

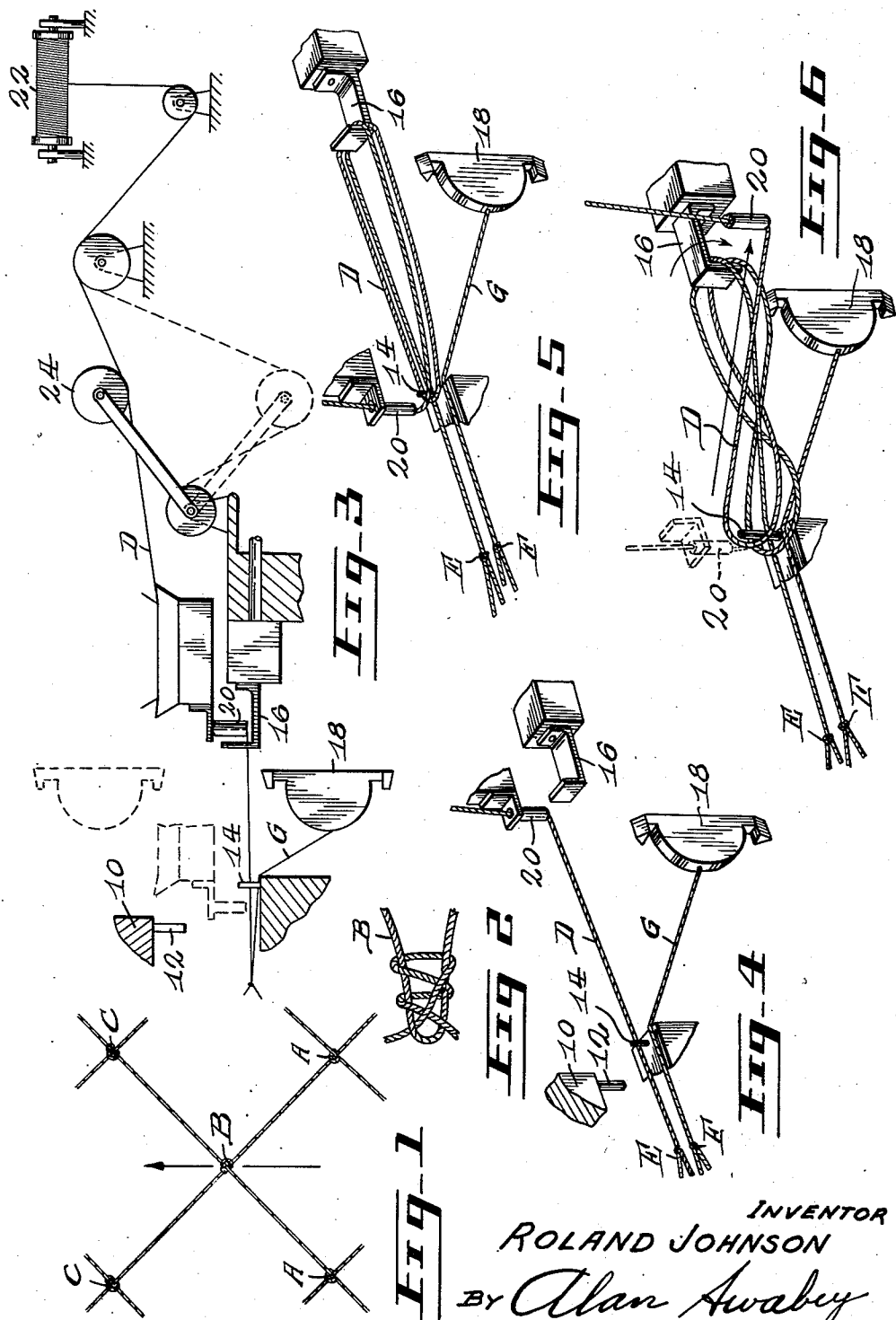
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DOUBLE KNOT NETTING

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2 Sheets-Sheet 1



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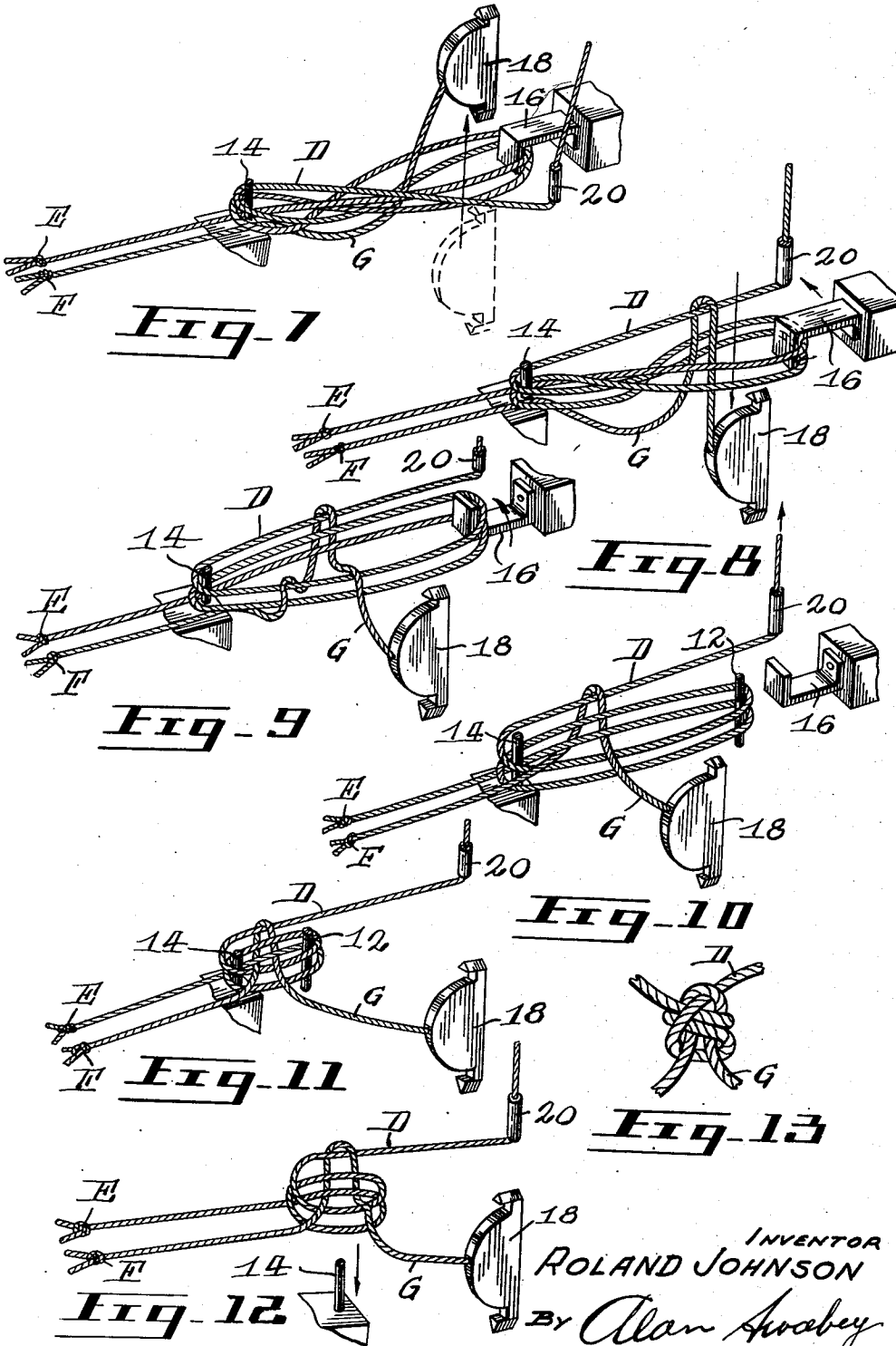
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## DOUBLE KNOT NETTING

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5 Claims. (Cl. 87—53)

The present invention relates to the manufacture of nets and more particularly to the making of a double weaver's knot on a netting loom.

In the making of nets on looms, certain strands or creel threads are arranged in multiple parallel alignment with each other. Other strands, or shuttle threads, are supplied by reciprocating shuttles located between the first strands. The creel threads are usually individually fed to and arranged about spaced apart rows of retaining members by means of twine tubes from supply creels. The shuttles are arranged so as to pass through the looped creel threads in a time related sequence so that the shuttle threads are each alternatively knotted to the two creel threads between which each shuttle operates. The creel threads are fed lengthwise as each knot is formed so that the meshes of the net are formed in the usual manner.

The knot uniting the creel threads and shuttle threads may be of a single or a double type of knot well known in the art as a weaver's knot. The double weaver's knot possesses certain advantages over the single knot in that it is more secure and accordingly is less liable to slippage.

The present invention aims to provide an improved method of making a double weaver's knot on a netting loom and apparatus by means of which the method may be carried out.

Accordingly, the invention is a method of forming a double weaver's knot comprising the steps of forming a double loop of a first or creel thread and retaining the ends of the loops on spaced apart retaining points, twisting the double loop to form a loop having two bights while moving the first thread diagonally to one side of one of the retaining points passing the second thread through one bight of the twisted double loop, moving the first thread to the other side of said retaining point, passing the second thread back down through said bight, untwisting the loop, and progressively restraining the loop while drawing up the first thread and then releasing the loops and tightening the knot. The entire sequence of steps is carried out with both the first thread and second thread under tension and in multiple fashion so that with each knotting step a complete row of meshes is added to the net. The knots are made alternatively right and left handed, with respect to the loom on alternate rows so as to prevent twisting of the net strands.

More specifically, a loom by means of which the present method may be carried out is provided with spaced apart rows of retaining pins and rotatable hooks arranged in opposed relationship. A double knot is made on this loom as follows; the creel thread is fed from supply creels in individual parallel rows to the retaining pins where each strand is wound, by means of a twine tube, in two full loops about a retaining pin and a corresponding hook. The hooks are each then rotated about 180 degrees to twist the loops over each other while the feeding portion of the creel thread is

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moved by the twine tube to a diagonal position across the twisted loops to a position at one side of the hook. The shuttle thread which is located on the shuttle between each pair of creel threads, is then passed by the shuttle up through the twisted loops and while the shuttle is in the top position the twine tube carrying the creel thread is moved back to the original side of the hook. The shuttle is then passed downwards through the loop to its original position beneath the retaining pin and hook. The rotatable hooks are then rotated back to their original condition untwisting the loop so that the shuttle thread is now looped about one portion of the creel thread and is looped about by two full loops of the creel thread.

A plurality of restraining pins are mounted on an elongated bar extending the length of the operative portion of the loom in spaced apart relationship corresponding to the location of the retaining pins and hooks and means provided whereby these restraining pins are moved forward and downward while the loops are slipped off the hooks onto the restraining pins. The bar holding the restraining pins is then caused to move backwards towards the retaining pins while the knots are drawn up by tension being applied to the creel thread fed through the twine tubes by a bascule acting on the creel thread between the supply packages and the twine tubes.

When the loops have been drawn up and the restraining pins have reached the retaining pins the bar holding the restraining pins is caused to lift leaving the loops solely on the retaining pins. The entire row of retaining pins are then withdrawn releasing the finished row of knots. The completed row of mesh is drawn backwards by the usual roll arrangement a predetermined distance so that when the retaining pins again come up into position the completed knots are free and the retaining pins are in starting position to receive the double loops from the twine tubes and so on.

As will be appreciated, the knots so made are alternated on every row so that each row of the mesh is united by a left-hand or right-hand knot keeping the strands from twisting as the weaving proceeds.

### Detailed description

Having thus generally described the nature of the invention particular reference will be made to the accompanying drawings showing by way of illustration a single set of the loom elements capable of making a double knot in accordance with the invention, and in which:

Figure 1 is a diagrammatic view showing a portion of a net embodying double weaver's knots formed in accordance with the invention.

Figure 2 is an enlarged detail view of a double weaver's knot formed according to the invention.

Figure 3 is a diagrammatic view partially in section showing the preferred arrangement of loom elements for making a double weaver's knot according to the invention.

Figures 4 through 12 illustrate in step by step sequence the present method of forming a double weaver's knot on a netting loom.

Figure 13 is an enlarged detail view of the completed knot as it would appear when tightened after the final step shown in Figure 12.

With particular reference to the drawings, Figure 1 shows a portion of a net wherein the strands are joined by double weaver's knots according to the invention to illustrate in more detail the alternative left and right-hand knot uniting the strands in alternate rows. The knots A in the first row are right-hand while the knot B in the second row is left-hand and the knots C in the

third row are again right-hand and so on. The enlarged detail of the partially tied knot in Figure 2 shows a left-hand knot similar to that indicated at B.

The netting loom by means of which the present method is carried out is of conventional construction with the exception that there is provided a moving bar 10 containing a plurality of spaced apart restraining pins 12, a portion of the bar and one pin only being shown by way of illustration. The present construction also includes retaining pins 14, rotatable hooks 16, reciprocating shuttles 18, and twine tube feeders 20 which are adapted to supply and feed a creel thread D from supply creels 22. A tensioning bascule 24 is pivotally mounted between the supply creels 22 and the twine tubes 20 so as to be adapted to exert tension on the creel thread D to draw up the knots as will be described in more detail later. This apparatus is utilized to carry out the present method of forming a double weaver's knot in the following sequence of operative steps.

Figure 4 shows the first step wherein the creel thread D is fed from the preceding knot E along one side of the retaining pin 14 towards the rotatable hook 16 while the shuttle thread G is held on the other side of the retaining pin 14 by the shuttle 18. The shuttle thread G extends from the preceding knot F of the row of meshes. (See Figure 4.)

Referring to Figure 5, the creel thread D is then looped in two full loops about the retainer pin 14 and the rotatable hook 16 by means of the twine tube 20.

Referring to Figure 6 the looped creel thread D is then twisted over between the retainer pin 14 and the hook 16 by rotating the hook 16 about 180 degrees and at the same time the twine tube 20 carries the feeding end of the creel thread "D" diagonally across the twisted loops to a position at one side of the hook 16.

Referring to Figure 7, the shuttle 18 then passes up through the crossed over loops of the creel thread D so as to carry the shuttle thread G through and above the loops.

Referring to Figure 8, while the shuttle 18 is in the top position shown in Figure 7, the twine tube 20 moves across to the other side of the hook 16 and the shuttle 18 then descends back down through the loops of the creel thread D.

Referring to Figure 9, the hook 16 then rotates back to its normal position, about 180 degrees, so that the shuttle thread G is looped about the top strand of the creel thread D and due to the untwisting of the loop by the counter rotation of the hook 16 also passes behind the two outside strands of the creel thread D forming the loops.

With reference to Figure 10, tension is then applied by the bascule 24 to the end of the creel thread D feeding through the twine tube 20 so that the loops of the creel thread are tightened and at the same time the restraining pin 12 has descended directly in front of the hook 16 so that the loops of the creel thread D are slipped from the hook 16 onto the restraining pin 12. As the creel thread D continues to be drawn up the restraining pin 12 moves towards the retaining pin 14 as is shown in Figure 11. When the knot has been tightened sufficiently so that the loops and the restraining pin 12 have almost reached the retaining pin 14 the restraining pin 12 is raised allowing the loops to be tightened further about the retaining pin 14. Finally, the retaining pin 14 is withdrawn allowing the completed knot to be tightened as is shown in Figure 13. As will be appreciated, the condition of the knot when it reaches the step shown in Figure 12 will be approximately the same as that shown in Figure 13 the loops being shown as open in the present illustrations to show the construction of the knot more clearly.

As this step by step sequence has been taking place all along the length of the loom, the completed knots

are withdrawn in the usual manner clear of the retaining pins 14 and the retaining pins will again arise into operative position ready for the next row. As will be appreciated, the knots so made are alternated on every row so that each row of the mesh is united by a left-hand or right-hand knot keeping the strands from twisting as the weaving proceeds.

I claim:

1. The method of forming a double weaver's knot comprising the steps of, forming a double loop of a first thread, twisting the loops so formed to form a twisted double loop having two bights and placing the leading end of said first thread across the twisted double loops, passing a second thread through one bight of the twisted double loops, bringing said leading end of the first thread back across the leading end of the second thread and then passing the leading end of the second thread down through said bight of the twisted loop, untwisting said loop, then applying tension to said first thread to draw the loops formed by said first thread to form with said second thread a knot uniting said first and second threads.

2. In a netting loom having a loom frame and rows of movable thread retaining pins and rotatable hooks mounted in spaced apart opposed parallel alignment on said frame, movable thread supporting and conveying means adapted to convey single threads about each opposed pair of said spaced apart movable pins and rotatable hooks, a plurality of thread carrying shuttles mounted in spaced apart relationship for reciprocal movement between said opposed rows of pins and hooks, said pins, hooks, thread supporting and conveying means, and shuttles being adapted to move in time related sequence to unite individual threads by knotting therebetween, an elongated bar mounted for reciprocal movement in time-related sequence with the movements of said retaining pins on said frame above and in parallel alignment with said retaining pins and hooks and carrying a plurality of downwardly extending restraining pins disposed in spaced-apart alignment corresponding to said retaining pins, whereby said restraining pins are adapted to be interposed between said retaining pins and hooks and moved in from a first position adjacent said hooks to a second position adjacent said retaining pins during the knot forming action of said loom.

3. In a netting loom as claimed in claim 2 wherein there is provided thread tensioning means adapted to cooperate with said restraining pins.

4. A method of forming a double weaver's knot comprising, forming a double loop of a first thread and retaining apart the ends of the loops at two points of retention, twisting the loop to form a twisted double loop having two bights, moving the first thread diagonally to one side of one of said points of retention, passing the second thread through the one bight of said twisted double loop adjacent the said one point of retention, moving the first thread to the other side of said one point of retention, passing the second thread back through the same bight of the loop, untwisting the loop and progressively restraining the loop while tightening the first thread, and then releasing the loops from retention and tightening the knot.

5. A method of forming a double weaver's knot according to claim 4 in which the loop at said one point of retention is rotated about 180 degrees to produce said twisted double loop with two bights.

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