

April 5, 1955

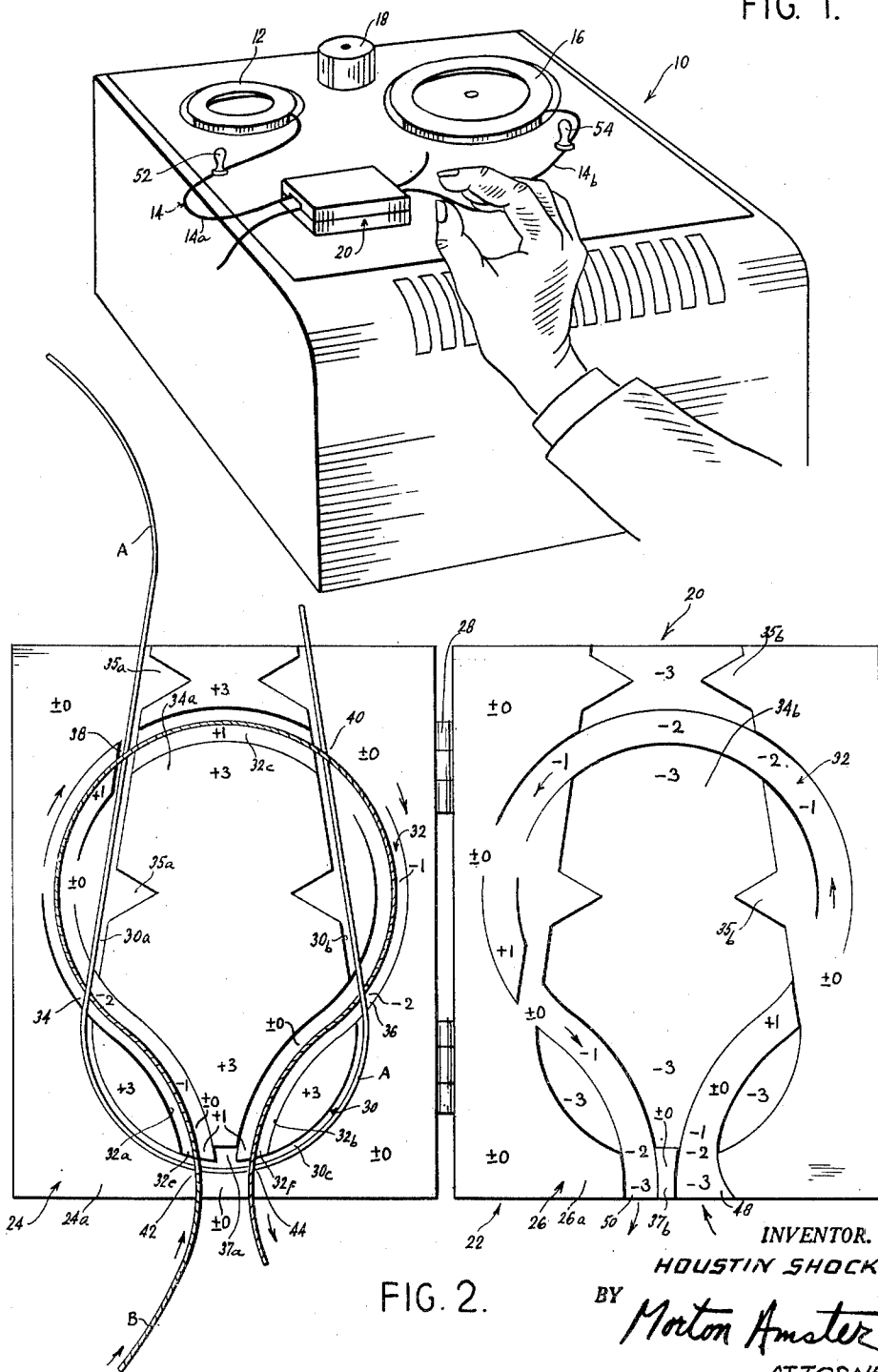
H. SHOCKEY
KNOT-TYING DEVICE

2,705,656

Filed May 18, 1953

3 Sheets-Sheet 1

FIG. 1.



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FIG. 3.

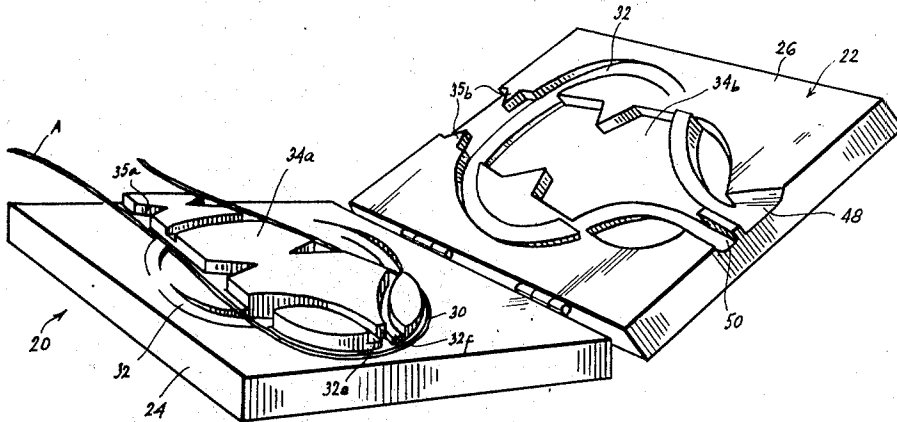


FIG. 4.

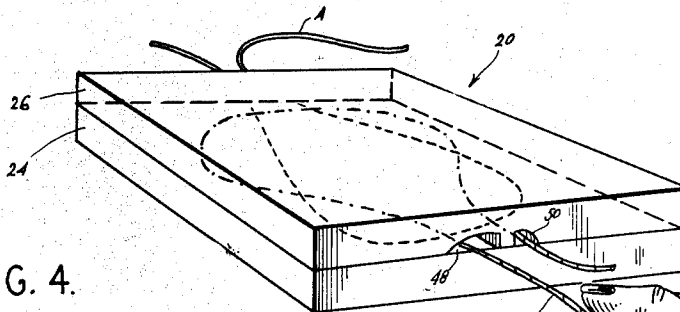


FIG. 5.

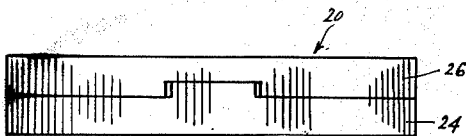


FIG. 6.



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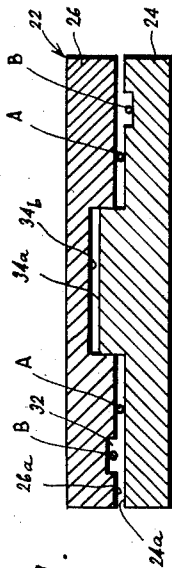


FIG. 7.

FIG. 8.

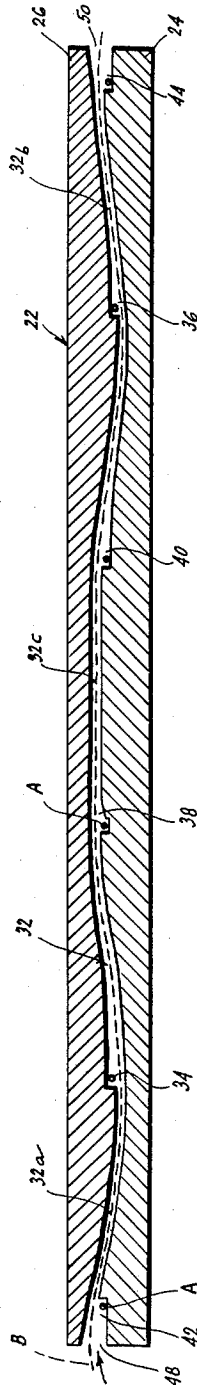
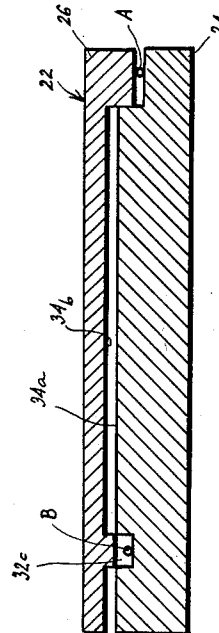


FIG. 9.



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KNOT-TYING DEVICE

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14 Claims. (Cl. 289—17)

The present invention relates to a knot-forming mechanism, and in particular to a device for tying square knots in lengths of bendable material. The invention is especially applicable for use in connection with electronic wire recorders to rejoin lengths of wire upon occurrence of a break during recording, playback or rewinding.

In the manufacture and handling of various wires, yarns, threads, cords, and the like, as well as in the processing of these types of stock into products, there are numerous applications for a square-knot tier. Of special interest are the situations where the nature of the material and/or its size virtually precludes normal tying without the exercise of extreme care and agility. For example, the recommended practice employed for splicing stainless steel sound-recording wires is to tie the end at the break and firm after tying with a scissor. This, of course requires dexterity and care.

Accordingly, it is an object of the present invention to provide a novel method and apparatus for forming and tying square knots in lengths of bendable material. Specifically, it is within the contemplation of the present invention to provide a knot-former for working with relatively fragile wires of small sections, such as are commonly used in standard wire recording units.

In accordance with one aspect of the invention, a knot is formed in two lengths of material to be joined together by supporting and laterally constraining one length along the predetermined path, and intertwining the other length into proper mutual relation with respect to the first length to form the well-known square knot configuration. Thereupon, the knot may be completed by pulling in opposite directions on the intertwined lengths.

As a specific feature of the present invention, a device is provided which comprises respective guide means defining first and second curved paths receiving the lengths of material, each path having a pair of terminal sections extending in opposite directions. One of the paths generally underlies the other of the paths and has a pair of intersecting points intermediate the respective pairs of terminal sections, the one path crossing over the other path at the intersecting points. Accordingly, upon bringing the respective lengths into their paths, as by laying one length in and by threading the other length through, a square knot configuration is formed.

A further problem frequently encountered when using conventional electronic wire recorders, in which the recording wire is unwound from a supporting spool onto a take-up drum, is the handling of the recording wire upon occurrence of a break. Lengths of the wire on opposite sides of the break tend to unravel and unwind from their respective supports, often becoming kinked and frequently fouling the recorder. This, along with the great difficulty in splicing per se, are among the primary disadvantages characteristic of commercial wire recording units.

Accordingly, it is another object of the present invention to provide means facilitating the handling of free lengths of wound wire normally having a tendency to unwind from their respective supports; and allowing for formation of a knot in the lengths, without requiring more than ordinary skill and dexterity.

In accordance with this aspect of the invention, a pair of clamps, either magnetic or mechanical, are mounted on a conventional wire recorder, and upon occurrence of a break, may be rendered operative to fix the wires at locations spaced from and on opposite sides of the break.

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Thereupon, with the wire lengths constrained from unraveling, the free end-adjacent lengths of the wire may be formed into a square knot in accordance with the apparatus and method outlined above in brief.

The above and still further objects, features and advantages of the present invention will become apparent upon reference to the following detailed description of an illustrative apparatus and process, when taken in conjunction with the accompanying drawings, wherein:

Fig. 1 is a perspective view on a reduced scale of a knot-former embodying features of the present invention and mounted on a standard recording unit;

Fig. 2 is a plan view of the knot-former shown in open position with a formed square knot in position to be removed from the knot-former;

Fig. 3 is a perspective view showing the beginning of the formation of a square knot, specifically illustrating one length of wire being supported along a guide path prior to closing of the knot former;

Fig. 4 is a perspective view showing the knot former of Fig. 3 closed and with the second length of wire threaded through a second guide path formed in proper mutual relation to the first guide path;

Fig. 5 is an elevational view, taken from the rear of Fig. 4;

Fig. 6 is a plan view, with parts broken away, showing a square knot formed by the apparatus and method of the present invention;

Fig. 7 is a transverse sectional view taken along the transverse mid-plane of the knot-former when in closed position;

Fig. 8 is a stretch-out section showing the contours of the respective guide paths of the knot-former at various locations along the paths; and,

Fig. 9 is a longitudinal sectional view taken along the longitudinal mid-plane of the knot-former when in the closed position.

Referring now specifically to Fig. 1, there is shown a standard wire recording unit 10 including a wire delivery spool 12 having a wire 14 wound thereon, and take-up reel 16 adapted to receive the wire 14 after passing through a recording and playback head 18. Supported on the unit 10 is a knot-former 20 which embodies features of the present invention. Although the knot-former 20 is illustrated in conjunction with a wire recording unit 10, and for the purposes of splicing breaks occurring in the recording wire 14, it is to be expressly understood that numerous other applications are contemplated for the knot-tier, for example, wherever the problem of tying together strands of bendable material occurs.

The knot-former illustrated in detail in Figs. 2 to 9 inclusive, includes a bipartite body or fixture 22 including cooperating body sections 24, 26. The body sections 24, 26 are swingably connected together by appropriate hinges or the like, generally designated by the reference numeral 28, for movement relative to each other from the open position illustrated in Fig. 2, wherein the faces 24a, 26a of the body sections 24, 26 lie in substantially the same plane and in side by side relation, to the closed position of Fig. 4, wherein the faces 24a, 26a confront and abut each other. Appropriate releasable catch means, not shown, may be provided between the body sections 24, 26 for detachably locking the respective sections 24, 26 in the cooperating confronting and abutting position illustrated in Fig. 4.

The body sections 24, 26 are formed with guide means defining first and second curved paths 30, 32 for receiving lengths of bendable material, respectively designated by the reference letters A and B. The first guide path 30 includes a pair of substantially straight runs 30a, 30b which extend in one direction and are interconnected by a curved run or section 30c. The respective runs merge and define a generally U-shaped path having a lateral constraining surface. The second path or guide 32 includes a pair of terminal runs or sections 32a, 32b arranged generally above the level of the curved run 30c of the path 30, and a horseshoe run 32c extending generally over the curved runs of the first path. The terminal runs 32a, 32b and the horseshoe run 32c merge to form the continuous guideway 32. As is apparent from

an inspection of Fig. 2, the guide path 30 terminates in a pair of ends opening in one direction and the guide path 32 terminates in a further pair of ends opening in the opposite direction. As is apparent from the elevation notations on Fig. 2 and upon inspecting Figs. 7 to 9 inclusive, the guide path 30 generally underlies the guide path 32 except for intersecting points or locations 34, 36 intermediate the respective pairs of terminal sections 30a, 30b and 32a, 32b where the guide path 30 crosses over the guide path 32.

The guide paths 30, 32 with their respective intersections and cross-over points 34, 36 are defined by cooperating complementary male and female sections formed integrally with or relieved from the confronting faces 24a, 26a of the body sections 24, 26. Specifically, the lateral constraining wall of the guide path 30 is defined by a plateau 34a formed on the body section 24. A complementary depression 34b being provided on the body section 26, the lateral wall of the depression 34b is somewhat spaced from the lateral wall of the plateau 34a. The plateau 34a is cut away at spaced pairs of transversely aligned locations, as generally designated at 35a, complementary projecting ears 35b being provided on the body section 26. The respective ears 35b are receivable within the adjacent cutouts 35a to align the body sections 24, 26 in superposed relation and to clamp the wire A in its supported position, as seen in Fig. 3.

As seen in Fig. 3, the wire length A may be supported substantially in the plane of the face 24a by being confined against the upstanding lateral wall of the plateau 34a. The wire A is constrained against displacement upon closing of the body sections 24, 26 by the clamping ears 35b, and a further clamping foot 37b receivable within a complementary depression 37a. Alignment of the cooperating plateaus and depressions is assured by the cutouts and ears 35a, 35b.

As can be best appreciated in Figs. 2 and 3, the guide path 32, including the curved runs 32c merging into the terminal runs 32a, 32b is formed by a segmental arcuate cutout arranged substantially transverse of the plateau 34a. The curved run 32c is of elevation +1, thereby bringing the wire B over the wire A at points 38, 40 or ends. It should also be noted that the terminal sections 32a, 32b of the guideway 32 have elevated bottoms 32e, 32f, lying generally above the face 24a whereby the terminal sections of the wire B cross over the curved sections of the wire A at locations 42, 44.

From the foregoing, it can be seen that the wire A can be supported in a generally U-shaped configuration with substantially straight runs lying along the guide path sections or runs 30a, 30b and with a curved run lying along the path section or run 30c. Wire B may be arranged to cross over the curved run 30c at the location 42, cross under the straight run 30a at the location 34, cross over the straight run 30a at the location 38, cross over the straight run 30b at the location 40, cross under the straight run 30b at the location 36, and ultimately cross over the curved run 30c at the location 44.

Upon viewing Figs. 7 to 9 inclusive, which are sections taken on a greatly enlarged scale with respect to the actual size of an operative mechanism for tying knots in recording wire, the interrelation between the guide or constraining paths 30, 32 for the respective wire lengths A, B may be best appreciated. Clearances between the respective parts are exaggerated in certain instances, and the elevation numbers on Fig. 2 indicate a presently preferred embodiment. Of course, it will be appreciated that the plateau 34a and the depression 34b will not be in perfect registry, thereby providing the requisite clearance to permit swinging into the closed position of Fig. 4. With respect to the contour of the guide path 32, as seen in Fig. 8, upon threading the wire B into the flared entry end 48, it will be possible to move the wire B through the guide 32 unimpeded and without the possibility of the wire becoming fouled due to interference by shoulders, sharp turns or obstructions, such as the presence of the wire A at a cross-over point. Further, viewing Fig. 8, it will be seen that the wire A lies in substantially a single plane with the wire B crossing over and under this plane, to bring the wires A and B into the square knot configuration, illustrated in Fig. 6.

In actually using this embodiment, it is merely necessary to bring the knot-tier 20 into the partially open position illustrated in Fig. 3, and to thereupon bring the

wire A into the position lying along the U-shaped guide path 30 and laterally constrained against the upstanding wall of the plateau 34a. Thereupon, the wire B may be threaded along the guide path 32 by insertion in the entry mouth or end 48 and pushing the wire through the path until the wire end emerges from the withdrawal end 50. The threading or intertwining is accomplished with the body sections 24, 26 releasably locked together, as shown in Fig. 4, the respective paths being illustrated in Fig. 4 by the phantom lines. Thereupon, the separable sections 24, 26 are brought into the open position of Fig. 2, and the properly intertwined wires A and B removed from the knot-former 20. By grasping the formed knot, and by pulling in opposite directions, the square knot will be completed.

Although this embodiment of the invention has been illustrated with the guide path 30 lying in substantially a single plane, and the guide path 32 following a course successively elevated and lowered with respect to the guide path 32 to provide the requisite intersecting points, it can be readily appreciated that it is possible to mutually interrelate the paths by imparting elevation to both of the paths to arrive at the desired intersecting guide arrangement.

The method in accordance with the present invention can be best appreciated by reference to Fig. 8 wherein there is shown the interrelation between the guide paths 30, 32 for the respective lengths of wire. Specifically, in accordance with this aspect of the invention, the square knot is formed by supporting the length A in a generally U-shaped configuration having straight runs (corresponding to the guide sections 30a, 30b) interconnected by a curved run (corresponding to the guide section 30c). Thereupon, the other length, namely B is successively threaded over the curved run at location 42, under the straight run at location 34, over the straight run at location 38, over the other straight run at location 40, under the other straight run at location 36, and over the curved run at location 44.

As seen in Fig. 1, a preferred system for combining the square knot tier with the recording unit 10, includes the provision of respective clamp members 52, 54 and the mounting of the tier 20 on the housing of the unit. The clamp members 52, 54, which may be either well-known mechanical or magnetic types are respectively disposed in close proximity to the feed spool 12 and the wind-up reel 16. Accordingly, upon occurrence of a break in the continuous wire 14 which normally passes through the recording head 18, the wire length 14a extending from the spool 12 may be clamped at the location of the clamp 52 and spaced from the broken end of the wire to provide a length to be worked with in tying the square knot; a corresponding length 14b is provided by clamping at a location corresponding to the position of the clamp 54. It will be noted that any suitable mechanisms may be provided for removably or permanently mounting the square knot tier 20 on the recording unit.

While in accordance with the provisions of the statutes, I have illustrated and described the best form of embodiment of my invention now known to me, it will be apparent to those skilled in the art that changes may be made in the form of the apparatus disclosed without departing from the spirit of my invention as set forth in the appended claims and that in some cases certain features of my invention may be used to advantage without a corresponding use of other features.

What I claim is:

1. A device for tying a square knot in two lengths of material comprising first guide means defining a first curved path receiving one of said lengths and having a pair of terminal sections extending in one direction, and second guide means defining a second curved path receiving the other of said lengths and having a pair of terminal sections extending in the opposite direction, one of said paths generally underlying the other of said paths and having a pair of intersecting points intermediate the respective pairs of terminal sections where said one path crosses over the other path.

2. A device according to claim 1 including a bipartite body formed with said first and second guide means, said body having cooperating sections separable in a substantial median plane.

3. A device according to claim 2 wherein the respective guide means include plateaus and corresponding de-

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pressions formed on the confronting surface of said separable sections.

4. A knot-tier for forming a square knot in two lengths of bendable material comprising a body having a first continuous path receiving one of said lengths and terminating in a first pair of ends opening in one direction and a second continuous path receiving the other of said lengths and terminating in a second pair of ends opening in the opposite direction, said first path including a first curved run underlying and traversing said second pair of ends, said second path including a second curved run overlying and traversing said first pair of ends, said first and second paths having cross-over points intermediate the respective curved runs.

5. A knot-tier according to claim 4 wherein said body includes a pair of sections connected together for movement into and out of confronting relation, said first and second continuous paths being formed on the confronting faces of said sections.

6. A device for tying a square knot in two lengths of bendable material comprising a knot-forming fixture having first and second generally U-shaped paths each receiving one of said lengths, said first path including a pair of straight runs interconnected by a curved run, and said second path including a pair of terminal runs extending over the curved run of said first path and a horseshoe run extending over the straight runs of said path, said terminal runs and said horseshoe run being arranged to form a continuous guideway crossing beneath said first path.

7. The combination with a wire recorder having a feed spool and a take-up drum, of a pair of clamps for respectively securing a wire on opposite sides of and at spaced locations from a break, and a device for tying a square knot in the lengths of wire between said break and said clamps, said device comprising first guide means defining a first curved path receiving one of said lengths and having a pair of terminal ends opening in one direction, and second guide means defining a second curved path receiving the other of said lengths and having a pair of terminal ends opening in the opposite direction, one of said paths generally underlying the other of said paths and having a pair of cross-over points intermediate the respective pairs of terminal ends.

8. The combination with a pair of clamps for holding two lengths of bendable material at locations spaced from their free ends, of a knot-tier for forming a square knot in said two lengths of said knot-tier comprising a body having a first continuous path receiving one of said lengths and terminating in a first pair of ends opening in one direction and a second continuous path receiving the other of said lengths and terminating in a second pair of ends opening in the opposite direction, said first path including a first curved run underlying and traversing said second pair of ends, said second path including a second curved run overlying and traversing said first pair of ends, said first and second paths having cross-over points intermediate the respective curved runs.

9. In combination with a wire recorder having wire being wound from a feed spool to a take-up drum, a pair of clamps for securing lengths of said wire to be tied together upon occurrence of a break, and means for tying a square knot in said lengths of wire, said means comprising a knot-forming fixture having first and second generally U-shaped paths extending in opposite directions and each receiving a length of said wire, said first path including a pair of straight runs interconnected by a curved run, and said second path including a pair of terminal runs extending over the curved run of said first path and a horseshoe run extending over the straight

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runs of said first path, said terminal runs and said horseshoe run being arranged to form a continuous guideway crossing beneath said first path.

10. A device for tying a square knot in two lengths of bendable material comprising a pair of body sections movable into and out of confronting relation with respect to each other, a plateau on one of said body sections defining a first curved path along which one length may be supported when said body sections are out of confronting relation, and means on said pair of body sections forming a second curved path for threading therethrough of the other length when said body sections are in confronting relation, said first and second curved paths having terminal sections extending in opposite directions, one of said paths generally underlying the other of said paths and having a pair of cross-over points intermediate the respective pairs of terminal sections.

11. A device according to claim 10 including means on the other of said body sections cooperating with said plateau to laterally constrain said one length.

12. A device for tying a square knot in two lengths of bendable material comprising a first body section formed with a guide path having a curved run interconnecting straight runs and supporting one length, a second body section cooperating with said first body section to provide a continuous passageway having an entry end and a withdrawal end, said continuous passageway being arranged from said entry end to said withdrawal end to extend successively over the curved run of said guide path, under one straight run, over said one straight run, over the other straight run, under said other straight run, and over said curved run.

13. A knot-tyer for forming a square knot in two lengths of bendable material comprising a body having a first continuous path receiving one of said lengths and terminating in a first pair of ends, and a second continuous path receiving the other of said lengths and terminating in a second pair of ends, said first path including a first run underlying and traversing said second pair of ends, said second path including a second run overlying and traversing said first pair of ends, said first and second paths having cross-over points intermediate said first and second runs.

14. A device for tying a square knot in two lengths of bendable material comprising a knot-forming fixture having first and second paths each receiving one of said lengths, said first path including a pair of terminal runs interconnected by an intermediate run, and said second path including a pair of terminal runs extending over the intermediate run of said first path and an intermediate run extending over the terminal runs of said first path, said terminal runs and said intermediate run of said second path being arranged to form a continuous guideway crossing beneath said first path.

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