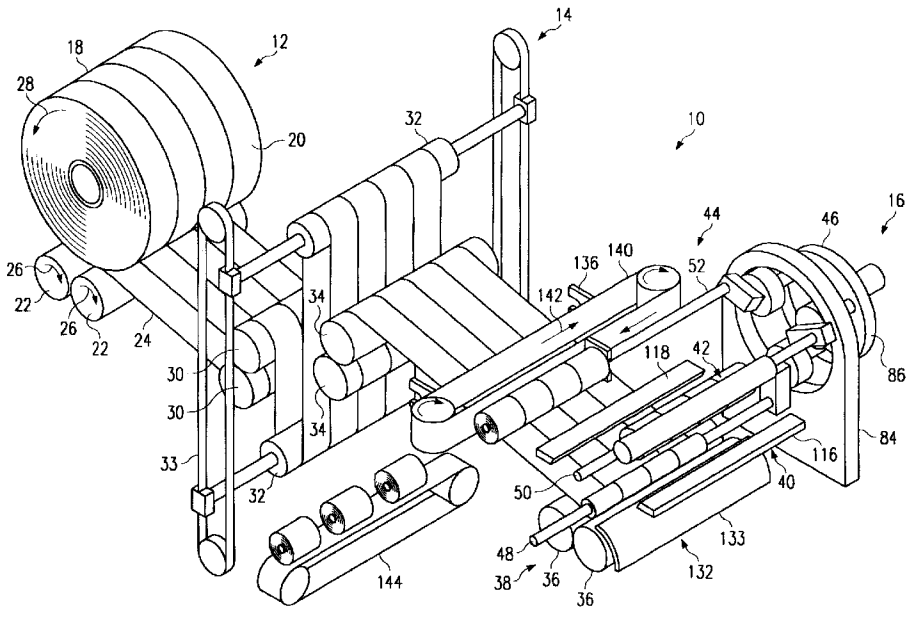
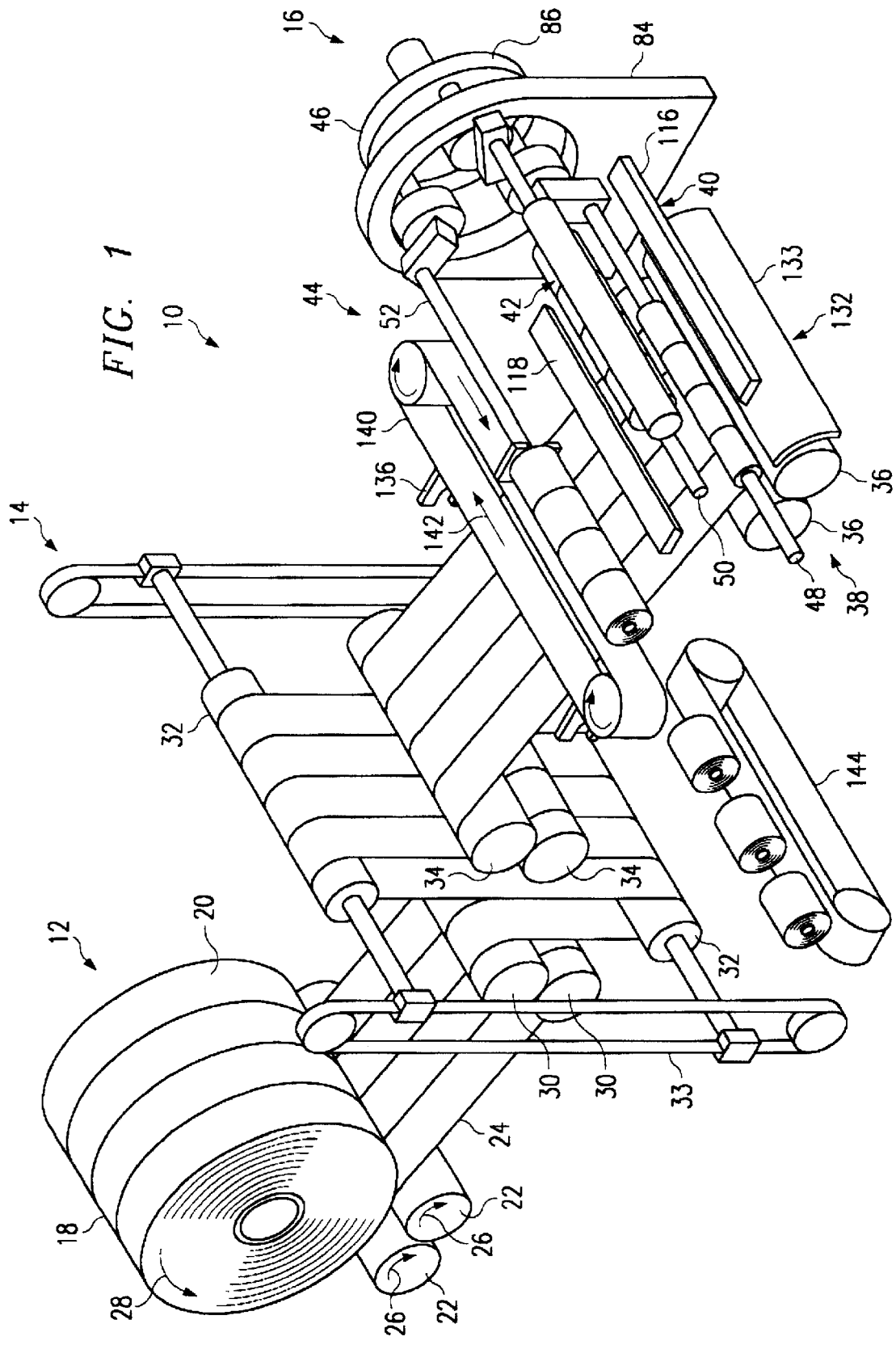


FIG. 1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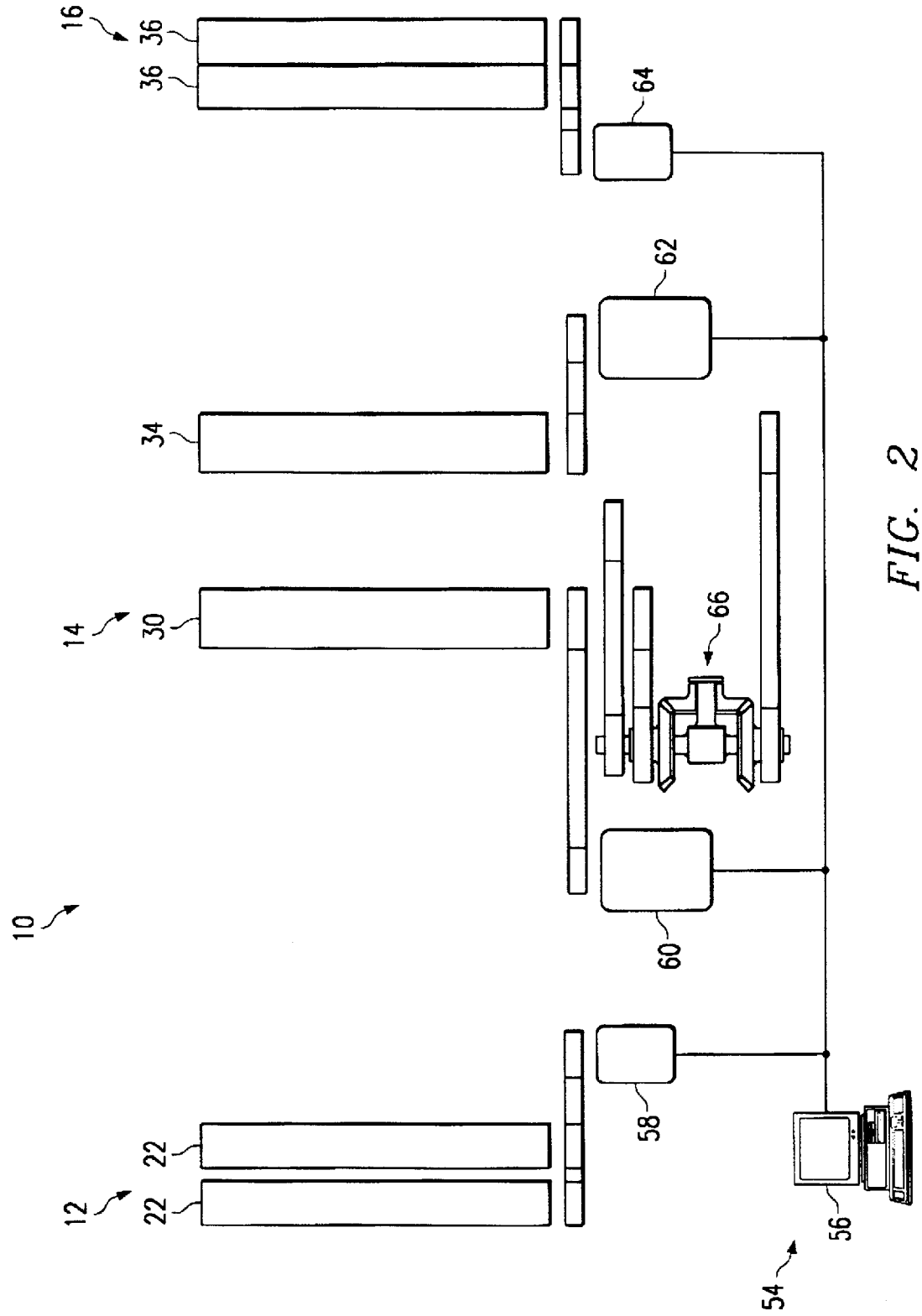

FIG. 2

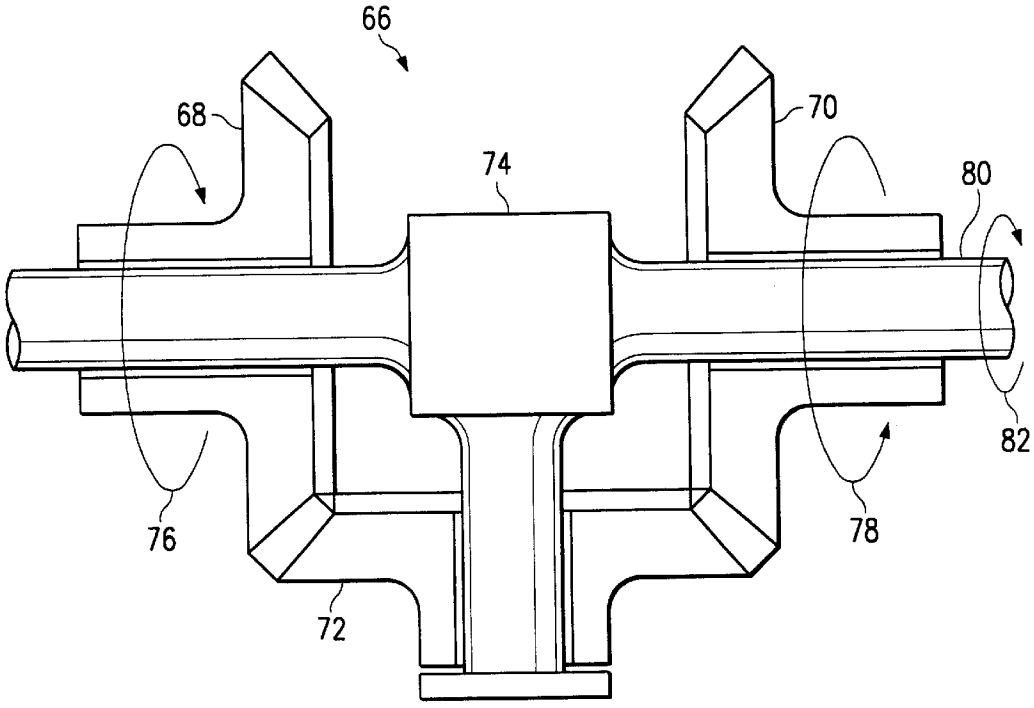

FIG. 3

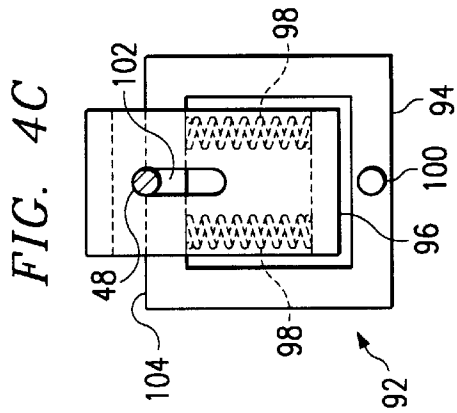

FIG. 4C

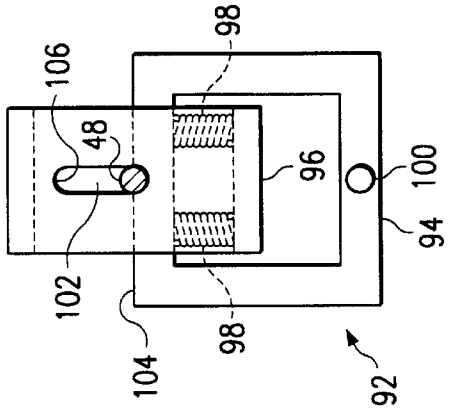

FIG. 4D

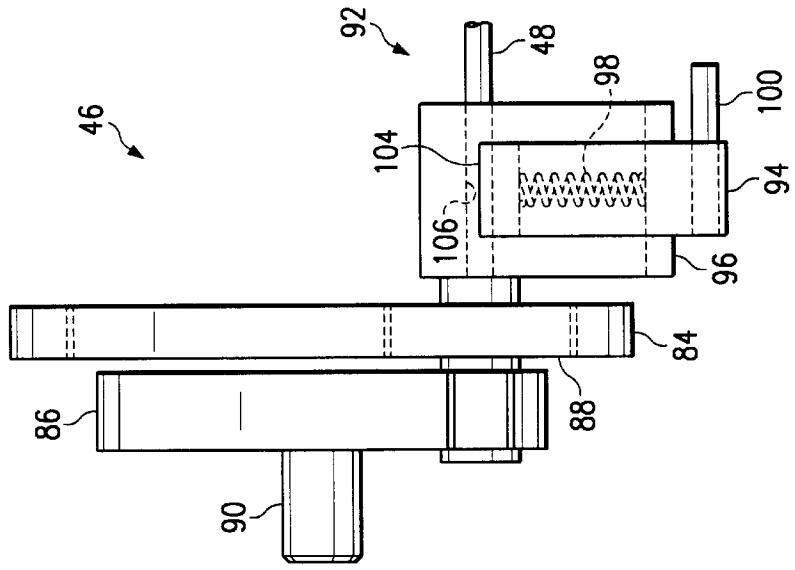

FIG. 4B

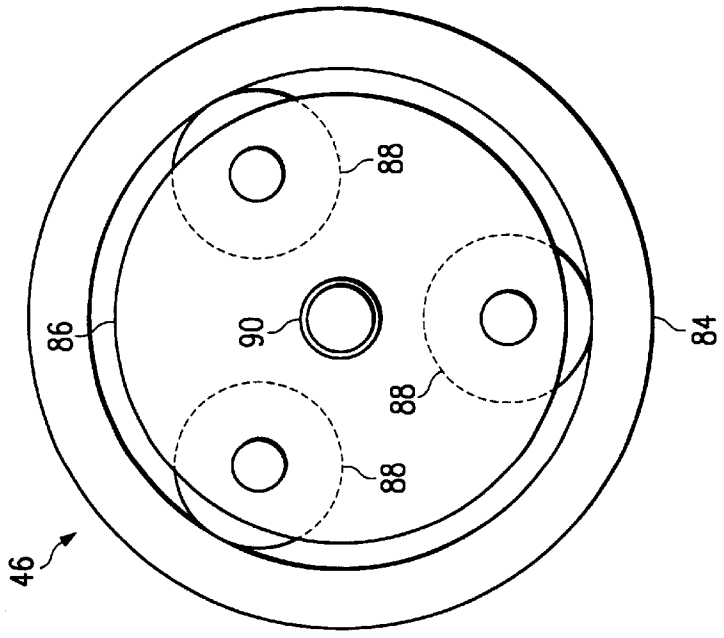

FIG. 4A

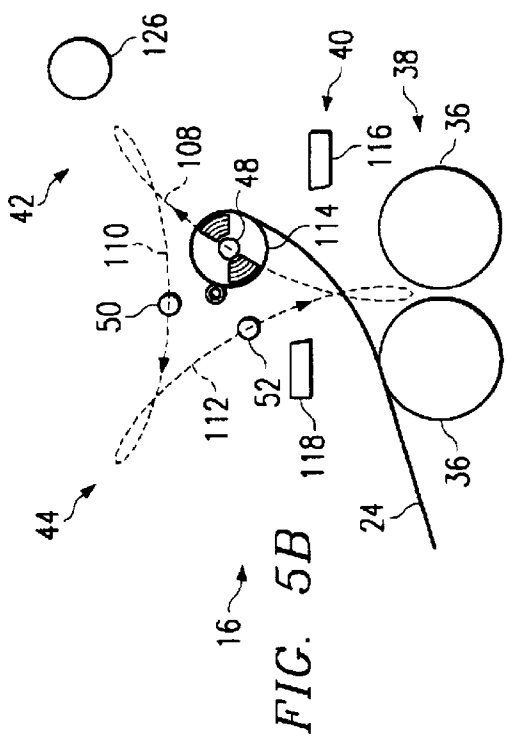

FIG. 5B

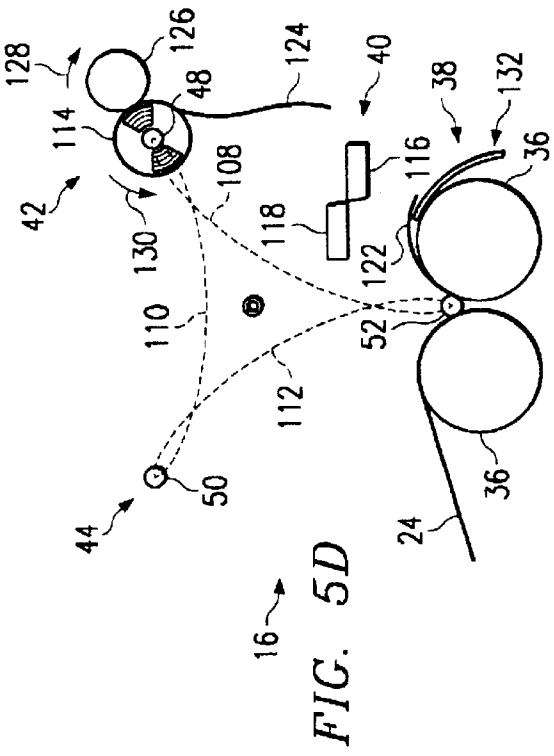

FIG. 5D

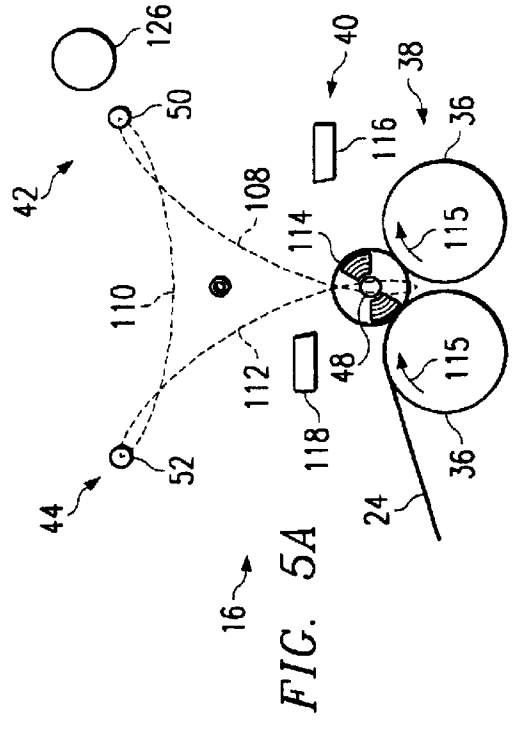

FIG. 5A

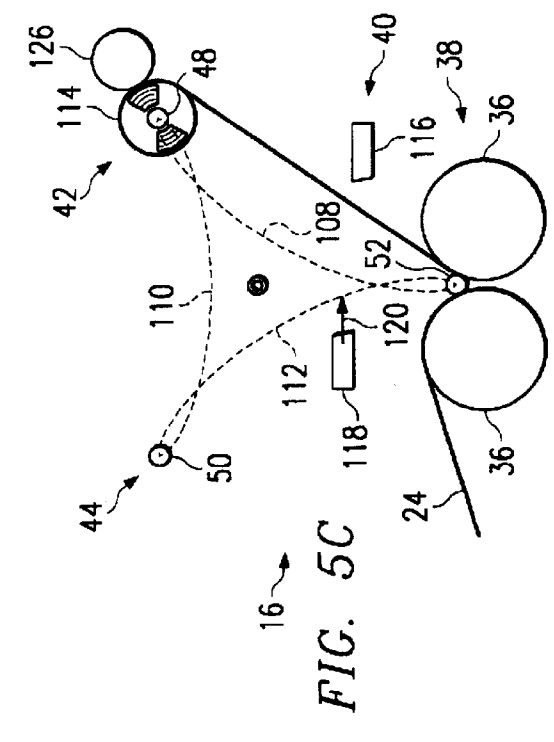

FIG. 5C

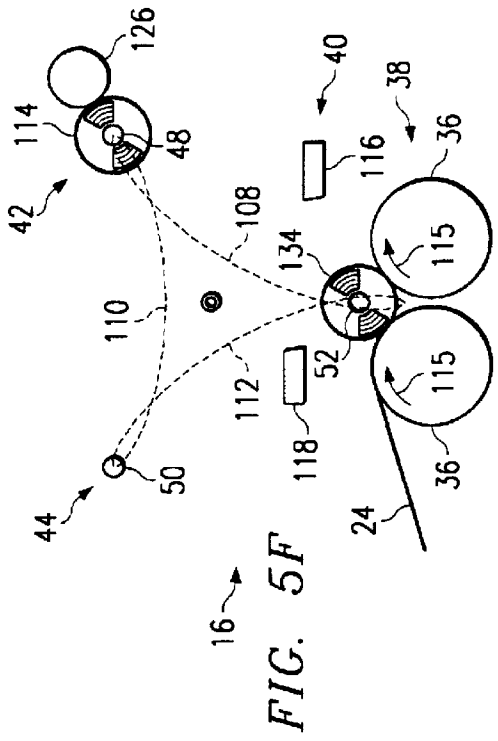

FIG. 5F

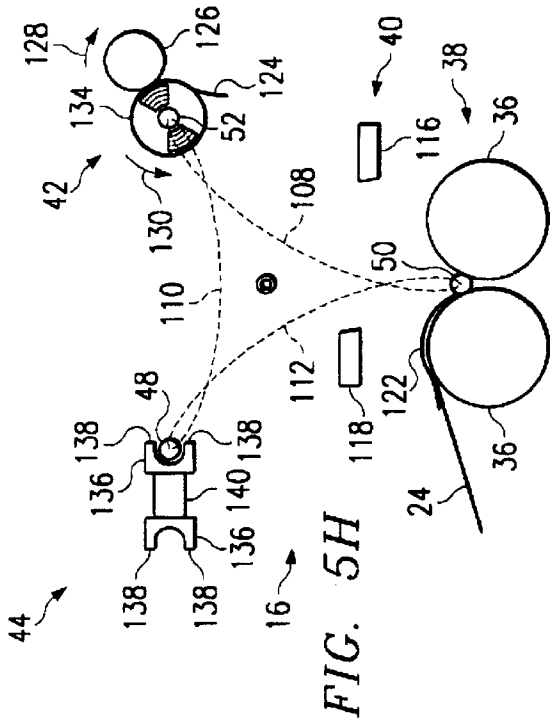

FIG. 5H

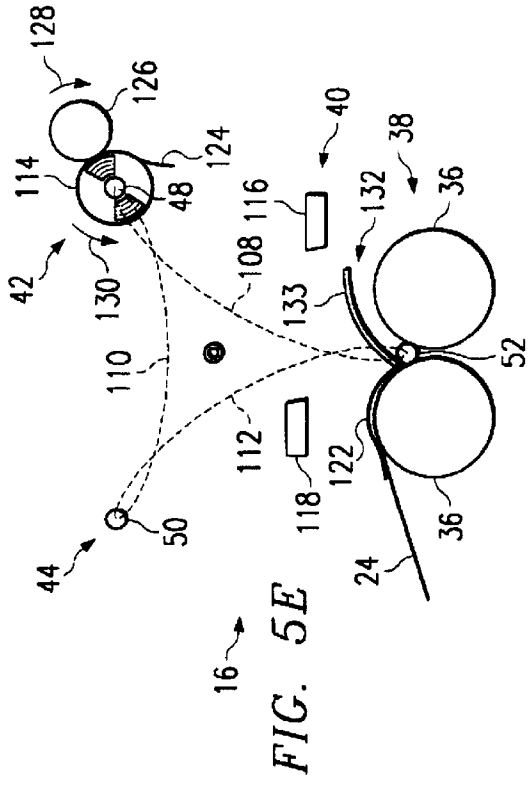

FIG. 5E

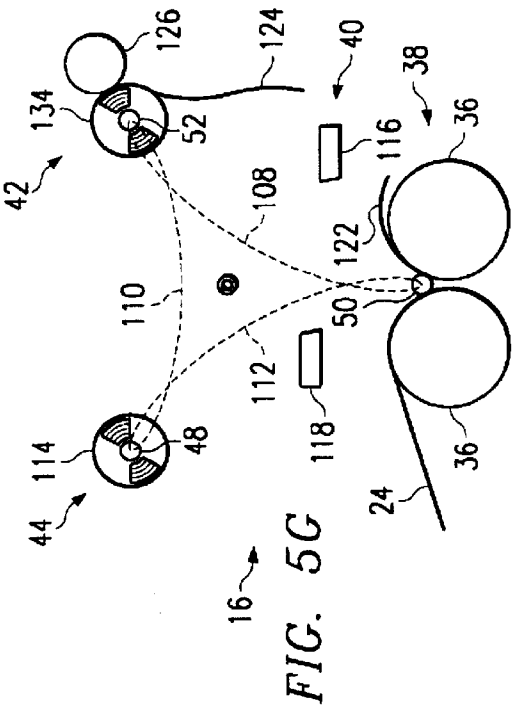

FIG. 5G

SYSTEM AND METHOD FOR PRODUCING CORELESS FABRIC ROLLS

TECHNICAL FIELD OF THE INVENTION

The present invention relates generally to the field of fabric or paper converting processes and machinery, and more particularly, to a system and method for producing coreless fabric rolls.

BACKGROUND OF THE INVENTION

Fabric rewind systems are generally used to unwind paper or fabric from a large parent roll and conduct the fabric through a finishing or converting operation. For example, the converting operation may include rewinding the fabric into a roll of a specific size which is generally smaller than the size of the parent roll. For example, the system may be used to produce products such as rolls of sanitary or tissue paper.

An example of a fabric rewind system may include a plurality of mandrels coupled to a rotatable turret. The mandrels rotate in a circular path a fixed distance from an axis of the turret. As the turret rotates, cores are placed on each mandrel, adhesive or glue is applied to the cores, and then the fabric is brought into contact with the cores. The cores are then driven in rotation by rotating the mandrels to wind the fabric about the cores.

An example of a coreless fabric rewind system may include a pair of winding rollers and an actuator to adjust the position of one winding roller relative to the other winding roller. The winding rollers are brought into contact with each other to sever fabric disposed between the winding rollers. As the winding rollers rotate in the same direction, the severed end of fabric curls on itself to begin the formation of a fabric roll. The actuator controls the position of one of the winding rollers to allow for an increase in diameter of the fabric roll during formation.

Prior systems suffer several disadvantages. For example, systems including rotating turrets may require actuators to adjust the position of either winding rollers or the turret prior to, during, and/or after the winding process to avoid interference between the fabric rolls, winding rollers, or other system components during rotation of the turret. Additionally, turret systems do not generally accommodate surface winding of the roll.

Coreless winding systems generally initiate winding by compressing the severed end of the fabric to roll the severed end back on itself to begin the fabric roll. Thus, this process compresses and flattens the fabric, thereby creating a hard center portion of the fabric roll.

SUMMARY OF THE INVENTION

Accordingly, a need has arisen for a system and method for producing coreless fabric rolls that increases the efficiency and reduces the amount of movement of system components. The present invention provides a system and method for producing coreless fabric rolls that address the short comings of prior systems and methods.

According to one embodiment of the present invention, a system for producing coreless fabric rolls include a winding station operable to wind a fabric web into a fabric roll about one of a plurality of spindles coupled to a turret. The system also includes a cutting station operable to separate the fabric roll from the remaining portion of the fabric web to form a leading edge of a fabric web and a trailing edge of a fabric reroll. The system includes a tucking station operable to receive the spindle from the winding station and wind the trailing edge about the fabric roll. The system further includes a stripping station operable to receive the spindle from the tucking station and remove the fabric roll from the spindle.

According to another embodiment of the present invention, a method for producing coreless fabric rolls include winding a fabric web about one of the plurality of the spindles to form a fabric roll at a first station. The spindles are coupled to a turret. The method includes transferring a spindle from the first station to a second station and separating the roll from the fabric roll. Separating the fabric roll from the fabric web forms a leading edge of the fabric web and a trailing edge of the fabric roll. The method also includes winding the trailing edge about the fabric roll at the second station and transferring the spindle from the second station to a third station. The method further includes removing the fabric roll from the spindle at the third station.

The technical advantages of the present invention include providing a system and method for producing wound articles with increased efficiency over prior systems and methods. For example, according to one aspect of the present invention, a rotating turret transfers a plurality of spindles through different stations to produce a fabric roll. Thus, the present invention provides an increased cycle rate for producing fabric rolls.

Another technical advantage of the present invention includes reduced movement of system components, thereby increasing efficiency and decreasing the amount of time required to form fabric rolls. For example, according to one aspect of the present invention, a rotating turret transfers a plurality of spindles through different stations along a generally hypocycloidal path, thereby substantially eliminating interference between the fabric rolls and other system components. Additionally, the present invention substantially eliminates a requirement to translate various system components toward or away from the fabric roll during formation of the fabric roll or to transfer the spindles between different stations.

Other technical advantages of the present invention will be readily apparent to one skilled in the art from the following figures, descriptions and claims.

BRIEF DESCRIPTION OF THE DRAWINGS

For a more complete understanding of the present invention and the advantages thereof, reference is now made to the following description taken in connection with the accompanying drawings, in which:

FIG. **1** is a diagram illustrating a system for producing coreless fabric rolls in accordance with an embodiment of the present invention;

FIG. **2** is a diagram illustrating a control system for the system for producing coreless fabric rolls in accordance with the an embodiment of the present invention;

FIG. **3** is a diagram illustrating a differential of an accumulator for the system in accordance with an embodiment of the present invention;

FIGS. **4A–4D** are diagrams illustrating a turret of the system in accordance with the embodiment of the present invention; and

FIGS. **5A–5H** are diagrams illustrating the production of coreless fabric rolls in accordance with an embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

Embodiments of the present invention and the advantages thereof are best understood by referring to the following

descriptions and drawings, wherein like numerals are used for like and corresponding parts of the drawings.

FIG. **1** is a diagram illustrating a system **10** for producing coreless fabric rolls in accordance with an embodiment of the present invention. System **10** includes a feed station **12**, and accumulator **14** and a rewind station **16**. Feed station **12** comprises a parent roll of fabric **18** rotatably mounted to an unwind support (not explicitly shown). Parent roll **18** may comprise paper, woven material, non-woven material or other suitable materials for producing coreless fabric rolls. For example, parent roll **18** may include woven or non-woven cotton or rayon/polyester fabric which may be used for producing rolled bandages. Parent roll **18** may also comprise one or more roll units **20** of fabric.

Feed station **12** also comprises unwind rollers **22** for feeding a fabric web **24** downstream from parent roll **18**. Unwind rollers **22** rotate in the direction indicated by arrows **26** to control the feed rate of fabric web **24** downstream from parent roll **18**. Thus, in operation, fabric web **24** is unwound from parent roll **18** by rotating parent roll **18** in a direction indicated by arrow **28**. As used throughout this description "downstream" relates to the direction of fabric travel though system **10**, whereas the term "upstream" refers to a direction opposite that of fabric travel.

Fabric web **24** is fed downstream to feed rollers **30** and accumulator **14**. Accumulator **14** comprises festoon rollers **32** that move toward or away from each other to discharge or accumulate, respectively, a reserve portion of fabric **24**. Festoon rollers **32** may be driven by a chain or timing belt **33** to control an amount of the reserve portion of fabric web **24** accumulated or discharged; however, other suitable devices or methods may be used to control the movement and speed of festoon rollers **32**.

In operation, unwind rollers **22** and feed rollers **30** feed fabric web **24** from parent roll **18** to accumulator **14** at a substantially constant rate of speed, thereby maintaining a substantially constant amount of tension in fabric web **24**. Unwind rollers **22** and feed rollers **30** may be electrically and/or mechanically coupled such that unwind rollers **22** and feed rollers **30** operate at substantially the same speed. During winding of fabric rolls at rewind station **16**, accumulator **14** accumulates the reserve portion of fabric web **24** to accommodate a reduced feed rate of fabric web **24** to rewind station **16**. In response to an increase in the feed rate of fabric web **24** to rewind station **16**, accumulator **14** discharges the reserve portion of fabric web **24**. Thus, accumulator **14** accumulates the reserve portion of fabric web **24** when the feed rate to rewind station **16** is less than the feed rate of feed station **12** and discharges the reserve portion of fabric web **24** when the feed rate to rewind station **16** is greater than the feed rate of feed station **12**.

Fabric web **24** is fed downstream from accumulator **14** through draw rollers **34** to rewind rollers **36** of rewind station **16**. Draw rollers **34** and rewind rollers **36** may be electrically and/or mechanically coupled such that draw rollers **34** and rewind rollers **36** operate at substantially the same speed, thereby maintaining a substantially constant tension of fabric web **24**. Additionally, feed rollers **30** and draw rollers **34** operate to isolate accumulator **14** to maintain a substantially constant tension of fabric web **24**.

Rewind station **16** comprises a winding station **38**, a cutting station **40**, a tucking station **42**, and a stripping station **44**. Rewind station **16** also includes a turret **46** comprising spindles **48**, **50** and **52**. In operation, turret **46** transfers spindles **48**, **50**, and **52** in a three-cusp hypocycloidal path between stations **38**, **42**, and **44**. Briefly, fabric web **24** is wound about spindles **48**, **50**, and **52** at winding station **38** using winding rollers **36** as each spindle **48**, **50**, and **52** is transferred through winding station **38**. Cutting station **40** severs the wound fabric rolls from fabric web **24** and tucking station **40** winds any remaining fabric after severing about the wound fabric rolls. The wound fabric rolls are removed from spindles **48**, **50**, and **52** at stripping station **44**.

FIG. **2** is a diagram illustrating a control system **54** of system **10** in accordance with an embodiment of the present invention. Control system **54** comprises a controller **56** and servo motors **58**, **60**, **62**, and **64**. Controller **56** comprises a computer, workstation, mini-computer, mainframe or other computing device. Controller **56** controls the operation of motors **58**, **60**, **62**, and **64**. For example, motor **58** may be slaved to motor **60**, and controller **56** may control the operation of motor **60** such that fabric web **24** is fed at a substantially constant rate of speed from parent roll **18** to accumulator **14**.

Additionally, for example, motor **64** may be slaved to motor **62**, and controller **56** may control the operation of motor **62** to control the feed rate of fabric web **24** from accumulator **14** to rewind station **16**. Thus, motors **62** and **64** may be controlled to deliver a predetermined length of fabric web **24** to rewind station **16** for producing fabric rolls.

As illustrated in FIG. **2**, accumulator **14** comprises a differential **66** to control operation of festoon rollers **32** to accumulate or discharge a reserve portion of fabric web **24**. For example, differential **66** may be mechanically coupled to feed rollers **30** and draw rollers **34** to control timing belt **33**. However, a servo motor or other suitable type of method or device may be used to control timing belt **33**.

FIG. **3** is a diagram illustrating differential **66** of system **10** in accordance with an embodiment of the present invention. Differential **66** comprises an input gear **68**, an input gear **70**, a spider pinion gear **72** and a spider **74**. Differential **66** receives input from feed rollers **30** through input gear **68** in the direction indicated by arrow **76**. Differential **66** also receives input from draw rollers **34** through input gear **70** in the direction indicated by arrow **78**. In operation, feed rollers **30** are operated at a substantially constant speed to provide a substantially constant feed rate of fabric web **24** to accumulator **14**. Input from draw rollers **34** is cyclic as fabric rolls are produced at rewind station **16**. Thus, differential **66** operates to regulate the position of festoon rollers **32** based on input speeds from feed rollers **32** and draw rollers **34**.

In operation, if the input from feed rollers **30** is greater than the input from draw rollers **34**, an output shaft **80** of spider **74** delivers output to timing belt **33** in the direction indicated by arrow **82**. If the input from feed rollers **30** is less than the input from draw rollers **32**, the output from shaft **80** of spider **74** is in a direction opposite that indicated by arrow **82**. If the input from feed rollers **30** equals the input from draw rollers **32**, festoon rollers **32** will remain in a substantially static condition. Thus, accumulator **14** accumulates or discharges a reserve portion of fabric web **24** using differential **66** based on the speeds of feed rollers **30** and draw rollers **34**.

FIGS. **4A–4D** are diagrams illustrating turret **46** of rewind station **16** in accordance with an embodiment of the present invention. Turret **46** comprises a fixed sun gear **84**, a planet carrier **86**, and planet gears **88** rotatably coupled to sun gear **84**. In operation, planet carrier **86** is rotated about the axis of shaft **90** of planet carrier **86**. As planet carrier **86** rotates, teeth (not explicitly shown) of planet gears **88** engage teeth

(not explicitly shown) of sun gear **84**, thereby causing rotation of planet gears **88**. Planet gears **88** are coupled to spindles **48**, **50**, and **52** such that spindles **48**, **50**, and **52** travel in a generally three-cusp hypocycloidal motion.

Referring to FIGS. **4**B and **4**C, spindles **48**, **50**, and **52** are coupled to planet gears **88** by spindle carriers **92**. Spindle carriers **92** each comprise a yoke **94**, a support **96**, and springs **98** disposed between yoke **94** and support **96**. Yoke **94** comprises an outwardly extending pin **100**. Support **96** comprises an opening **102** for receiving one of spindles **48**, **50**, and **52**. In operation, yoke **94** cooperates with support **96** such that springs **98** bias a clamping surface **104** of yoke **94** towards a clamping surface **106** of opening **102** of support **96** to secure spindles **48**, **50**, and **52** within opening **102**. Thus, spindle carriers **92** secure spindles **48**, **50**, and **52** in a predetermined position relative to a center axis of planet gears **88**.

Referring to FIG. **4**D, as spindles **48**, **50**, and **52** are positioned at winding station **38**, a downwardly directed force is applied to pin **100** to resist the bias force of springs **98** and direct yoke **94** downwardly relative to support **96**, thereby releasing spindles **48**, **50**, and **52** for movement within opening **102**. For example, the force may be applied to pin **100** from a pneumatically operated cylinder (not explicitly shown) controlled by controller **56**; however, other suitable devices or methods may be used to apply a downwardly directed force to pin **100**. As yoke **94** moves downwardly relative to support **96**, spindles **48**, **50**, and **52** also move downwardly within opening **102** so that spindles **48**, **50**, and **52** are positioned in a nip defined by adjacent winding rollers **36**. As fabric web **24** is surface wound about spindles **48**, **50**, and **52**, spindles **48**, **50**, and **52** are operable to move upwardly within opening **102** to accommodate an increasing diameter of fabric roll formed about spindles **48**, **50**, and **52**. After the fabric roll is formed to a desired size, pin **100** may be released, thereby causing yoke **94** to be biased upwardly from springs **98** to secure spindles **48**, **50**, and **52**. Thus, spindle carriers **92** releasably engage spindles **48**, **50**, and **52** to locate spindles **48**, **50**, and **52** in a position for surface winding of spindles **48**, **50**, and **52**, and to accommodate an increasing diameter of the fabric rolls during formation of the fabric rolls.

In the embodiment illustrated in FIGS. **4**B–**4**D, spindle carriers **92** comprise pin **100** for directing yoke **94** downwardly relative to support **96** to releasably engage spindles **48**, **50**, and **52**. However, other suitable methods or devices may be used to releasably engage spindles **48**, **50**, and **52** to provide positional control of spindles **48**, **50**, and **52** relative to winding rollers **36**.

FIGS. **5**A–**5**H are diagrams illustrating rewind station **16** in accordance with an embodiment of the present invention. Referring to FIG. **5**A, rewind station **16** comprises winding station **38**, cutting station **40**, tucking station **42**, and stripping station **44**. As described above, turret **46** rotates about a central axis to transfer spindles **48**, **50**, and **52** between winding station **38**, tucking station **42**, and stripping station **44** along generally three-cusp hypocycloidal paths **108**, **110**, and **112**.

As illustrated in FIG. **5**A, fabric web **24** is wound about spindle **48** using rewind rollers **36** of winding station **38** to form a fabric roll **114**. For example, fabric roll **114** may be surface wound about spindle **48** by rotating rewind rollers **36** in the direction indicated by arrows **115**. As described above, spindle carrier **92** disengages spindle **48** at winding station **38** to position spindle **48** in a nip defined by adjacent winding rollers **36**. Additionally, spindle carrier **92** disengages spindle **48** to allow rotation of spindle **48** caused by the rotation of winding rollers **36**. The speed and duration of winding may be controlled using control system **54** to form fabric roll **114** to a desired size. After fabric roll **114** has been wound to the desired size, rotation of winding rollers **36** and draw rollers **34** is dwelled to prevent feeding additional fabric web **24** to winding station **38**. Additionally, spindle carrier **92** engages spindle **48** in preparation for indexing of turret **46**.

FIG. **5**B illustrates an indexing of turret **46** to transfer spindles **48**, **50**, and **52** between stations **38**, **42**, and **44**. For example, spindle **48** and fabric roll **114** are transferred from winding station **38** to tucking station **42** along hypocycloidal path **108**. Additionally, spindle **50** is transferred from tucking station **42** to stripping station **44** along path **110**, and spindle **52** is transferred from stripping station **44** to winding station **38** along path **112**. Transferring spindles **48**, **50**, and **52** between stations **38**, **42**, and **44** along generally hypocycloidal paths **108**, **110**, and **112** prevents interference between components of rewind station **16** and alleviates additional movement of components of rewind station **16** to avoid interference.

As illustrated in FIG. **5**C, turret **46** has completed indexing and has positioned spindle **48** and fabric roll **114** at tucking station **42** and spindle **50** at stripping station **44**. Additionally, as described above, spindle carrier **92** disengages spindle **52** at winding station **38**, thereby allowing spindle **52** to be disposed within a nip defined by adjacent winding rollers **36**. As turret **46** indexes, fabric web **24** is positioned between spindle **52** and rewind rollers **36** such that fabric web **24** becomes secured between rewind rollers **36** and spindle **52** as spindle **52** reaches winding station **38**.

Cutting station **40** comprises shear blades **116** and **118** to separate fabric roll **114** from a remaining portion of fabric web **24**. As illustrated in FIG. **5**C, as spindle **52** reaches winding station **38**, spindle **52** causes a tension in a portion of fabric web **24** extending from winding station **38** to fabric roll **114** so that shear blades **116** and **118** may separate fabric web **24** from fabric roll **114**. For example, shear blade **118** may be moved in a direction indicated by arrow **120** to cooperate with shear blades **116** to separate fabric web **24** from fabric roll **114**. Controller **56** may be used to control actuation of shear blades **116** and **118** to separate fabric web **24** from fabric roll **114**.

Referring to FIG. **5**D, shear blade **118** engages shear blade **116** to separate fabric web **24** from fabric roll **114**, thereby forming a leading edge **122** of fabric web **24** and a trailing edge **124** of fabric roll **114**. Tucking station **42** comprises a tucking roller **126** to wind trailing edge **124** about spindle **48** and fabric roll **114**. For example, tucking roller **126** may be operated in a direction indicated by arrow **128**, thereby causing fabric roll **114** to rotate in a direction indicated by arrow **130** to wind trailing edge **124** about fabric roll **114**. Controller **56** may be used to operate tucking roller **126** after separation of fabric roll **114** from fabric web **24**. Rewind station **16** also comprises a tucking station **132** to position leading edge **122** of fabric web **24** into a position to form another fabric roll about spindle **52**.

Referring to FIG. **5**E, shear blade **118** is retracted and tucking roller **126** continues rotation to wind trailing edge **124** about fabric roll **114**. Tucking station **132** comprises an arm **133** to engage leading edge **122** of fabric web **24** and position leading edge **122** about spindle **52** at winding station **38** in preparation for forming another fabric roll. However, tucking station **132** may also comprise other suitable methods or devices for positioning leading edge **122**

of fabric web **24** adjacent spindle **52**, including, but not limited to, an air jet.

Referring to FIG. **5**F, rewind rollers **36** are activated in the direction indicated by arrows **115** to wind fabric web **24** about spindle **52** to form a fabric roll **134**. As described above, spindle carrier **92** disengages spindle **52** at winding station **38** to allow movement of spindle **52** to accommodate formation of fabric roll **134**. As illustrated in FIG. **5**F, spindle **52** moves upwardly away from the nip of winding rollers **36** to accommodate an increase in diameter of fabric roll **134**.

Referring to FIG. **5**G, turret **46** indexes and transfers spindle **48** and fabric roll **114** from tucking station **42** to stripping station **44** along hypocycloidal path **110**, spindle **52** and fabric roll **134** from winding station **38** to tucking station **42** along hypocycloidal path **108**, and spindle **50** from stripping station **44** to winding station **38** along hypocycloidal path **112**. As illustrated in FIG. **5**G, shear blades **116** and **118** have been releasably engaged to separate fabric web **24** from fabric roll **134**, thereby forming leading edge **122** of fabric web **24** and trailing edge **124** of fabric roll **134**. Trailing edge **124** may then be wound about spindle **52** and fabric roll **134** using tucking roller **126**.

Referring to FIG. **5**H, stripping station **44** comprises one or more paddles **136** to remove fabric rolls formed on spindles **48**, **50**, and **52**. Paddles **136** each comprise fingers **138** that extend across and straddle spindles **48**, **50**, and **52** adjacent fabric rolls formed on spindles **48**, **50**, and **52**. In operation, paddles **136** are translated along spindles **48**, **50**, and **52** to slide and remove the fabric rolls from spindles **48**, **50**, and **52**.

Paddles **136** may be coupled to a belt **140** for repeated positioning and translating of paddles **136** in stripping station **44**. For example, referring to FIG. **1**, belt **140** may be driven in a direction indicated by arrow **142** to remove fabric rolls from spindles **48**, **50**, and **52**. Belt **140** may be driven at a speed and with various quantities of paddles **136** to correspond with indexing of turret **46**. However, other suitable methods or devices may be used for repeated stripping of fabric rolls from spindles **48**, **50**, and **52**. Fabric rolls may then be transferred to a conveyor **144** or other suitable transfer device or method to transport the fabric rolls to additional processing stations.

Although the present invention and its advantages have been described in detail, it should be understood that various changes, substitutions, and alterations can be made therein without departing from the spirit and scope of the present invention as defined by the appended claims.

What is claimed:

1. A method for producing coreless fabric rolls comprising:

winding a fabric web onto one of a plurality of spindles to form a coreless fabric roll at a first station, the spindles coupled to a turret;

transferring the spindle, after winding the fabric web onto the spindle, from the first station to a second station along a generally hypocycloidal path;

separating the coreless fabric roll from the fabric web;

forming a leading edge of the fabric web and a trailing edge of the coreless fabric roll;

winding the trailing edge about the coreless fabric roll at the second station;

transferring the spindle from the second station to a third station along a generally hypocycloidal path; and

removing the coreless fabric roll from the spindle at the third station.

2. The method of claim **1**, further comprising:

securing the spindle in a first position relative to the turret; and

releasing the spindle at the first station to provide movement of the spindle from the first position to a second position during forming of the coreless fabric roll.

3. The method of claim **1**, wherein the removing step comprises disposing a paddle adjacent an end of the coreless fabric roll and translating the paddle along the spindle.

4. The method of claim, **1**, further comprising tucking the leading edge of the fabric web adjacent another spindle disposed at the first station.

5. The method of claim **1**, wherein the separating step comprises activating a shear blade disposed between the first and second stations to sever the fabric web from the coreless fabric roll.

6. The method of claim **1**, further comprising:

providing the fabric web from a feed station at a substantially constant feed rate; and

accumulating a reserve portion of the fabric web while the spindle is transferred from the first station to the second station.

7. A system for producing coreless fabric rolls comprising:

a hypocycloidal turret having a plurality of spindles;

a winding station operable to wind a fabric web onto one of the spindles to form a coreless fabric roll;

a cutting station operable to separate the coreless fabric roll from the fabric web to form a leading edge of the fabric web and a trailing edge of the coreless fabric roll;

a tucking station operable to wind the trailing edge about the coreless fabric roll;

a stripping station operable to remove the coreless fabric roll from the spindle; and

a control system operable to transfer each of the spindles to the winding, tucking, and stripping stations along a generally hypocycloidal path.

8. The system of claim **7**, wherein the turret further Comprises a spindle carrier coupled to each of the spindles to secure each of the spindles in a first position, and wherein the control system is further operable to disengage the spindle carrier from the spindle to provide for movement of the spindle from the first position to a second position in response to forming the coreless fabric roll.

9. The system of claim **7**, further comprising:

a feed station operable to provide the fabric web at a substantially constant feed rate; and

an accumulator operable to accumulate a reserve portion of the fabric web as the spindles are transferred between each of the winding, tucking, and stripping stations.

10. The system of claim **9**, wherein the accumulator is further operable to discharge the reserve portion of the web during forming of the coreless fabric roll.

11. The system of claim **7**, wherein the stripping station comprises a paddle having a plurality of fingers, the fingers operable to extend over the spindle, and wherein the control system is further operable to translate the paddle along the spindle to remove the coreless fabric roll from the spindle.

12. The system of claim **7**, wherein the cutting station comprises a shear blade, and wherein the control system is further operable to activate the shear blade to separate the coreless fabric roll from the fabric web while the spindle is disposed at the tucking station.

13. A method for producing fabric rolls, comprising:

providing a fabric web at a substantially constant feed rate;

moving a first spindle of a turret to a first station;

accumulating a reserve portion of the fabric web during movement of the first spindle to the first station;

discharging the reserve portion to the first station to form a fabric roll about the first spindle;

transferring the first spindle from the first station to a second station along a generally hypocycloidal path;

accumulating a next reserve portion of the fabric web during transfer of the first spindle from the first station to the second station;

moving a second spindle of the turret to the first station;

separating the fabric roll from the fabric web;

winding a remaining portion of the fabric web about the fabric roll at the second station;

discharging the next reserve portion to the first station to form another fabric roll about the second spindle;

transferring the first spindle from the second station to a third station along a generally hypocycloidal path; and

removing the fabric roll from the first spindle at the third station.

14. The method of claim 13, wherein accumulating the reserve portion comprises:

receiving the fabric web from a feed station at a plurality of festoon rollers; and

moving the festoon rollers away from each other to accumulate the reserve portion.

15. The method of claim 14, wherein discharging the fabric web comprises moving the festoon rollers toward each other to discharge the reserve portion.

16. The method of claims 13, wherein moving the first spindle comprises moving the first spindle to the first station following a substantially hypocycloidal path.

17. The method of claim 13, further comprising:

receiving the reserve portion of the fabric web at a plurality of rollers of the first station;

disposing a portion of the fabric web adjacent the first spindle; and

rotating the plurality of rollers to form the fabric roll about the first spindle.

18. A method for producing fabric rolls, comprising:

disposing a spindle of a turret adjacent a plurality of winding rollers in a winding station;

providing a fabric web from a feed station to an accumulator at a first feed rate;

providing the fabric web from the accumulator to the winding station at a second feed rate;

rotating the plurality of winding rollers to wind the fabric web about the spindle at the winding station to form a fabric roll;

transferring the spindle from the winding station to a tucking station following a substantially hypocycloidal path;

reducing the second feed rate to less than the first feed rate during transfer of the spindle from the winding station to the tucking station; and

accumulating a reserve portion of the fabric web at the accumulator when the second feed rate is less than the first feed rate.

19. The method of claim 18, further comprising discharging the reserve portion when the second feed rate is greater then the first feed rate.

20. The method of claim 18, wherein accumulating comprises:

receiving the fabric web at a plurality of festoon rollers of the accumulator; and

moving the festoon rollers away from each other to accumulate the reserve portion.

21. The method of claim 20, further comprising discharging the reserve portion from the accumulator by moving the festoon rollers towards each other when the second feed rate is greater than the first feed rate.

22. The method of claim 18, wherein winding comprises:

releasing the spindle to a first position adjacent a plurality of rollers in the winding station;

rotating the rollers to wind the fabric web about the spindle, the spindle moving from the first position to a second position in response to an increasing thickness of the fabric roll; and

securing the spindle at the second location for transfer from the winding station.

23. A system for producing a fabric roll, comprising:

a feed station operable to provide a fabric web at a substantially constant feed rate;

a turret operable to intermittently move each of a plurality of spindles into a winding station, a tucking station, and a stripping station through a substantially hypocycloidal path;

the winding station operable to wind the fabric web about one of the spindles; and

an accumulator operable to accumulate a reserve portion of the web during movement of the spindles relative to the winding station, the accumulator is further operable to discharge the reserve portion of the fabric web to the winding station after another of the spindles is positioned at the winding station.

24. The system of claim 23, wherein the accumulator comprises a plurality of festoon rollers, the festoon rollers operable to receive the fabric web from the feed station and move away from each other to accumulate the reserve portion.

25. The system of claim 24, wherein the festoon rollers are further operable to move towards each other to discharge the reserve portion to the winding station.

26. The system of claim 23, wherein the winding station comprises a plurality of rollers operable to wind the fabric web about one of the spindles, and wherein the turret comprises a spindle carrier operable to disengage one of the spindles to dispose one of the spindles into a first position adjacent the rollers, the spindle carrier operable to reengage the one spindle in a second position after forming the fabric roll, the one spindle moving from the first position to the second position in response to an increasing diameter of the fabric roll.

27. A system for producing a fabric roll, comprising:

a turret having a plurality of spindles, the turret operable to intermittently move each of the plurality of spindles into a winding station, a tucking station, and a stripping station through a substantially hypocycloidal path;

a feed station operable to provide a fabric web at a first feed rate;

the winding station operable to receive the fabric web at a second feed rate and wind the fabric web about the spindles; and

an accumulator operable to receive the fabric web from the feed station and transfer the fabric web to the winding station, the accumulator further operable to

accumulate a reserve portion of the fabric web when the second feed rate is less than the first feed rate.

28. The system of claim **27**, wherein the accumulator is further operable to discharge the reserve portion to the winding station when the second feed rate is greater than the first feed rate.

29. The system of claim **27**, wherein the accumulator comprises a plurality of festoon rollers operable to move away from each other to accumulate the reserve portion.

30. The system of claim **29**, wherein the festoon rollers are further operable to move toward each other to discharge the reserve portion to the winding station.

31. The system of claim **27**, wherein the turret further comprises a spindle carrier coupled to each of the spindles, each spindle carrier operable to provide for movement of the spindle during formation of the fabric roll in response to an increasing size of the fabric roll.

32. The system of claim **27**, wherein the winding station comprises a plurality of rollers operable to rotate relative to one of the spindles to wind the fabric web about the one spindle.

33. The system of claim **32**, further comprising an arm operable to position a portion of the fabric web in a nip defined by one of the spindles and one of the plurality of rollers in preparation for rotation of the rollers.

34. A method for producing coreless fabric rolls comprising:

providing a fabric web to a winding station having a winding roller;

rotating a turret having a plurality of spindles to dispose one of the spindles at the winding station;

positioning a portion of the fabric web proximate a nip defined by the spindle and the winding roller;

rotating the winding roller to wind the fabric web onto the spindle at the winding station to form a coreless fabric roll;

separating the coreless fabric roll from the fabric web; and

removing the coreless fabric roll from the spindle.

35. The method of claim **34**, wherein providing the fabric web comprises providing the fabric web at a substantially constant feed rate, and further comprising accumulating a reserve portion of the fabric web during rotation of the turret.

36. The method of claim **35**, further comprising discharging the reserve portion to the winding station after positioning one of the plurality of spindles at the winding station.

37. The method of claim **34**, wherein removing the fabric roll comprises disposing a paddle adjacent the fabric roll and translating the paddle along the one spindle.

38. The method of claim **34**, further comprising:

disengaging the one spindle to position the one spindle in a first position adjacent the roller; and

reengaging the one spindle at a second location after formation of the fabric roll, the one spindle moving from the first location to the second location in response to an increasing size of the fabric roll.

39. The method of claim **34**, wherein rotating the roller comprises rotating the roller to form a plurality of coreless fabric rolls on the one spindle, and wherein removing comprises removing each of the plurality of fabric rolls from the one spindle.

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