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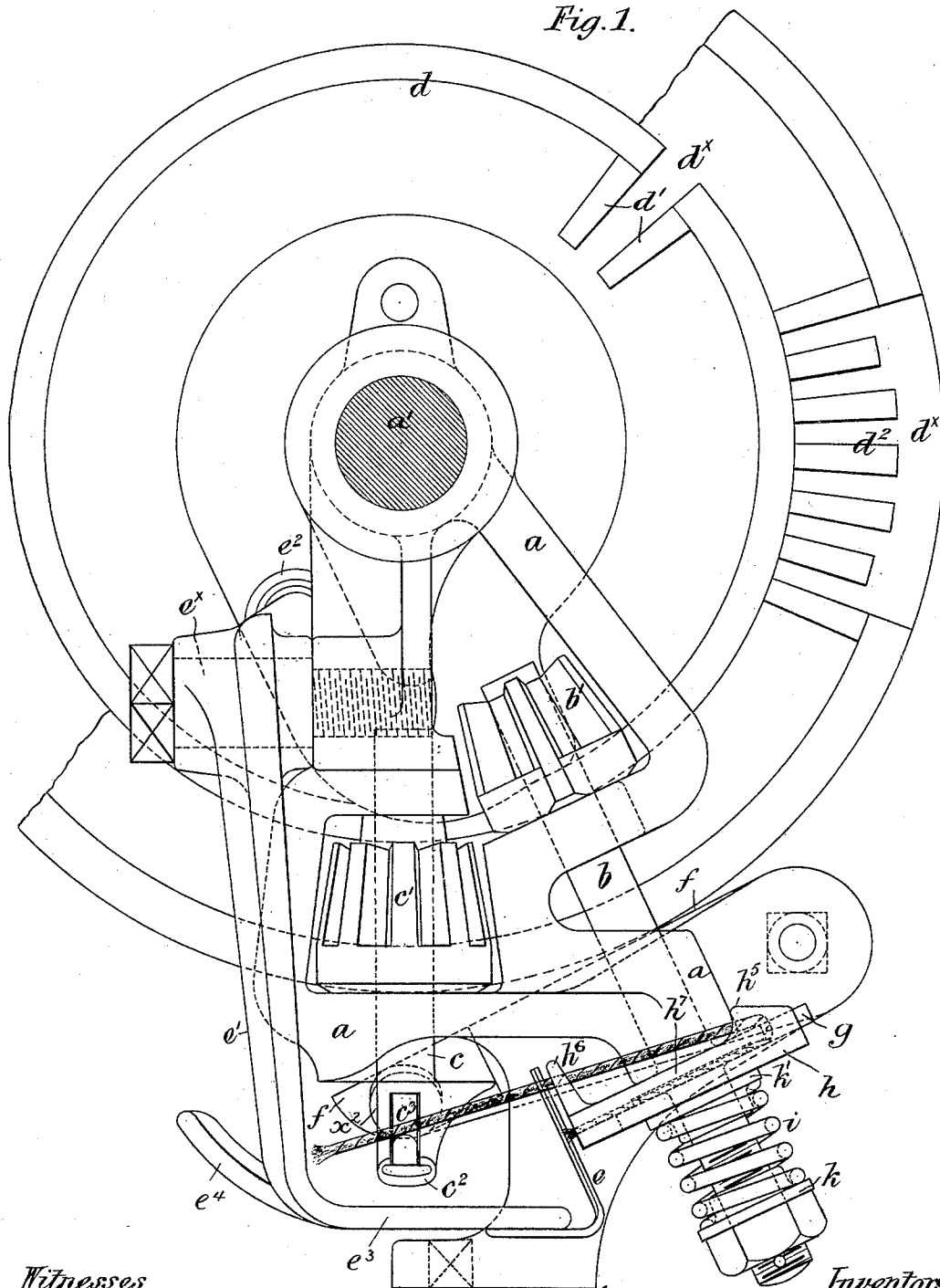
4 Sheets—Sheet 1.

J. HORNSBY, J. INNOCENT, I. TROLLEY & J. H. SMITH.
KNOTTING MECHANISM.

No. 465,610.

Patented Dec. 22, 1891.

Fig. 1.



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(No Model.)

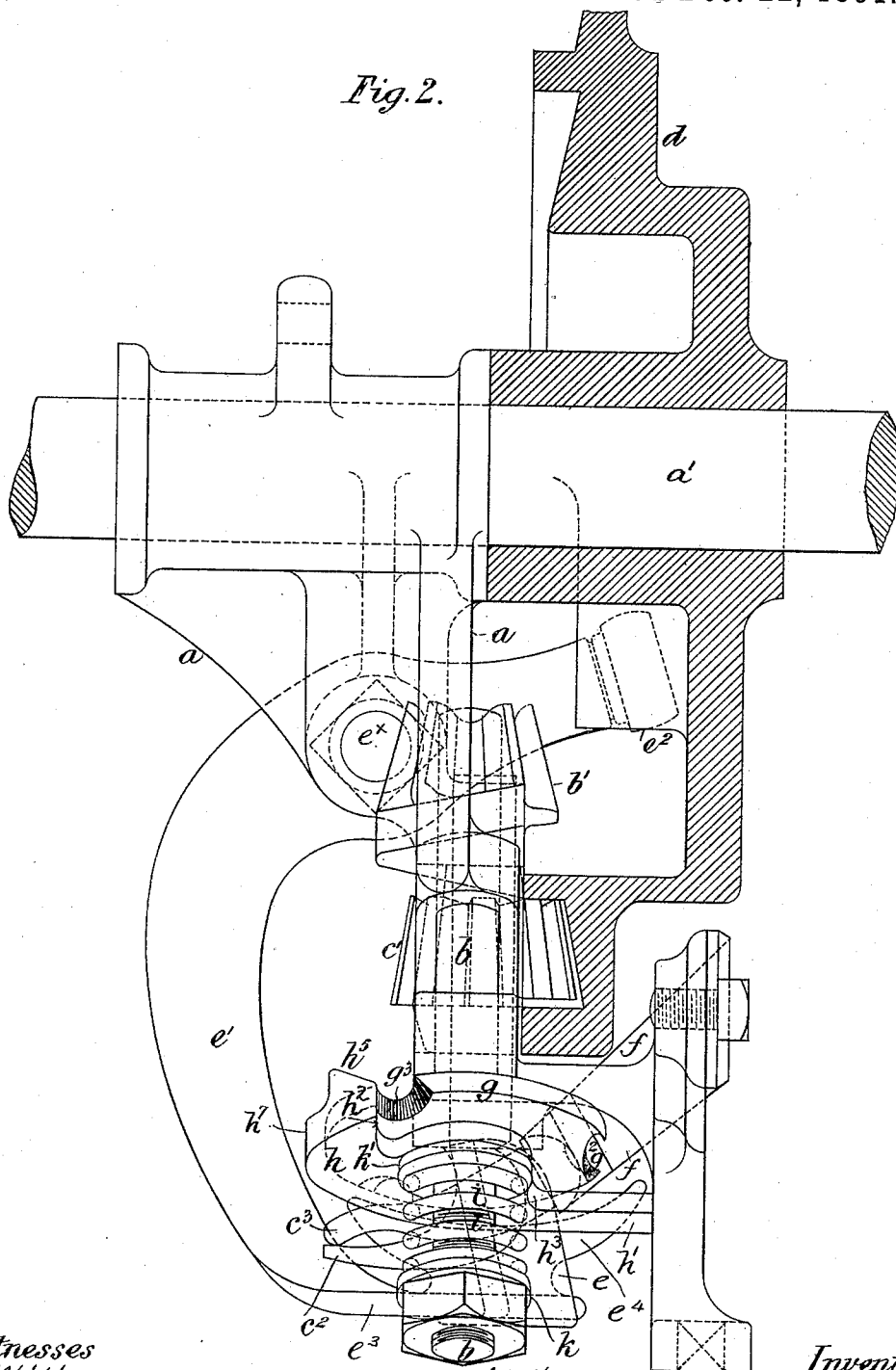
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Fig. 2.



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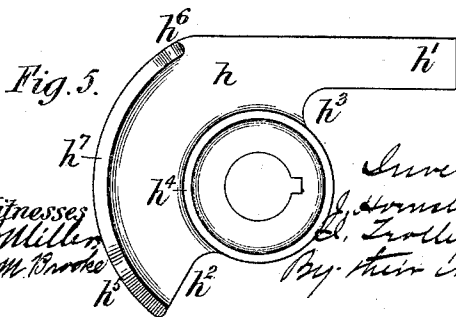
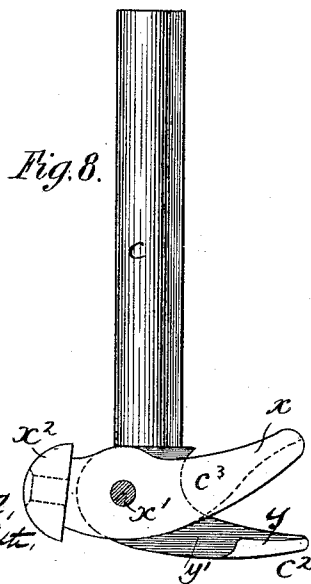
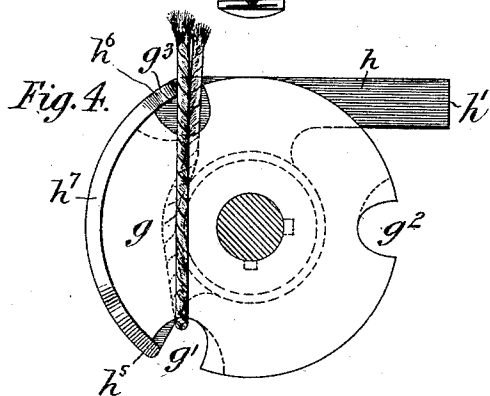
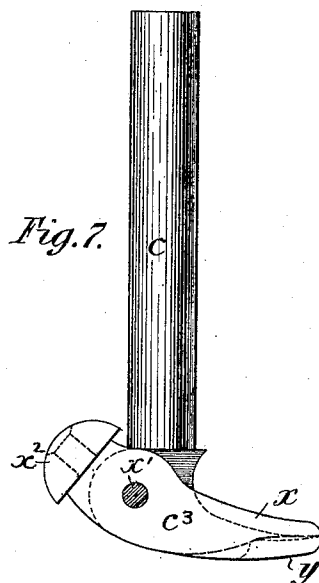
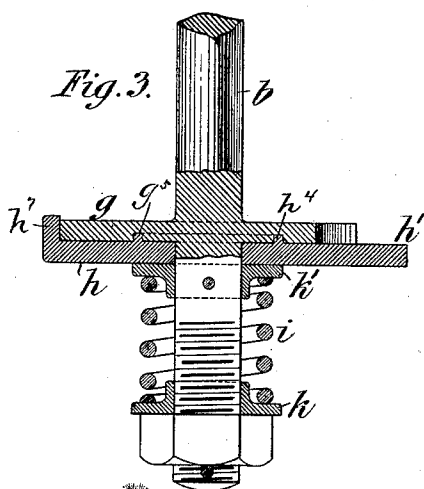
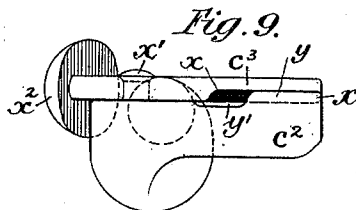
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Fig. 6.

A circular diagram showing a central shaded area labeled 'h' surrounded by a ring of segments labeled 'g' through 'g^5'.



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Fig. 10

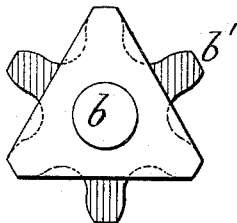
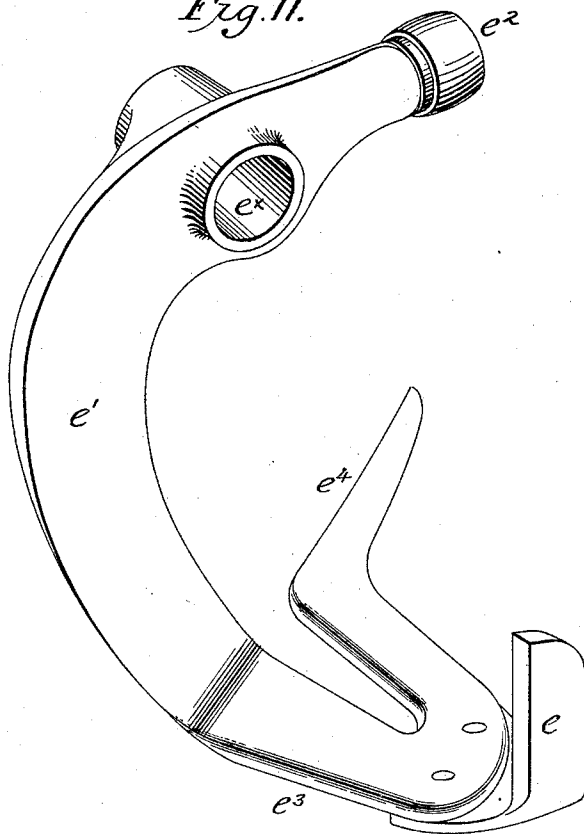


Fig. 11.



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UNITED STATES PATENT OFFICE.

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KNOTTING MECHANISM.

SPECIFICATION forming part of Letters Patent No. 465,610, dated December 22, 1891.

Application filed February 3, 1891. Serial No. 380,098. (No model.) Patented in England August 7, 1888, No. 11,419; in France October 24, 1888, No. 193,703; in Victoria November 27, 1888, No. 6,370; in New South Wales November 29, 1888, No. 1,099; in South Australia December 5, 1888, No. 1,181; in New Zealand December 14, 1888, No. 3,442, and in Germany December 19, 1888, No. 52,021.

To all whom it may concern:

Be it known that we, JAMES HORNSBY, JOHN INNOCENT, ISAAC TROLLEY, and JOHN HENRY SMITH, engineers, subjects of the Queen of Great Britain, all residing at Spittlegate Iron-Works, Grantham, in the county of Lincoln, England, jointly have invented certain new and useful Improvements in Grain-Binders, (for which we have received Letters Patent in Great Britain, No. 11,419, dated August 7, 1888; in Victoria, No. 6,370, dated November 27, 1888; in New Zealand, No. 3,442, dated December 14, 1888; in South Australia, No. 1,181, dated December 5, 1888; in New South Wales, No. 1,099, dated November 29, 1888; in France, No. 193,703, dated October 24, 1888, and in Germany, No. 52,021, dated December 19, 1888,) of which improvements the following is a specification.

Our invention more especially relates to knotting mechanism of the class in which a rotating disk cord holder or gripper co-operates with a rotating knotter or tying-bill to form the knot.

The object of our invention is to secure an effective and simple mechanism by which the cord or string will be securely held both by the cord-holder and the knotter-jaws at the proper time, and will yet afford slack enough for the proper formation of the knot without overstraining the cord. These ends we attain by certain novel constructions and organizations of instrumentalities hereinafter specified. Unless otherwise indicated the parts are of usual and approved construction.

The accompanying drawings represent so much only of a grain-binder knotting mechanism embodying all our improvements in various forms as is necessary to illustrate the subject-matter claimed.

Figure 1 is an elevation of the knotter mechanism, showing the actuating side of the main cam and gear-wheel, with the parts in the position they occupy while the bundle is being collected; Fig. 2, a view at a right angle to Fig. 1, with the cam and gear-wheel in section; Fig. 3, a vertical central section through the cord holder or gripper; Fig. 4, a

plan thereof; Fig. 5, a plan of the presser or retainer, and Fig. 6 a view of the under side of the gripper or holder disk. Fig. 7 is a side view of an improved knotter-bill or knotting-hook with its jaws closed; Fig. 8, a similar view of the same with its jaws open, and Fig. 9 an under side view thereof. Fig. 10 is an under side view of the disk holder driving-pin and its delay-cam or holding-plate. Fig. 11 shows a view in perspective of the knife and knife arm or lever detached.

Figs. 1 and 2 show a knotter-frame *a* suspended from the main actuating-shaft *a'*. The knotter shaft or spindle *c* and the gripper or cord-holder spindle *b* turn freely in bearings in this frame and carry pinions *c'* *b'*, respectively, engaging at suitable intervals with sector racks or teeth *d'* *d* on the knotter-cam and gear-wheel *d*, which makes one complete revolution every time a knot is tied. The teeth *d'* *d* are arranged concentrically on the cam *d*, one set inside or nearer the shaft than the other, and the pinions *b'* *c'* are correspondingly arranged. While disengaged from these teeth the pinions are locked in position by suitable delay-surfaces thereon traversing flanges on the cams. These flanges are cut away at proper points *d''* *d''* to allow the angles of corresponding flanges on these delay-surfaces to pass. The central portion or hub of the cam and gear-wheel *d* is recessed laterally, as shown, to receive a curved knife arm or lever *e'*, rocking on an intermediate pivot *e''* and carrying on its upper end a roller *e''*, running in a guide-course in the cam and gear-wheel. The axes both of the knotter and of the gripper lie in a plane between the cam and the knife-arm pivot. The arm itself curves outward and downward around and below the knotter-jaws and carries a knife *e*, which extends upward at an angle transverse to the string between the knotter and gripper. Consequently the knife at proper intervals traverses athwart the string to cut it.

The knotting-hook or knotter-bill carried by the lower end of the spindle *c* has two jaws, as usual, but differently organized. (See Figs. 7, 8, and 9.) Instead of one jaw

working over the other, one jaw c^2 is fixed on its spindle c and has an inward projection y on its nose, an eye or opening y' being left between this projection and the spindle. The other jaw c^3 rocks vertically on a horizontal pivot x' in a plane parallel with the other jaw and carries on its nose an inwardly-projecting flange x , overlapping the projection y of the fixed jaw. This jaw is also recessed laterally between its nose and spindle. The movable jaw is controlled by a roller x^2 on its end, acted upon by a plate-spring f , fixed on the frame a .

The gripper or holder disk g is fixed on the lower part of the spindle b . It is shown as organized to make three equal intermittent movements to each complete revolution of the knoter, and accordingly has three equidistant notches g' g^2 g^3 , provided with inclined sides, as shown. Radial grooves g^4 in the under side of the disk increase its hold upon the cord. Fig. 6 shows one of these grooves intersecting the active or forward edge of each notch. An annular groove g^5 near the spindle b receives the corresponding flange h^4 of a presser-plate h , mounted loosely on the spindle and prevented from turning therewith by an arm h' , abutting against the frame. The nipping-surface of the presser extends from its rear shoulder h^2 about halfway round the spindle b to the discharge-recess h^3 and lies between the annular internal flange h^4 , above mentioned, and a concentric external flange h^7 . A properly-inclined shoulder h^5 on the rear end of this flange, in conjunction with the shoulder h^2 , aids in leading the cord properly into the appropriate notch of the holder-disk when laid therein by the binder-arm or needle. An upright shoulder h^6 on the opposite end of this flange supports the cord against the strain of the knife while being cut. (See Figs. 1 and 2.)

The laying of the cord or string in proper position on the knoter-bill and holder is facilitated by a cord-guide e^4 , Figs. 1, 2, and 11, diverging from the knife-arm near the heel of the knife on the same side of the path of the binder-arm or of the line in which the cord is laid as the knoter and operating in well-known ways.

The presser-plate is constantly pressed toward the disk g by a spiral spring i , encircling the spindle b . One end of this spring abuts against a collar k , held in place on the spindle by a nut, by which its pressure may be adjusted. The other end acts on a collar k' , which abuts against the presser-plate and is adapted to move longitudinally on the spindle to accommodate the yielding of the presser-plate to adapt itself to varying sizes of cord.

The action is as follows: Unless otherwise indicated the drawings show the attitude assumed by the apparatus while a bundle is being collected, at which time all the parts are at rest. Prior to this time, however, the binder-arm or needle has advanced through

the usual slot in the breast-plate and laid a strand of cord in one of the notches of the gripper or holder disk, the lower end of the strand being clamped in one of the grooves g^4 between the disk g and presser h . (See dotted lines, Figs. 1 and 4.) The binder-arm and breast-plate are not shown in the drawings; but the latter, as usual, is secured to the bottom or foot of the frame a substantially at a right angle to the knoter-shaft. The knoter-jaws normally stand transversely over this slot. The gripper or cord-holder spindle, as well as the knoter-shaft, is radial to the main actuating-shaft a' , and the two shafts lie in the same vertical plane, one behind the other, close to and parallel with the line of the cord or the path of the needle. The gripper stands at a slight angle to the plane of the breast-plate, with its lower edge nearer the knoter. The cord consequently, when under strain, tends to lift itself clear of the upper surface of the gripper-disk, thus avoiding friction thereon. The bundle being laid in the bight of the cord, the needle again advances and lays the second strand of cord in the same notch—say g' —as the former strand and pauses in that position. The doubled strand of cord now lies on the knoter-bill, both of its jaws being closed, with its rear ends in the notch g' , and its front portion—that nearest the knoter—abutting against the shoulder h^6 of the outer flange of the holder-plate, the knife e lying between the knoter and gripper on the opposite side of the cord from this shoulder. (See Figs. 1 and 4.) The flanges or delay-surfaces on the knoter and gripper pinions hold them securely from turning. Fig. 10 shows the delay-flange of the gripper-pinion. The actuating-gears d' d^2 on the cam and gear wheel now engage with their appropriate pinions b' c' at the same time that the delay-surfaces enter the breaks d^x in their flanges, and the knoter and gripper both simultaneously revolve from left to right—that is, toward the front or needle end of the apparatus. As the knoter revolves its bill engages the depressed bight of the strands in front of it and winds them round it. The gripper at the same times makes its one-third of a revolution, carrying the cord with it toward the knoter. This movement clamps the free end of the cord, or that in the needle, between the gripper-disk g and presser-plate h to form the next loop. As the notch in the gripper in which the strands are laid approaches the knoter it slackens the strands, which slack is at once taken up by the knoter as it revolves. This is important in relieving the cord from strain, the tightening of the cord around the bundle as the knot is tied being insufficient. The gripper stops after moving its proper distance; but the knoter continues to rotate. During the latter quarter of its revolution the movable jaw rises above and embraces the strands between the knoter and gripper (see Fig. 8)

and the strands slide between the nose flanges or projections x y into the central eye or space between the jaws, which then close upon them. The knife now advances, presses the strands against the shoulder h^6 of the presser-plate, and severs them close to the gripper. The knotter then comes to rest in its normal position. The strain on the bundle, as usual, draws the loop on the bill over the strands held in the jaws to form the knot, and a continuance of this strain draws the strands endwise laterally through the eye of the bill and the bundle is discharged. The nose-flanges x y , above mentioned, prevent the cord from slipping sidewise from the point of the bill, as is usual. The needle now retracts, leaving its cord in the gripper, as before, and the operations above-described are repeated. The loose end of cord left by the knife escapes from the gripper during its next movement.

Having thus fully described the construction, organization, and operation of our improved knotting mechanism, what we claim therein as new and as of our own invention is—

1. The knotter-hook hereinbefore described, consisting of a rotating shaft, a fixed jaw thereon, its lateral nose projection, an intermediate eye or recess, a jaw movable vertically in a different vertical plane from the fixed jaw, its lateral nose-flange overlapping the corresponding projection of the fixed jaw and its intermediate lateral recess or eye, the organization being such that the strands are grasped in this eye and are drawn endwise therethrough, being prevented by the nose

projections from being drawn off the bill lengthwise.

2. The gripper or cord-holder hereinbefore described, consisting of the combination, substantially as hereinbefore set forth, of a rotating spindle, a disk thereon, its peripheral notches, radial grooves intersecting said notches, a presser-plate movable endwise on the holder-spindle, its external flange overlapping the disk, its rear incline coinciding with the notch in which the cord is laid by the needle and its front shoulder, which holds the strands against the thrust of the knife when they are cut, and the coiled spring pressing the plate against the disk to grasp the cord between them.

3. The combination, substantially as hereinbefore set forth, of a rotating spindle, a disk fixed thereon, its peripheral notches, its radial grooves, its annular groove, a presser-plate movable endwise on the spindle, its annular flange engaging with the annular groove of the disk, its concentric external flange overlapping the working side of the disk, and its actuating-spring, the organization being such that the cord is clamped between the disk and plate and between the flanges and moved first laterally away from but longitudinally toward the knotter-spindle and then toward it again just before the cord is cut.

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