

Nov. 16, 1965

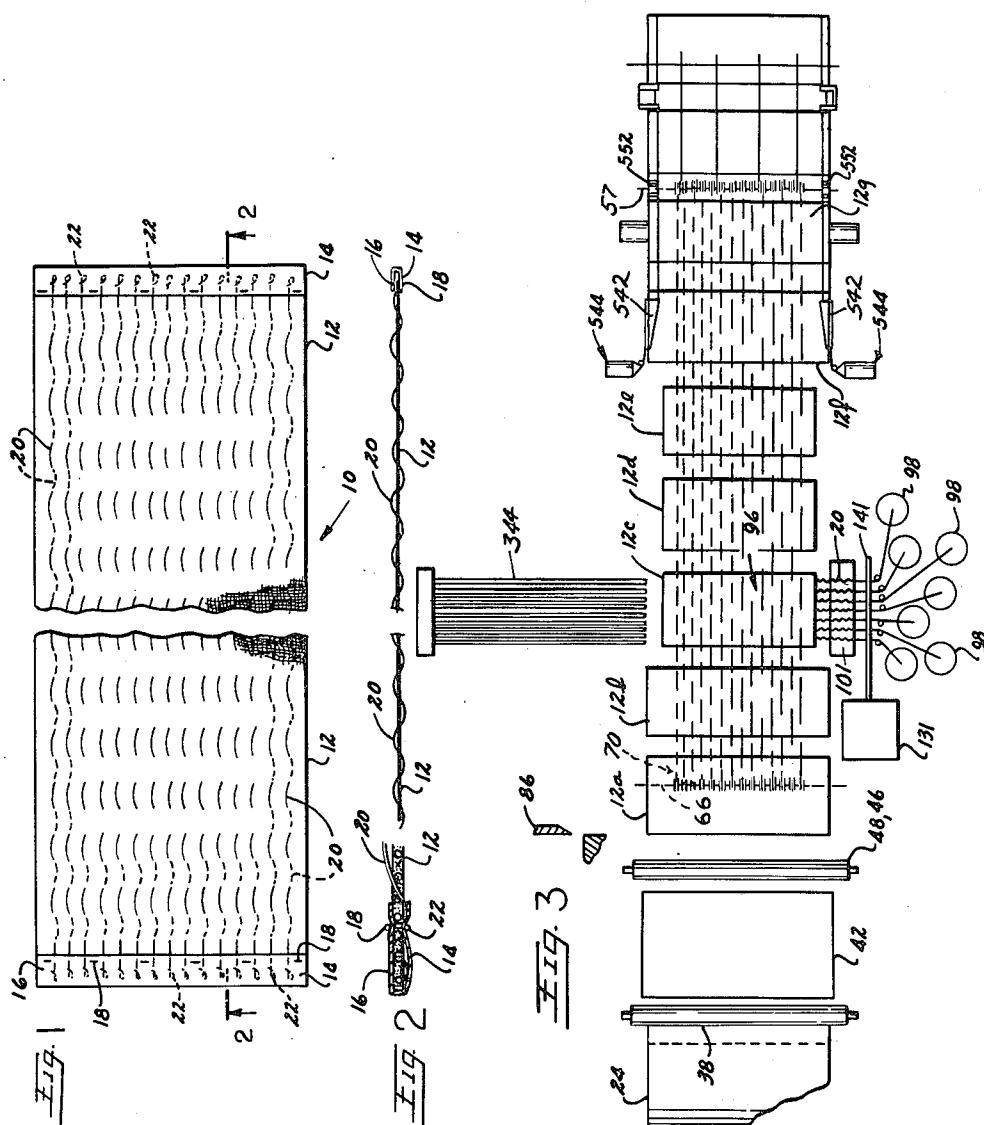
R. P. DOERER ET AL

3,217,756

WIRE SPIRALLING APPARATUS

Original Filed June 23, 1960

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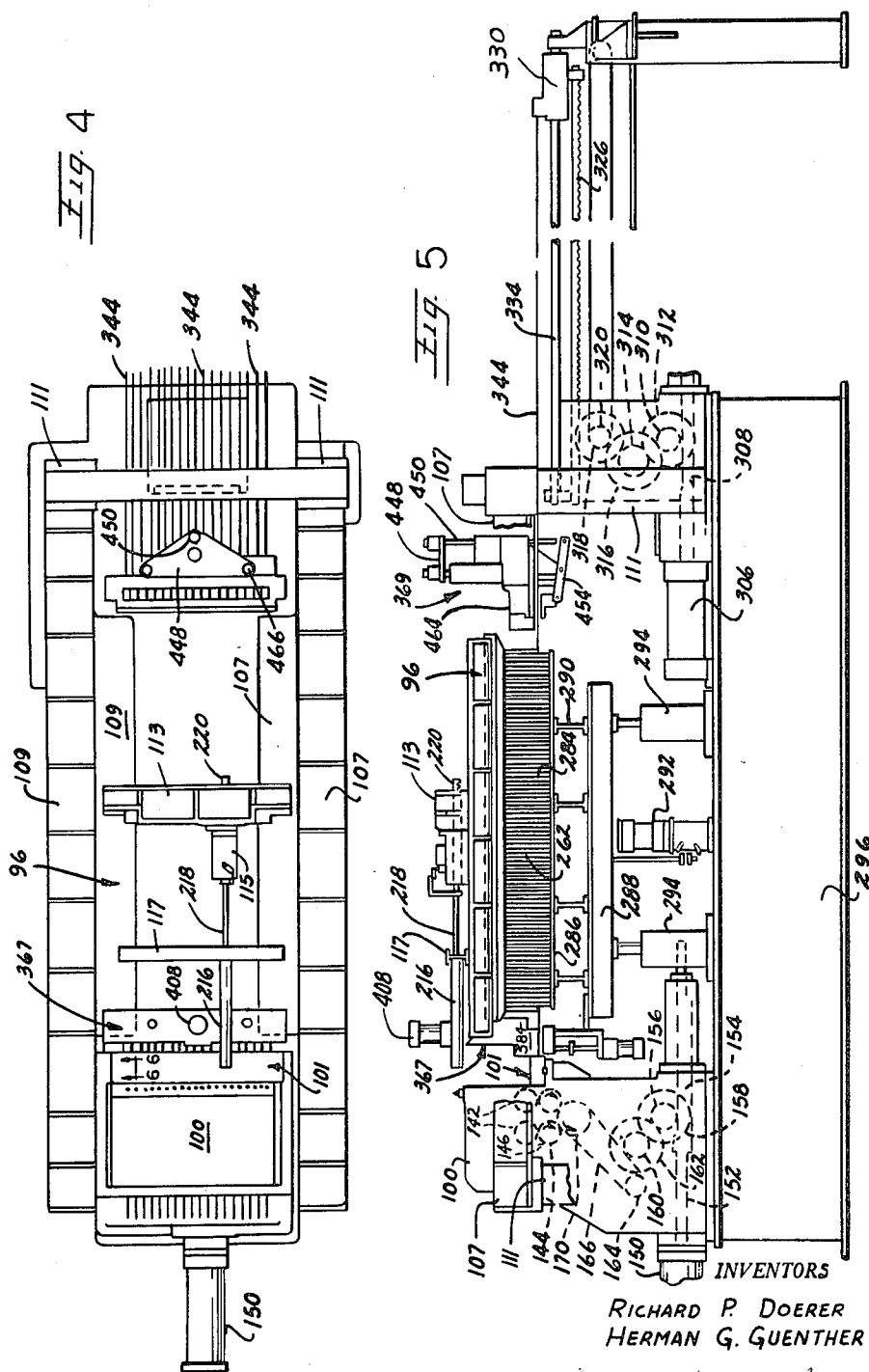
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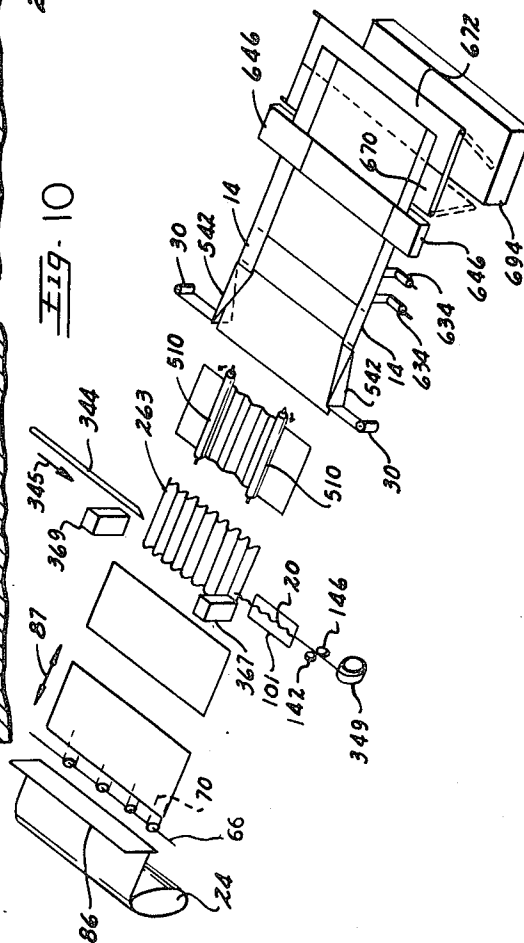
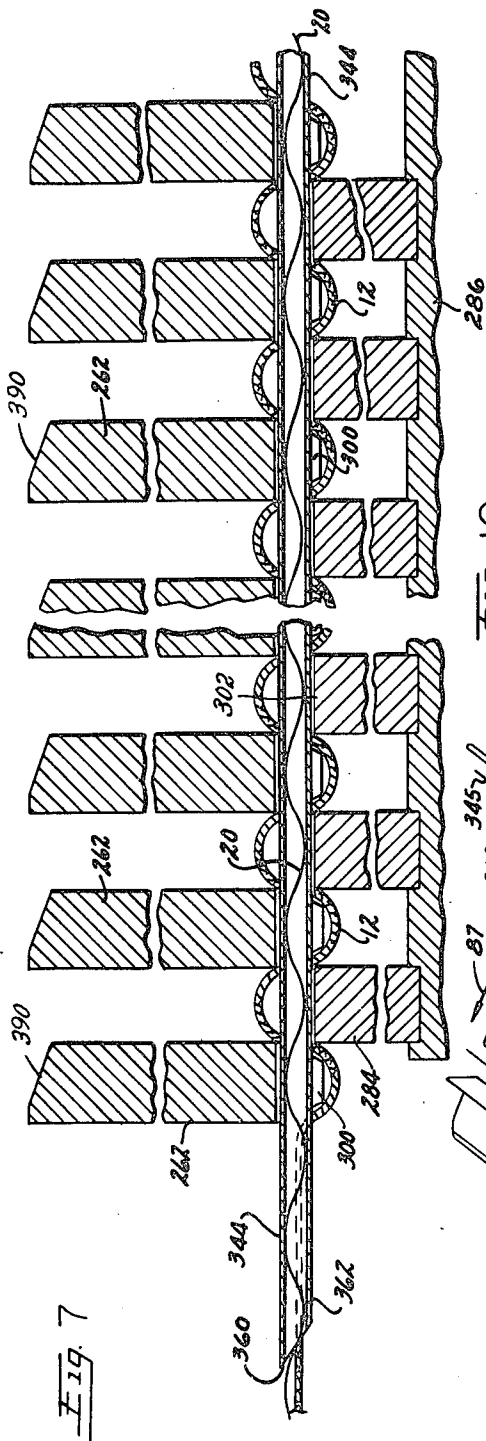
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WIRE SPIRALLING APPARATUS

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10 Claims. (Cl. 140—3)

This invention relates generally to apparatus for making a strand reinforced panel and refers more particularly to strand spiralling mechanism forming a part of the apparatus.

This application is a division of our co-pending application Serial No. 38,402, filed June 23, 1960.

Reinforced fabric panels of the type described herein are manufactured by inserting into a web or panel of fabric material elongated strands preferably in the form of wires to reinforce the material. The strands are preferably of an undulatory or spiral configuration so that they will readily yield or elongate. A reinforced panel of this type may serve as an insulator between the overlying padding and underlying spring structure of an upholstered assembly, for example.

One object of the invention is to provide a spiral passage for imparting a spiral configuration to a straight strand, with guide means for maintaining control over the strand after it emerges from the passage while permitting the strand to spring back to a condition in which it is under less stress.

Another object is to provide apparatus for making a strand reinforced panel in which the spiralling mechanism includes an elongated passage having first and second contiguous spiral sections through which the strand material passes, the second spiral section having a greater pitch and a greater diameter than the first spiral section to permit springback of the strand prior to introducing the strand into a panel or web of material.

Another object is to provide apparatus for making a strand reinforced panel in which the spiralling mechanism includes a first elongated rod having a groove in its outer surface, means surrounding the rod to form with the groove a first passage, a second rod arranged end to end with the first and having a spiral second groove, means surrounding the second rod to provide a spiral second passage, a portion of the first passage being spirally formed and the second passage having greater pitch and diameter than the spiral of the first passage to permit a strand moving through the passages in sequence to spring back to a substantially unstressed condition in the second passage.

Another object is to provide apparatus as defined in the preceding paragraph in which the means surrounding the spiral portion of the first passage includes a freely rotatable sleeve so as to distribute wear on the sleeve more evenly.

Another object is to provide a support for the second rod which carries a cutting element operative in conjunction with a movable cutting element to sever a strand moving through the passages in sequence.

Other objects and features of the invention will become apparent as the description proceeds, especially when taken in conjunction with the accompanying drawings, wherein:

FIGURE 1 is a plan view of a strand reinforced fabric panel adapted to be formed by the apparatus shown diagrammatically in FIGURE 3.

FIGURE 2 is a sectional view taken on the line 2—2 of FIGURE 1, with the left hand portion of the panel enlarged.

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FIGURE 3 is a plan view diagrammatically showing the apparatus for forming the strand reinforced panels of FIGURE 1, indicating also the positions of various fabric panels as they are advanced through the apparatus.

FIGURE 4 is a plan view of portions of the apparatus in FIGURE 3, including the pleater structure.

FIGURE 5 is an elevational view of the structure shown in FIGURE 4.

FIGURE 6 is a sectional view of the wire spiralling apparatus taken along the line 6—6 of FIGURE 4.

FIGURE 7 is a sectional view showing the needle and wire strand structure between the pleater elements.

FIGURE 8 is a diagrammatic view of certain operating components of the pleater structure in retracted position.

FIGURE 9 is a diagrammatic view similar to FIGURE 8 but showing the components in an intermediate position.

FIGURE 10 is a perspective view showing the operations performed on a fabric panel by the apparatus in FIG. 3.

Referring now more particularly to the drawings, and especially to FIGURES 1 and 2, there is illustrated an insulator pad or panel 10 comprising a length of burlap 12 having its edge portions extended over strips 14. The strips 14 may be paper or any suitable material and extend beyond the edges of the burlap and are turned on to the upper face of the burlap as shown at 16 in FIGURE 2. The turned edge portions 16 are suitably secured to the burlap, for example by gluing, stapling or sewing. To reinforce the panel, a number of strands of wire 20 are provided, each being preferably undulatory or spiral in configuration as shown in FIGS. 1 and 2.

In order that the ends of the reinforcing strands 20 do not unduly project from the surface of the burlap, the reinforcing strands may be knotted at their ends as shown at 22 in FIGURE 1. By utilizing webs 14 as shown, the wire knots are shielded so as not to form sharp projections which might prove a safety hazard in handling of the panels and which might undesirably lock adjacent panels together when they are stacked on one another.

Several operations are required to form the articles shown in FIGURES 1 and 2. Thus, the burlap is cut to size, the strands 20 are given their undulatory configurations and threaded through the burlap, the end portions of the wire strands are knotted, the strips 14 are applied to the burlap-strand assembly and folded over the edges thereof, and the entire assembly is adhered together at 18.

Referring to FIGURE 10, the fabric burlap material is taken from a supply reel 24 and advanced beneath a vertically reciprocating cutter 86 which cuts it into individual panels of a predetermined dimension (in the arrow 87 direction). The conveyor means at 70 locates each panel at a predetermined point thereon, and introduces each panel into a pleater mechanism which automatically gives the panel a pleated condition as shown at 263.

While the panel is still in a pleated condition hollow pointed tubes or needles 344 are passed transversely through the pleats in the arrow 345 direction. Immediately thereafter the rolls 142 and 146 are rotated to drive undulatory wire strands 20 into the hollow needles. It will be noted that the wire strands are taken from supply reels 349 in non-undulatory conditions. The strand undulations are formed in the undulation-producing mechanism generally designated by numeral 101. FIGURE 10 shows only one needle and one wire strand, but it will be appreciated from a study of FIGURE 3 that in actual practice a multiplicity of the needle-strand arrangements are utilized.

It will be appreciated that hollow tubes 344 act as guides to permit the undulatory wire strands to be rapidly

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advanced into and through the panel pleats. When the strands have been advanced into the tubes (or while they are being advanced therein) the tubes are retracted from the pleats, leaving the undulatory strands embedded or extended within the pleats. The strands are then cut and knotted at both ends by automatic mechanisms 367 and 369.

After the knotting operations the panel-strand assembly (with the panel still in a pleated condition) is advanced into position beneath rollers 510 which rotate about fixed axes to iron out the panel pleats and return the panel to a flat condition.

The panel is then advanced through the space between two traveling webs 14 which are taken from supply reels 30 and folded about the fabric panel edges by means of the folder structure 542.

The assembly is subsequently advanced over the adhering mechanism shown in FIGURE 10 as comprising the automatic stapling guns 634. The webs are at this time still in the form of continuous strips, and such strips are therefore cut through at appropriate points by the automatic cutters 646.

As the last operation the complete panel assembly is passed onto the trap doors 670 and 672, which automatically swing down at a preappointed time to discharge the assembly into a shipping carton 694. When the carton is filled with a certain number or weight of panels it is replaced with an empty carton.

Referring to FIGURE 3, the burlap is supplied from a reel 24 by a suitable feed roll, not shown, which is driven by any source of power. An idler roll 38 overlies and conceals the feed roll in FIGURE 3 and serves to maintain the burlap in driven engagement with the feed roll. The burlap moves through a trough 42 which serves as an accumulator space for maintaining a web supply for the cut-off structure or knife generally indicated at 86.

The burlap is fed from the bin by a rubber coated driver roll 46 and a rubber coated idler roll 48. The arrangement is such that as rolls 46 and 48 draw burlap from the trough, a switch is operated to energize the motor for the feed roll associated with idler roll 38 to replenish the supply of burlap in the trough.

The driver roll 46 is operated intermittently to advance the burlap a predetermined distance beyond the cutter or knife 86. After each intermittent advance of the continuous burlap web by the driver roll 46, the knife is operated to sever a panel of burlap from the leading end of the web, and the severed panel is deposited on and received by the conveyor chains 70 which extend longitudinally of the apparatus in laterally spaced relation, being trained over sprockets on the shaft 66 adjacent the cutter and sprockets on the shaft 57 spaced from the shaft 66 in the direction of advance of the fabric through the apparatus, or to the right as shown in FIGURES 3 and 10.

The conveyor chains are driven so that their parallel top flights, which lie in a common horizontal plane, move to the right as viewed in FIGURES 3 and 10. The chains 70 are synchronized with the driver roll 46 so that they advance the panels deposited thereon a distance equal to the advance or feed of the web of burlap by driver roll 46, the intermittent operation of the chains 70 occurring at the same time as the intermittent feed of the burlap by roll 46. Preferably the chains 70 are also briefly operated between intermittent operations of the web driving roll 46 to advance the cut panel deposited thereon a predetermined distance to provide the desired spacing between panels. The drive mechanisms for the roll 46 and for the chains 70, and the synchronization thereof forms no part of this invention and therefore will not be further described, although a full description is provided in our co-pending application Serial No. 38,402.

As an illustrative example, the roll 46 and chains 70 may be simultaneously actuated to advance the burlap supply past the upraised shear blade 86 a distance of 22

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inches, and to carry a previously cut panel 12b for the same distance along the conveyor chains. While the roll 46 then remains motionless, the shear blade 86 is operated to cut a 22 inch panel 12a from the burlap supply which is deposited on the rear end of the chains 70. Thereupon the chains 70 are again operated to shift the cut panel 12a downstream, or to the right, by a predetermined amount, as for example 8 inches. During this time the roll 46 remains motionless. Thereafter this same cycle is repeated over and over. The chains have longitudinally spaced barbs 71 (FIG. 9) thereon to hold the burlap in fixed positions.

Chains 70 are of a length sufficient to carry the burlap from the burlap panel cutter 86 through a pleating station, needle insertion, wire advancement station, needle retraction station, wire knotting station, and burlap unpleating station. As each panel is moved by the chains 70 it initially passes into the pleater station 96, the function of which is to distort the panel into a wave-like configuration as shown at 263 in FIGURE 10 to permit the wire strands 20 to be threaded therethrough.

Referring to FIGURE 3, the wire strands are supplied from suitable reels 98, there being one reel for each strand to be threaded into the panel. The illustrated machine is designed to simultaneously thread 18 wire strands into the panel, and there are therefore employed 18 supply reels 98 for the individual strands. Each strand as it comes from its reel is not undulatory, and it must therefore be given its undulatory shape before threading through the panel. The mechanism for giving each wire strand its undulatory or spiral configuration is diagrammatically illustrated at 101 in FIGURES 3 and 10. This mechanism is shown in detail in FIGURE 6.

Referring to FIGURES 5 and 10, the fixed housing structure 100 carries the wire feed mechanism. Each wire is fed from its reel through the undulating device 101 and into the pleated fabric by the cooperating discs 142 and 146, the wire being gripped between the peripheries of the discs. In FIGURE 10, only one pair of discs 142 and 146 for each wire is shown, but preferably two pairs of such discs are provided, as shown in FIGURE 5. A fluid cylinder 150 has a piston rod 152 provided with a rack 154 meshed with gear 156. By a series of distance multiplying gears 158 through 164, a multiplied movement is transmitted to chain 166. Chain 166 drives a shaft which carries a series of gears 170 (18 in the illustrated embodiment), the arrangement being such that each gear 170 meshes with the geared portions of the discs 146 to drive them clockwise (in FIG. 5). The discs 146 are respectively geared to the discs 142 so that as a result the individual wire strands are fed from their respective reels through the undulatory device 101 and into the pleated panel. Suitable one-way clutch means is located in the drive from rack 154 and chain 166 such that reverse movement of the rack will not reverse rotate the discs 142 and 146.

The cylinder 150 is operated to intermittently feed the 18 wire strands simultaneously from their respective reels. After each feeding movement of the wire strands, the bar 141 extending across the wire strands descends by gravity and pulls a fresh supply of wire from the reels 98. If the wire on any reel becomes tangled so that it will not readily pull from the reel, that particular strand will remain taut and will prevent the gravitational descent of the bar 141. The bar 141 is connected with a suitable safety shut-off mechanism 131, the arrangement being such that failure of the bar 141 to descend at the dictated time will halt the cycle. The attendant may then take care of any entanglements.

The strand spiralling mechanism 101 is provided to impart a spiral configuration to the wire strands which are of course straight when they leave the cooperating discs 142 and 146 of the wire feed mechanism. The spiralling mechanism comprises a base 174 having a series of 18 separate block elements or supports 176 adjustably

secured thereon by means of set screws 178 which extend through a cover plate 180. The cover plate 180 extends laterally over all of the various block elements or supports 176 and is fixedly secured to the base 174 by a plurality of spaced screws 182. Spacers (not shown) are provided at the ends of the base 174 and cover plate to hold the two in the spaced positions illustrated in FIGURE 6.

The downstream face of each support or block element 176 is provided with an enlarged bore, and one end portion of a former rod 186 is closely received and secured in the bore by a suitable set screw as shown. Each rod 186 is provided in its outer surface with a straight groove portion 188 which extends from the end thereof received in the block element 176 and leads to a spiral groove portion 190 which extends entirely to the opposite or downstream end of the rod. The arrangement is such that as the wire strand is fed into the groove portion 190 by the action of the discs 142 and 146 of the wire feed mechanism it is twisted into a spiral configuration. Former rod 186 extends through a tubular member or sleeve 192, the internal surface of which closely surrounds the rod and cooperates with the groove portion 190 in forming a spiral passageway for the strand. It will be understood that the bore of block element 176 in which the end of the former rod is received cooperates with the straight groove portion 188 to complete the definition of the passageway for the strand. In order to minimize wear on the internal surface of sleeve 192, the sleeve preferably has a rotatable fit on the rod 186 so that the sleeve can turn under the influence of the advancing strand whereby different portions of the internal surface of the sleeve are presented to the spiral groove portion 190 during successive spiralling operations so as to prolong the life of the sleeve. In this connection, it will be appreciated that the strand spiralling operations are carried out at relatively high speeds, and the abrasive action on the sleeve may become excessive.

A second rod 196 is provided which is aligned with rod 186 and in substantial end to end abutting relation therewith. The rod 196 is slightly larger in diameter than the rod 186 and has in its outer surface a spiral groove 194 extending from end to end thereof. The end of the spiral groove portion 190 in rod 186 registers with the end of spiral groove 194 so that a strand can pass continuously through the two grooves in sequence. Each rod 196 is closely received within a bore in a block or support 198 and secured thereto by means of a set screw as shown. The internal passage or bore in the block 198 closely surrounds the rod 196 and cooperates with the groove 194 to define a passageway for the strand. The upper face of each block 198 is provided with a pair of V-shaped grooves 200 which form cam surfaces for cooperation with the conical end portions of set screws 202. Accordingly, the block 198 may be adjusted in the direction of length of rod 196, that is in the direction of the arrow 204. When in the desired position of axial adjustment, the screws 202 may be advanced into the V-shaped grooves 200 to lock the adjustment. Preferably the position of the block 198 is such that the rods 186 and 196 substantially abut in end to end relation as shown, so that there is a minimum clearance between the sleeve 192 and the end face of block 198. The end of sleeve 192 should have a slight clearance with the block 198 and with the end of rod 196 so that the sleeve is free to rotate and not clamp against the downstream face of block 176.

The right end portion of block 198 as shown in FIGURE 6 carries a cut-off block 206 which defines a face 208 located to be traversed by a reciprocating cutter 210. It will be understood that at a predetermined point in the operating cycle, the cutter 210 will be moved downwardly across the cut-off block to sever a length of the formed spiral strand.

As seen in FIGURE 6, the major diameter of the groove 194 is slightly greater than the major diameter of the groove 190. Also the pitch of the groove 194 as de-

noted by dimension 214, is greater than the pitch of groove 190 as denoted by dimension 215. These differences are designed to accommodate the tendency of the wire strand to spring back after its deformation in groove 190. The diameter and pitch of groove 194 will accommodate substantially all of the springback so that the wire strand in groove 194 is unstressed, and a precise length thereof will be discharged past the block 206 during each operating cycle. In this manner the subsequent operations on the strand are more accurately performed and the resultant product (FIGS. 1 and 2) is more uniform.

As seen in FIGURE 6, the block 176 is formed with concave surfaces 392 which are substantially concentric with the discs 142 and 146 and extend in between the discs. The edge where the concave surfaces meet extends into the bite between the discs. A passage 393 in block 176 extends from the edge where the concave surfaces meet, to the passage formed by the strand portion 188 of the groove in rod 186 and is aligned with groove portion 188. Hence a wire strand fed from the discs 142 and 146 enters the spiralling mechanism through the passage 393 and is fed continuously through the spiral passages provided by the rods 186 and 196 to be given the desired spiral configuration.

The undulating or spiralling mechanism 101 shown in FIGURE 6 may be employed with some or all of the strands; that is, some of the strands may be fed into the fabric panel without being spiralled and some of the strands may be given different undulatory shapes than that produced by the mechanism of FIGURE 6. Also, some of the strands may be of relatively heavy gauge, and some may be of relatively light gauge in accordance with different characteristics to be given to different areas of the final product. Those other strands which are to be given the same spiral configuration as the strand shown in FIGURE 6 will of course be formed to spiral configuration by similar apparatus to that shown in FIGURE 6.

Referring to FIGURES 4 and 5, it will be seen that after the individual wire strands have been fed through the device 101, they are forced into a pleater station 96 which operates to form and maintain the burlap panel in a pleated condition during insertion of the wire strands.

The pleater operation may best be visualized by referring to schematic illustrations in FIGURES 8 and 9. As shown in FIGURE 8, the burlap panel 12c is supported on the conveyor chains 70. Disposed beneath and between the various chains 70 are the elongated lower pleater elements or bars 284 which are each of a length somewhat greater than the length of the panel (that is the dimension of the panel in the direction of arrow 87 in FIGURE 10). The various pleater bars 284 are carried on an elevator 288, and when the elevator is raised from its FIGURE 8 position to its FIGURE 9 position the various pleater bars 284 are projected upwardly between the chains 70 so as to lift the burlap panel from the chains as shown in FIGURE 9. In its FIGURE 9 position the panel is located very closely adjacent to the lower edges of an upper set of pleater bars 262. There are provided a center pleater bar, designated by numeral 276, and additional pleater bars on both sides thereof. The pleater bars at the left of center pleater bar 276, as well as center pleater bar 276, are notched at their upper edges to form cam surfaces 390 for causing the bars to be cammed downwardly by leftward movement of the overlying cam bar 271. The pleater bars at the right of center pleater bar 276, as well as center pleater bar 276, are suitably notched at their upper edges to form cam surfaces 391 for causing the bars to be cammed downwardly by rightward movement of cam bar 274. The cam bars 271 and 274 are shown retracted in FIGURES 8 and 9, and the pleater bars over which they extend when retracted are suitably notched to clear the cam bars. Suitable spring means, not shown, are provided to retract the upper set of pleater elements 262 to the FIGURE 8 position when the cam bars are retracted as illustrated.

In the preferred operation the cam members or bars 271 and 274 are moved simultaneously in opposite directions so as to cross one another and sequentially depress the various pleater bars in the upper set of bars, beginning from the center pleater bar 276 and continuing laterally outwardly with depressions of successive bars on both sides of the center pleater bar. The arrangement is such that initially the center pleater bar 276 is depressed downwardly so as to cooperate with the subjacent pleater bars to tightly grip the center area of the burlap panel. Therefore, as the other pleater bars come down successively the panel will maintain its position relative to the longitudinal center line of the machine such that very little lateral bodily shifting of the panel will occur. Since the outermost pleater bars will not come down until the innermost pleater bars have been depressed there will be no excessive strain placed on the burlap such as might tear or deform the burlap fibers.

FIGURE 4 provides an elevational view of the pleater station which, as will be seen, comprises two ribbed beams 107 and 109 supported at their ends by pillars 111. A bridge structure 113 extends across the space between beams 107 and 109 to rigidify them and provide a support for housing 115. Cylinder 216 has a rod 218 which extends into housing 115 to operate cam bars 271 and 274 by suitable mechanism not shown.

The foregoing brief description provides a general outline of the mode of operation of the panel pleating structure. For a more detailed description reference is made to applicants' co-pending parent application, Serial No. 38,402.

It will be noted from FIGURE 7 that the lower edge portion of each pleater element 262 is provided with a series of slots 300. In the illustrated mechanism each of the pleater elements 262 is provided with eighteen slots corresponding in number to the number of wire strands to be inserted through the fabric pleats. Each of the pleater elements in the lower set of pleater elements 284 is provided with a corresponding number of slots 302 in its upper edge, the arrangement being such that when the pleaters are in their FIGURE 7 positions a series of eighteen passages is formed through the pleater element assembly.

The purpose of these passages is to permit hollow needle structures to be driven through the fabric pleats, said needle structures serving as guides for subsequent insertion of the spiral wire strands previously described.

Power for the needle insertion operation is derived from a fluid cylinder 306 shown in FIGURE 5. The piston rod for cylinder 306 carries a rack 308 which meshes with a gear 310 carried by the shaft of a larger gear 312. Gear 312 in turn meshes with a gear 314 carried by the shaft of a relatively large gear 316 which meshes with the gear 320 carried on the shaft of a larger gear 318. The gear 318 meshes with a rack 326 which is connected at one end to a cross-head 330 slidably supported on fixed guide rods 334. The cross-head 330 carries eighteen hollow needles 344, the arrangement being such that energization of cylinder 306 is effective to move rack 326 to the left as viewed in FIGURE 5 to thereby carry the needles 344 through the pleater elements and pleated fabric panel as shown in FIGURE 7. The slots 300 and 302 in the adjacent edges of the pleater elements 262 and 284 line up transversely of the machine when the pleater elements are moved toward each other as shown in FIGURE 7 to provide elongated passages adapted to receive the respective needles. The needles are actually hollow tubes and are inserted through the pleated fabric prior to insertion of the wires to serve as guides and prevent deflection or jamming of the wires during insertion of the latter.

The leading edge of each needle is sharply pointed as at 360, with the edge portion 362 tapering back at a small

angle to form a pointed end operative to easily penetrate the burlap panel during high speed insertion of the needle. When the needles are located within the pleater elements as shown in FIGURE 7, the cylinder 150 (FIGS. 4 and 5) is energized to feed the wire strands through the spiralling mechanism and into the hollow needles to the FIGURE 7 position. The hollow needles protect the wire strands during insertion so they will not interfere with the burlap threads.

It is contemplated that the insertion of the needles will be completed before introduction of the wires into the pointed ends of the needles. However, the needles may retract during the advance of the wires, the most important aim being to have at least the ends of the wire strands within the needles as the strands are fed through the pleats. However, the needles may remain in the extended position within the pleater station during the entire strand advancing operation.

After insertion of the wire strands into the extended hollow needles, the hollow needles are withdrawn to leave the strands threaded through the pleats of the fabric panel. The wire strands will then be severed and knotted at both ends. Preferably, the strand knotting operation is performed at the conclusion of the strand insertion operation while the fabric is in a pleated condition. The left hand knoter mechanism is shown at 367 and the right hand knoter at 369. These knoter mechanisms will be only briefly described and for a complete description thereof reference is made to applicants' co-pending application, Serial No. 38,402.

The left hand knoter 367 includes a vertically reciprocable member 384 which is moved up and down by the fluid cylinder 408. The member 384, in addition to carrying certain knoter mechanism, not shown, also carries a knife 210 which traverses the cut-off block 206 carried by the block 198 of the wire spiralling mechanism 101. Hence on downward movement of the knoter member 384 to knot the left end of the inserted wire strands, the strands are initially severed from the supply at the outlet of the spiralling mechanism. After the severed ends of the inserted strands have been knotted the fluid cylinder 408 is reversed to retract or raise the member 384.

The knoter mechanism 369 is operated simultaneously with knoter mechanism 367 and functions to knot the other ends of the inserted strands. The cross-head 448 is operated by a fluid cylinder, not shown, to control the knoter via connections 450 and 454.

During the knotting operations the fabric panel is held in a pleated condition with the needles of course withdrawn. The wire strands 20 frictionally engage the burlap fibers and tend to hold the pleated form of the panel. Accordingly, after the inserted wire strands have been knotted, the fluid cylinder 216 is operated to allow the upper pleater elements to return to the position of FIGURES 8 and 9, the cylinder 292 is operated to lower the elevator 288 carrying the lower pleater elements to the position of FIGURE 8, and the strand reinforced panel is moved to a flattening station which has the rubber coated rolls 510. The panel is carried from the pleater to the flattening station by the conveyor chains 70 during subsequent intermittent operation thereof. The rolls 510 serve to flatten the pleated panel so that it assumes substantially the configuration shown in FIGURE 2. The flattening station is more fully described in our copending parent application, Serial No. 38,402.

Thereafter, the conveyor chains 70 transfer the panel through the space between the travelling strips 14 which are taken from supply rolls 30 and folded about the edges of the fabric panel by means of the folder structure 542. In FIGURE 3, the panel 12f is shown between the folder structures. Panel 12e is approximately at the unpleating or flattening station and panel 12d is in an intermediate position.

The stapling guns 634 in FIGURE 10 secure the folded

strips to the edges of the reinforced panel, and thereafter the complete panel assembly is transferred to the point of discharge over the trap doors 670 and 672 which automatically open to deposit the panel assembly into a shipping carton.

The apparatus illustrated and described herein is operated so as to cut the fabric panels to length before pleating and insertion of the reinforcing strands. However, the panels could be cut to length after insertion of the strands. The shear blade 86 can be placed at the downstream end of the machine so that the severing of the individual panels occurs only after all of the other operations, pleating, strand insertion, unpleating, etc., have been completed. Apparatus as thus modified, in which the panels are severed as the last operation, is described in our copending application Serial No. 38,402. Accordingly, the piece of material into which the strands are inserted may be either the individual panels or the continuous web before it is severed into panels. Stated another way, the panels into which the strands are inserted may be either separate members already severed from the continuous web, or they may be unsevered and still an integral part of the web.

Whether the panels are severed before pleating, as illustrated and described, or as the final operation, the operation of the strand feeding and strand spiralling apparatus will be the same.

What we claim as our invention is:

1. Apparatus for making a strand reinforced piece of material comprising spiralling mechanism including means providing an elongated passage, said passage extending helically from one end thereof throughout at least a portion of its length, means positioned at the said one end of said passage for maintaining control over the strand after it emerges from said passage while permitting said strand to spring back to a condition in which it is under less stress than in said passage, means for forcing a strand through said passage and control means in sequence, and means for locating a piece of material in position to receive a strand from said control means.
2. Apparatus for making a strand reinforced piece of material comprising strand spiralling mechanism including an elongated passageway having a first helical section of predetermined length, a second helical section contiguous with the first, said second helical section having a greater pitch and a greater diameter than said first helical section to permit springback of a strand passing sequentially through said first and second sections, means for forcing a strand through said first and second helical sections in sequence, and means for locating a piece of material in position to receive a strand from the second section of said passageway.
3. Apparatus for making a strand reinforced piece of material comprising strand spiralling mechanism including means providing an elongated first passage, said passage extending helically from one end thereof throughout at least a portion of its length, means providing an elongated helical second passage having one end disposed in substantial continuation of the said one end of the first passage so that a strand can pass continuously from said first to said second passage, said second passage having a greater pitch and a greater diameter than the helical portion of said first passage to permit springback of a strand to a substantially unstressed condition in said second passage after it has passed through said first passage, means for forcing a strand through said first and second passages in sequence, and means for locating a piece of material in position to receive a strand from said second passage.
4. Apparatus for making a strand reinforced piece of material comprising a strand spiralling mechanism including a first elongated rod having a groove in its outer surface from one end to the other, means surrounding said rod and cooperating with said groove to provide a

first passage, said groove, and hence said first passage, extending helically from said other end of said rod throughout at least a portion of its length, a second elongated rod aligned with said first rod having one end thereof close to and confronting said other end of said first rod, said second rod having a helical groove in its outer surface from end to end, means surrounding said second rod and cooperating with said groove thereof to provide a helical second passage, said passages at the confronting ends of said rods being contiguous so that a strand can pass continuously therethrough, said second passage having a greater pitch and a greater diameter than the helical portion of said first passage to permit springback of a strand to a substantially unstressed condition in said second passage after it has passed through said first passage, means for forcing a strand through said first and second passages in sequence, and means for locating a piece of material in position to receive a strand from said second passage.

5. The apparatus defined in claim 4, wherein the means surrounding said first rod includes a freely rotatable sleeve.

6. The apparatus defined in claim 4, wherein said first groove has a straight portion adjacent said one end of said first rod, said means surrounding said first rod includes a fixed support for said first rod which surrounds the straight portion of the groove in said first rod, and a freely rotatable sleeve surrounding the helical portion of the groove in said first rod.

7. The apparatus defined in claim 6, wherein said means surrounding said second rod includes a second support, means securing said second rod to said second support, said second support being adjustable in the direction of the length of said second rod, and means for locking said second support in adjusted position.

8. The apparatus defined in claim 7, wherein said confronting ends of said rods substantially abut.

9. Apparatus for making a strand reinforced piece of burlap comprising strand spiralling mechanism including a first elongated rod having a groove in its outer surface from one end to the other, means surrounding said rod and cooperating with said groove to provide a first passage, said groove, and hence said first passage, extending helically from said other end of said rod throughout at least a portion of its length and extending substantially straight for the remainder of its length, said means including a fixed support surrounding the substantially straight portion of said groove, means securing said rod to said support, said means also including a freely rotatable sleeve surrounding the spiral portion of the groove in said first rod, a second elongated rod aligned with said first rod having one end thereof confronting said other end of said first rod in substantial abutting relation, said second rod having a helical groove in its outer surface from end to end, means surrounding said second rod and cooperating with said groove thereof to provide a helical second passage, said passages at the confronting ends of said rods being contiguous so that a strand can pass continuously therethrough, said second passage having a greater pitch and a greater diameter than the helical portion of said first passage to permit springback of a strand to a substantially unstressed condition in said second passage after it has passed through said first passage, means for forcing a strand through said first and second passages in sequence, means for advancing a piece of burlap in position to receive a strand from said second passage, and means fixed with respect to said second rod providing a cutting element in cooperation with which a second cutting element can sever a strand.

10. The apparatus defined in claim 9, wherein said means surrounding said second rod includes a second support, means securing said second rod to said second support, said second support being adjustable in the direction of the length of said second rod, means for locking said second support in adjusted position, said means pro-

viding said cutting element being secured on said second support.

References Cited by the Examiner

UNITED STATES PATENTS

2,062,552 12/1936 Burgess et al. 153—66

2,106,454
2,513,611
2,749,962
2,800,151
2,944,584

1/1938
7/1950
6/1956
7/1957
7/1960

Frost et al. 153—66
Woller 153—66
Kitseiman 153—64
Shockey et al. 140—3
Calmy 153—66

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