United States Patent

[11] 3,633,632

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Original application Dec. 31, 1968, Ser. No. 793,921. Divided and this application Dec. 8, 1969, Ser. No. 883,345

[54] **CIRCULAR WEAVING APPARATUS PRODUCT AND PROCESS**
4 Claims, 6 Drawing Figs.

[52] **U.S. Cl.** **139/13,** 139/123
[51] **Int. Cl.** **D03d 37/00**
[50] **Field of Search** 139/11–17, 122–124

[56] **References Cited**

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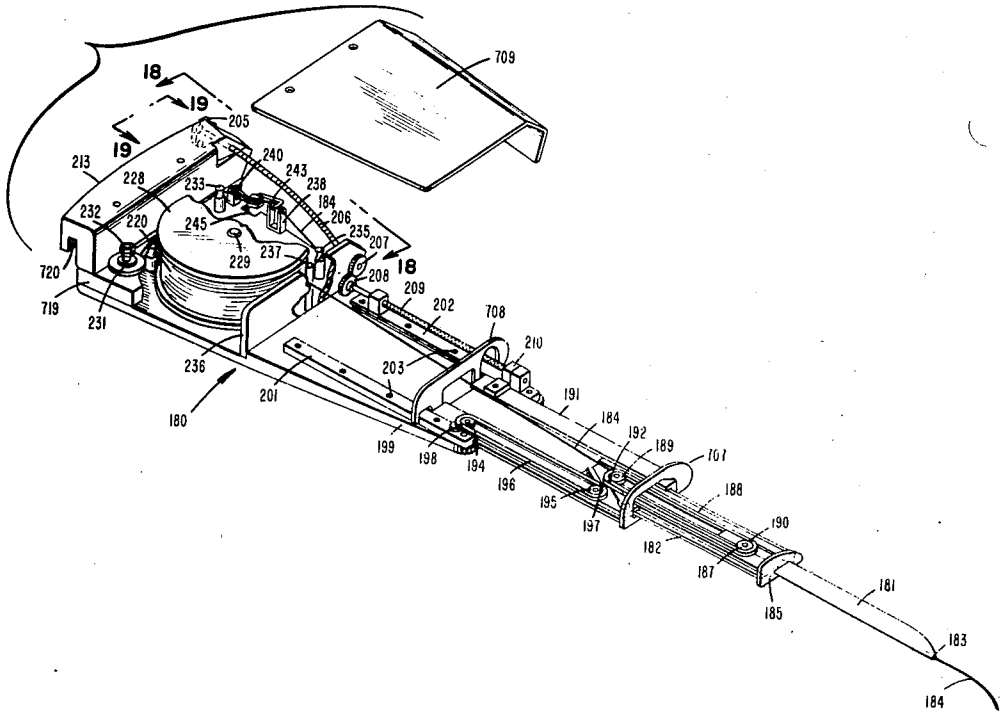
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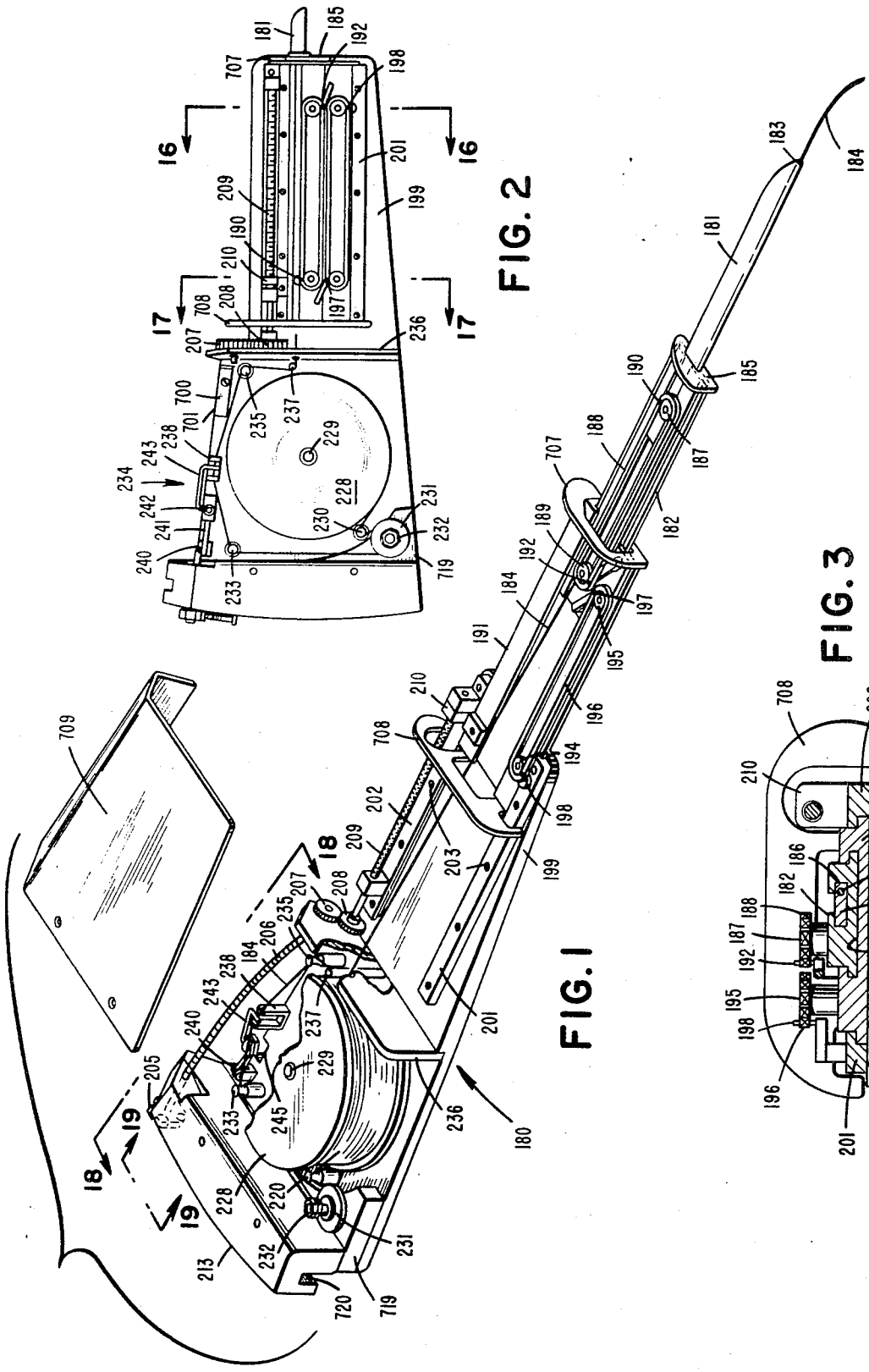
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ABSTRACT: A thick-walled, three-dimensionally shaped fabric is produced on a circular weaving machine with the aid of a rotating filling yarn inserter. The filling yarn inserter is adaptable for placing a filling yarn in an annular shed formed by the machine by moving through a path circling the vertical axis of the fabric.




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FIG. 1
FIG. 2
FIG. 3

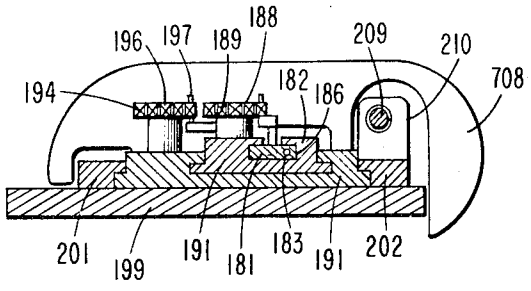


FIG. 4

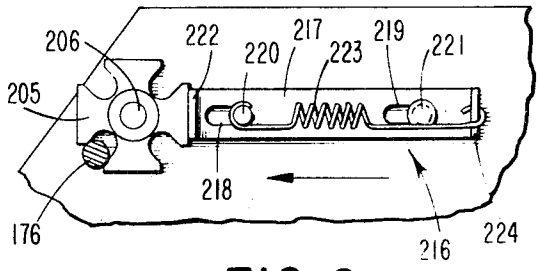


FIG. 6

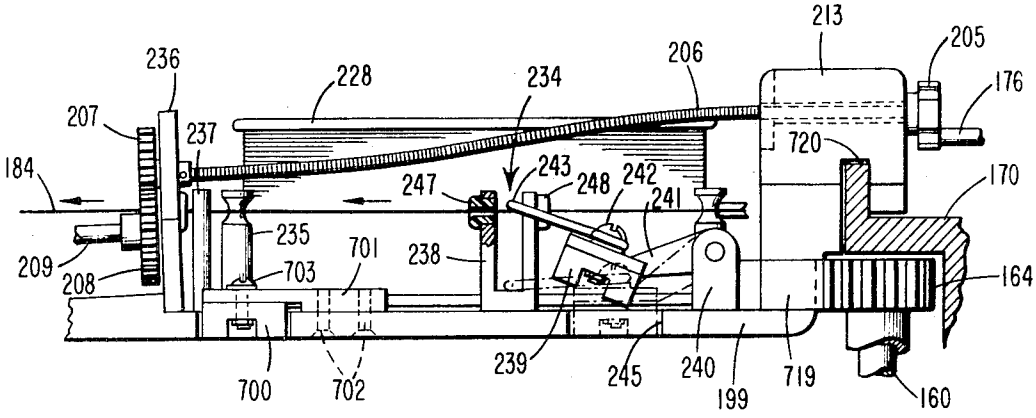


FIG. 5

CIRCULAR WEAVING APPARATUS PRODUCT AND PROCESS

This application is a division of application, Ser. No. 793,921, filed Dec. 31, 1968.

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to a shuttle for a circular weaving machine and, more particularly, to a filling yarn inserter which is adaptable for movement along a circular track and for placing a filling yarn in selectively formed sheds to build up an integrally woven, thick-walled, hollow fabric.

SUMMARY OF THE INVENTION

The filling yarn inserter of this invention is useful in circular weaving machines as described in applications, Ser. No. 882,387, filed Dec. 8, 1969, which is also a divisional application of parent application Ser. No. 793,921, filed Dec. 31, 1968. The main drive gear support has affixed thereto a plurality of vertically aligned filling yarn inserter drive gear supports and a circumferentially arranged disjointed rail. The filling yarn inserter drive gears are vertically journaled for rotation in the filling yarn inserter drive gear supports. These gears are rotated by the motion of the main drive gear. Each segment of the support rail encompasses a short arc about the outer circumference of the main drive gear support and is positioned immediately above each of the filling yarn inserter drive gears. The filling yarn inserter is adapted to simultaneously engage the circumferentially arranged disjointed rail and at least one of the filling yarn inserter drive gears. The filling yarn inserters are mounted extending radially inward toward the vertical axis of the apparatus between the aforementioned fabric compactors. The filling yarn inserters and the fabric compactors move in unison in horizontal planes normal to the axis of the apparatus and are adapted to be extendable and retractable to enable weaving of fabrics of varying diameters upon the surface of a given shaped mandrel. The warp yarns are aligned to pass freely between the plurality of filling yarn drive gear supports without engagement therewith by means of the heddle array provided by the comberboards.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a filling yarn inserter in an extended position;

FIG. 2 is a plan view showing the filling yarn inserter in a retracted position;

FIG. 3 is a section view taken along line 16—16 of FIG. 15 showing the relationship of the slides to the guides;

FIG. 4 is a section view taken along line 17—17 of FIG. 15;

FIG. 5 is a fragmentary elevation view of FIG. 14 showing the filling yarn break detector and a filling yarn inserter drive gear in meshing engagement with the filling yarn inserter;

FIG. 6 is a fragmentary end view of FIG. 14 showing a filling yarn inserter tip positioning star wheel in engagement with the filling yarn inserter star wheel drive pin;

FILLING YARN INSERTERS

The filling yarn inserter **180** as generally set forth in FIGS. **1, 2, 3, 4, 5** and **6** is adapted to supply the filling yarn **184** at the rate of a single pick per filling yarn inserter per revolution of the main drive gear for the weaving of the thick-walled, integrally woven, selvage free, three-dimensionally shaped fabric of this invention and to deliver the yarn **184** to substantially the precise point of incorporation into the fabric at a preselected level of filling yarn tension.

To facilitate the delivery of the yarn **184** to substantially the precise position in the shed for final incorporation into the fabric weave the filling yarn tip **181** is adapted to move inwardly and outwardly in a plane substantially perpendicular to the vertical axis of the apparatus as the filling yarn inserter **180** is propelled around the same axis along a substantially circular path in the same plane. The tip **181** moves in and out a distance substantially equal to the thickness of the fabric being woven divided by the number of filling yarn inserters employed. This oscillatory motion of the tip **181** directly associated with laying the yarn **184** in the shed at the proper depth for incorporation into the weave will hereinafter be referred to as the weaving oscillating motion. The tip **181** is also adapted to move inwardly and outwardly in a nonoscillating manner in order to compensate for noncircular cross sections of the mandrel **81** and/or variations in mandrel cross-sectional area as weaving progresses. The motion of the tip **181** associated with following the contour of the mandrel, i.e., the periphery or point generatrix of the cross section of the mandrel **81** at the plane of weaving, and independent of the weaving oscillating motion will be hereinafter referred to as the mandrel tracking motion.

The filling yarn inserter **180** includes a tip **181** which is slidably mounted by means of a dove tail arrangement or the like in the tip carrier **182**. The tip **181** includes an opening **183** which is adapted to receive and to permit the travel of the filling yarn **184** therethrough thereby inserting the filling yarn into the shed which is formed of the warp yarns. The outwardly extending end of the tip carrier **182** is provided with a shed spreader **185** which assists in spreading the shed sufficiently to allow the filling yarn inserter to pass therethrough. Likewise and for the same purpose the ends of intermediate carrier **191** are provided with shed spreaders **707** and **708**. The tip **181** is adapted to slide in the channel **186** of the tip carrier **182** by means of sprockets **187** and **189** and the chain **188**. The sprocket **187** is mounted at the forward end of tip carrier **182** and sprocket **189** is mounted at the rearward end thereof with chain **188** tautly held therebetween to form a closed path. The pin **190** extends through the chain **188** and securely fastens the same to the tip **181**. The tip carrier **182** is slidably mounted in tract **193** which is defined by the intermediate carrier **191**. The chain **188** is provided with another pin **192** which extends through same and securely attaches the chain **188** to the intermediate carrier **191**. Thus, as the intermediate carrier **191** moves outwardly, pin **192** forces the chain **188** to move about its endless path around the sprockets **189** and **187** to cause the tip **181** to move outwardly due to its attachment to the pin **190**. The intermediate carrier **191** is also provided with the sprockets **194** and **195** about which the chain **196** moves in an endless path. The chain **196** is provided with the pin **197** which extends through same and into the tip carrier **182** and the pin **198** which extends through the chain **196** into the guide **201** of the base carrier **199**. The base carrier **199** is provided with a pair of opposed and facing L-shaped guides **201** and **202** which define a track along which this intermediate carrier **191** slides. Guides **201** and **202** are secured to the base carrier **199** by means of screws **203** or the like. Thus, as the intermediate carrier **191** moves inwardly and outwardly along a path defined by the guides **201** and **202**, tip carrier **182** moves inwardly and outwardly along track **193** of intermediate carrier **191** and tip **181** moves inwardly and outwardly along channel **186** of tip carrier **182**. Due to the relationship of the tip **181** to the base carrier **199** through the telescoping carrier members **182** and **191** and their means of interconnections by way of the chains, sprockets, and pins **188, 196, 187, 189, 194, 195, 190, 192, 197,** and **198** the extent of movement of the tip **181** with respect to the base carrier **199** is three times that of the power block **210**. Filling yarn inserter **180** is driven along a circular path by the gears **164** engaging the rack **719** which is secured to the rearward end of the base carrier **199** by screws or any appropriate means. Gears **164** are spaced around the axis of the apparatus at such intervals that rack **719** is engaged with at least one gear at all times. The tracking guide **213** which is fastened to the rack **719** by screws or any other appropriate means is supplied with a tracking guide slot **720** which engages at all times at least one segmented rail **170** which functions to precisely guide the filling yarn inserter tip **181**.

The filling yarn inserter **180** is slidably supported at the outboard end of the base carrier **199** by filling yarn inserter support members having a low coefficient of friction. The support members are mounted on a filling yarn inserter support ring which is substantially concentric with the main drive gear and supported by cantilevered brackets which are secured to the gear supports.

The support members are mounted in a circle concentric with the apparatus and space sufficiently close together that a base carrier **199** is always in contact with at least one support member.

The tip **181** is moved inwardly and outwardly by means of the chain and sprocket arrangement as previously described and by means of the star wheel **205**, flexible drive cable **206**, meshing gears **207** and **208**, threaded shaft **209** and threaded power block **210**. The star wheel **205** is rotatably mounted in the upper portion of the tracking guide **213** which slides on yarn filling inserter support rail segments **170** and is directly connected to the flexible drive shaft **206** so that upon the rotation of the star wheel **205**, a likewise rotation is produced in the flexible drive shaft **206**. The rotation of the star wheel **205** is effected by any solid object adaptable for engagement therewith, such as, a pin means which may be selectively placed into contact with star wheel **205** by a solenoid or the like. The pin means causes star wheel **205** to rotate incrementally as filling yarn inserter passed thereby. Star wheel **205** may be rotated in both the clockwise and counterclockwise directions.

The star wheel **205** is prevented from rotating more than one quarter of a revolution in either direction by means of the detent spring arrangement **216**. The detent spring arrangement **216** includes a slide bar **217** having elongated slots **218** and **219** for slidably mounting with aligning pins **220** and **221**. The slide bar **217** has an abutting end **222** which normally resides against a flat portion of the star wheel **205** and is maintained in that position by means of the detent spring **223** which is connected between pin **220** and end **224** of slide bar **217**. As the star wheel **205** rotates by engaging of spring loaded pin **175**, **176**, slide **217** moves in the direction opposite to that of the arrow in FIG. **6** thus elongating the spring **223** which in turn provides the necessary force to return the slide bar **217** to its normal resting position against a flat surface of the star wheel **205** upon the completion of the quarter revolution of the star wheel **205**.

The base carrier **199** of filling yarn inserter **180** is provided with a spool **228** which is rotatably mounted upon vertically arranged shaft **229**, the vertical shaft **229** being rigidly secured to base carrier **199**. Spool **228** supplies yarn **184** for distribution to tip **181** and ultimate insertion into the woven fabric as filling yarn. The yarn **184** is pulled from spool **228** around guide **230** and through tensioning means **231**. The tensioning means **231** is of the adjustable type and the tension applied to the yarn may be increased or decreased by the selective rotation of nut **232**. The yarn **184** then passes around a second guide **233**, through stop mechanism **234**, around a third guide **235**, around aligning guide **237**, through support plate **236** and into tip **181**. The yarn **184** is pulled through opening **183** in tip **181** and is incorporated into the fabric at that point.

In reference to FIG. **5**, the yarn break detector **234** includes a U-shaped yarn guide **238** which is mounted on base carrier **199** in an upwardly extending position. A magnet **239** and a support arm **243** are mounted to the pivot support **240** by means of the pivot arm **241** and the screw **242**. Under normal conditions, support arm **243** rests between the upright arms of the U-shaped yarn guide **238** and is supported by yarn **184** which extends through the eyelets **247** and **248** in the U-shaped yarn guide **238**. Yarn **184** in turn supports the magnet **239** in a pivotally raised position. Upon the breaking of yarn **184**, the magnet **239** pivots downwardly under the influence of gravity so that it resides in opening **245** of base carrier **199** as shown in dotted lines in FIG. **5**. The filling yarn inserter **180** continues to move along its normal path until the magnet **239** comes in close proximity to a reed switch which closes an electrical circuit whereby the weaving apparatus is substantially instantaneously stopped from further rotation.

FIG. **2** shows the filling yarn inserter **160** in a completely retracted position. The tip **181** is extended a solenoid being energized which pushes the spring loaded pin **176** into contact with the star wheel **205** to turn same in a clockwise direction. The clockwise rotation of the star wheel **205** of one quarter of a revolution causes likewise a clockwise rotation in gear **207** which in turn by meshing engagement with gear **208** rotates the same in a counterclockwise direction. A counterclockwise rotation of gear **208** results in the threaded power block **210** being driven outwardly along the threaded shaft **209** whereby the intermediate carrier **191** is driven outwardly along the track provided by the base carrier **199** in combination with the guides **201** and **202**. As the intermediate carrier **191** moves outwardly the chain and sprocket arrangement **194**, **195** and **196** causes tip carrier **182** to likewise be moved outwardly along the track of the intermediate carrier **191** which in turn actuates the chain and sprocket arrangement **187**, **188** and **189** to result in the movement outwardly of the tip **181** a distance equal to three-fourths the lead of the threaded shaft **209**.

We claim:

1. A filling yarn inserter comprising a base, said base including a track, a plate mounted for slidable movement in said base, said plate forming a track, a tip slidably mounted in said plate track and defining a passageway, means mounted on said base and connected to said plate for selectively moving said plate relative to said base, means mounted on said plate and connected to said tip for selectively moving said tip relative to said plate, a yarn supply source mounted on said base for housing a continuous length of yarn, said yarn extending from said yarn supply source through said tip passageway and being adapted to be drawn from said yarn supply source.

2. The filling yarn inserter of claim **1** wherein tension means are mounted on said base and receive said yarn from said yarn supply source, said tension means adapting said yarn to be drawn from said filling yarn inserter under a predetermined amount of tension.

3. The filling yarn inserter of claim **2** wherein said means for moving said tip relative to said plate is dependent for movement upon said means for moving said plate relative to said base.

4. The filling yarn inserter of claim **3** wherein said tip is retractable or extendable into or out of said plate track and said plate is retractable or extendable into or out of said base track.

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