(No Model.) 3 Sheets—Sheet 1.

A. O. CARMAN.

KNOTTING DEVICE FOR GRAIN BINDERS.

No. 423,124. **Patented Mar. 11, 1890.**

Fig. 1.

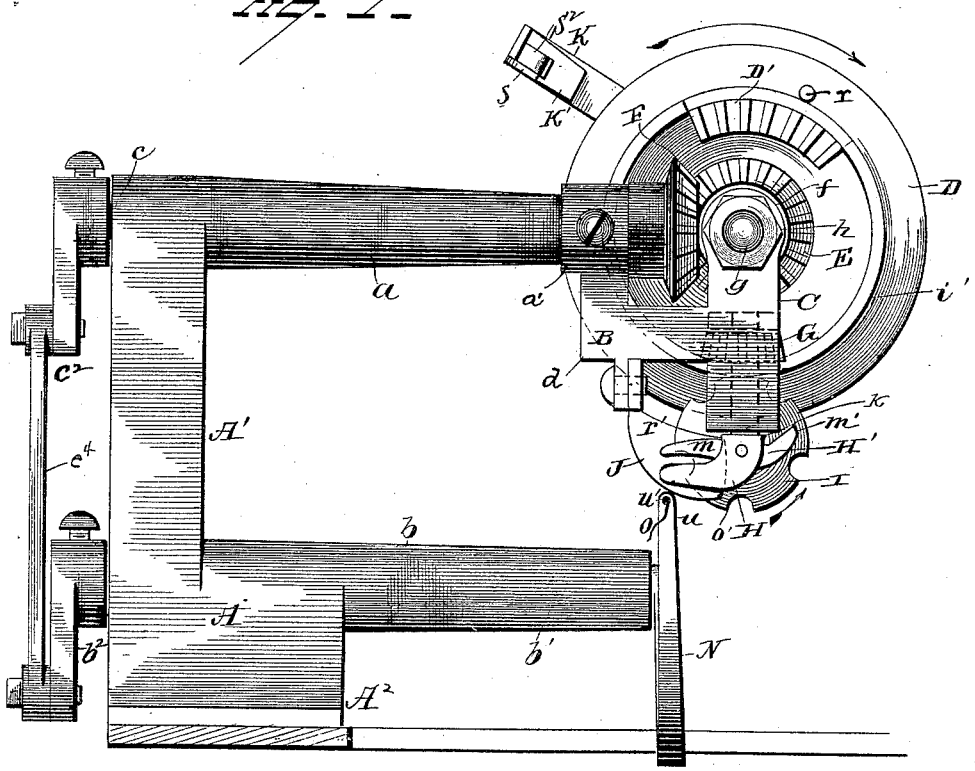


Fig. 6.

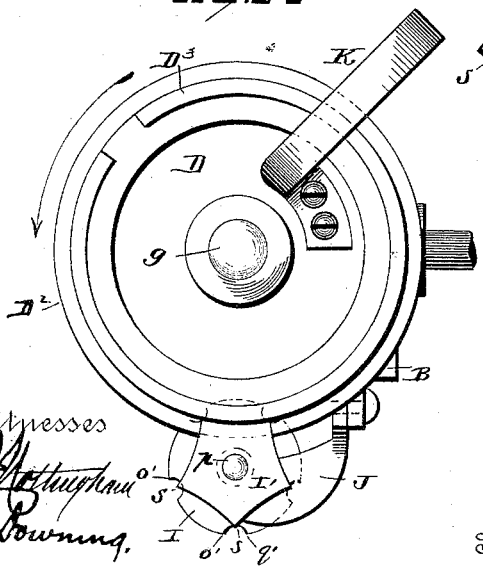
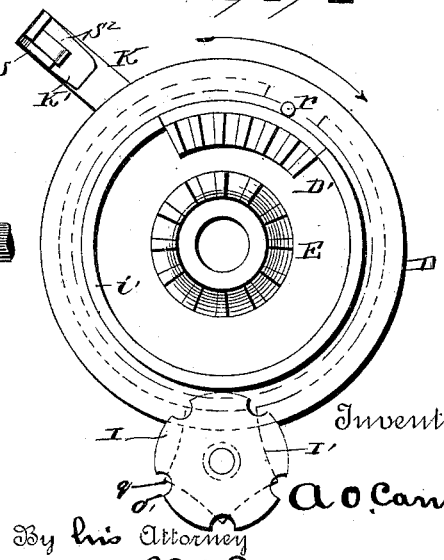


Fig. 7.



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G. F. Downing.

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(No Model.) 3 Sheets—Sheet 2.

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KNOTTING DEVICE FOR GRAIN BINDERS.

No. 423,124. Patented Mar. 11, 1890.

Fig. 2.

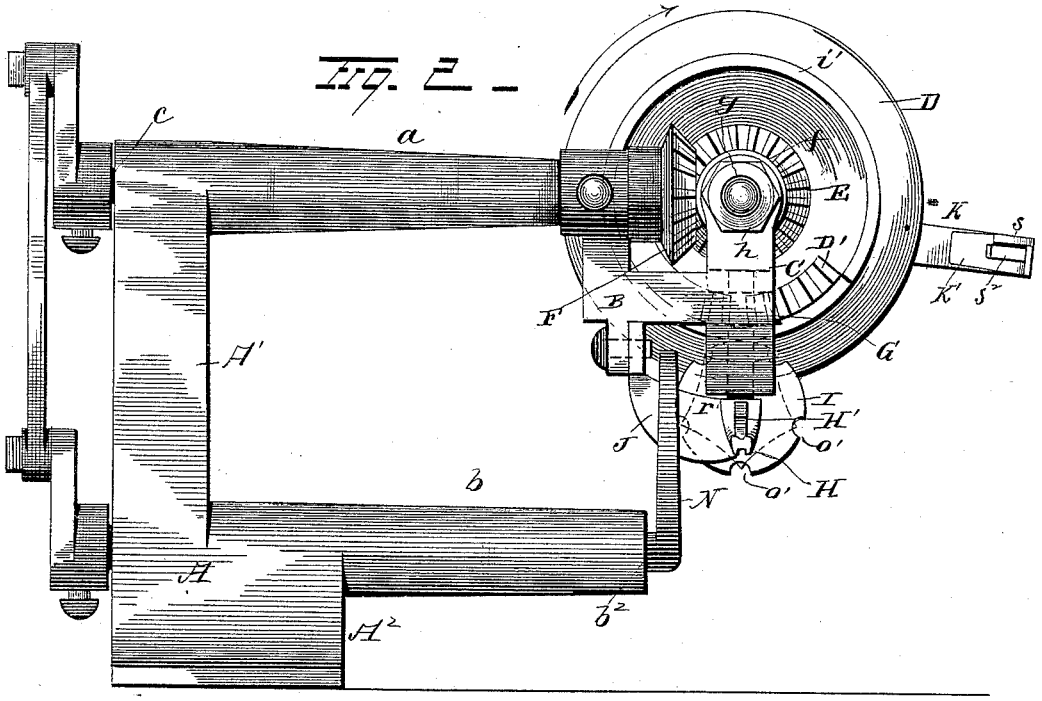


Fig. 4.

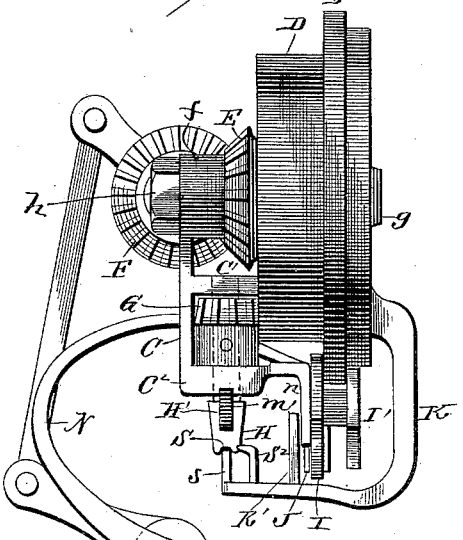
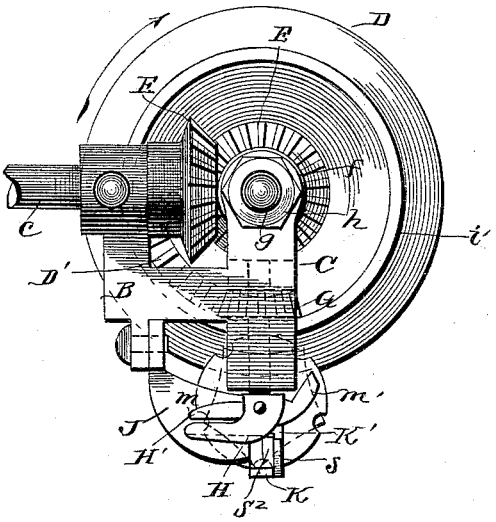


Fig. 3.



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(No Model.) 3 Sheets—Sheet 3.

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KNOTTING DEVICE FOR GRAIN BINDERS.

No. 423,124. Patented Mar. 11, 1890.

Fig. 4.

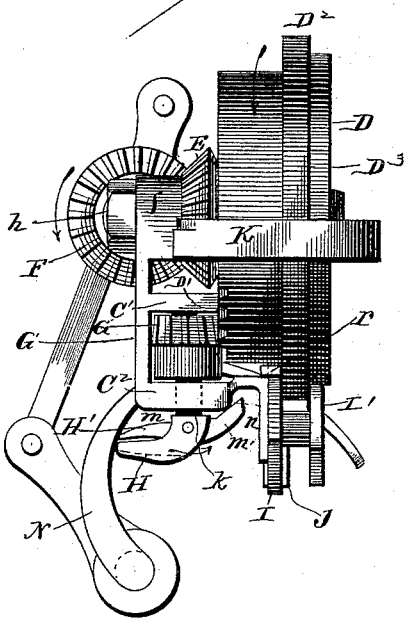
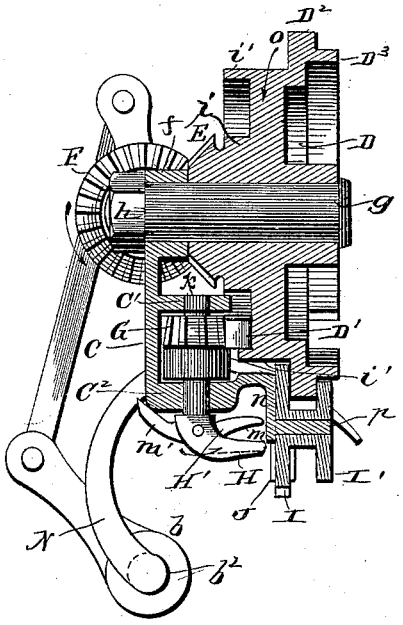


Fig. 5.



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UNITED STATES PATENT OFFICE.

ALVIN O. CARMAN, OF POTTERVILLE, MICHIGAN.

KNOTTING DEVICE FOR GRAIN-BINDERS.

SPECIFICATION forming part of Letters Patent No. 423,124, dated March 11, 1890.

Application filed November 23, 1887. Serial No. 255,983. (No model.)

To all whom it may concern:

Be it known that I, ALVIN O. CARMAN, of Potterville, in the county of Eaton and State of Michigan, have invented certain new and useful Improvements in Knotting Devices for Grain-Binders; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to an improvement in knotting devices for grain-binders, the object being to simplify the construction, reduce the number of parts, and accomplish the looping and stripping the knot and cutting the band by one compact device, these distinct operations being accomplished by the harmonious movement of the needle-arm, tying-wheel, knotting-bill, band-clamping disk, and band-cutter, all these parts being operated by one shaft.

A further object is to produce a knotting mechanism for grain-binders in which a rotary tying-wheel is supported in the same vertical plane with a notched clamping-disk, and is adapted to move the disk one notch upon a complete revolution of the wheel, the tying-wheel also giving one revolution to a vertical shaft which carries the knotter-bills for each distinct rotation upon its own axis.

A further object is to provide a band-cutting knife and stripping-fingers that are directly operated by the rotation of a tying-wheel and so combine them with a knotter-bill that the fingers will finish a knot and the knife cut off the tie-band at the same time.

A further object is to furnish a knotting mechanism in which a rotary tying-wheel, a notched band-clamping disk, a revolving knotter-bill, and a rocking needle-arm are so combined as to place a band around a gavel or bundle of grain, clamp the ends of the band, twist these ends into a loop, strip the loop from the knotter-bill over the ends of the band seized thereby to form a knot, and cut the band upon each revolution of the tying-wheel.

With these objects in view my invention consists in certain features of construction and combinations of parts, that will be hereinafter described, and pointed out in the claims.

In the drawings making a part of this specification, Figure 1 represents a front elevation of the device as viewed from the grain-table, with the needle-arm in depressed position ready to receive a bundle of grain. Fig. 2 shows a front elevation with the parts in position assumed when the bundle has been lifted by the needle-arm to tie the band. Fig. 3 shows the position of the parts relatively when the bundle has been tied and the stripper about to remove the knot from the knotter-bill. Fig. 4 is a right-side elevation of the knotting mechanism with the stripper in engagement with the knotter-bill. Fig. 5 represents a vertical section of the tying device with the jaws of the knotter-bill opened to receive the band-strands and clasp them. Fig. 6 is a rear view of the tying-wheel and supporting-frame with attached parts. Fig. 7 is a front face view of the tying-wheel. Fig. 8 is a side elevation of the knotting mechanism.

A represents the binder-gear standard or bracket, upon which the binding mechanism is supported. It consists of two parallel cylindrical arms *a b*, that project horizontally parallel from one side of the upright standard A′ and in the same vertical plane with each other. The bracket-arms *a b* are each axially perforated throughout their entire length, said perforations also extending through the vertical standard A′, this standard being provided with a flanged foot A^2, which affords a base for the standard, and which may be secured to the frame of the grain-table of a grain-harvester. The upper hollow bracket-arm *a* affords a support for a shaft *c*, this shaft being of sufficient length to project beyond each end of its support *a*. Upon the outer surface of the end *a′* of the hollow arm or box *a* a depending arm B is attached by set-screw or other means. At a point *d* the arm B is bent at right angles to extend outwardly in a line coincident with the axis of the shaft *c*, and at its outer end is furnished with an integral portion that extends above and below this point to produce a bracket-arm C, which is about parallel in

position to the depending arm B, to which it is connected, as shown.

Upon the upper end of the vertical arm C a rounded enlargement or boss *f* is formed, (see Fig. 5,) which is thickened toward the rear side to afford a good support for the stud *g*, upon which the tying-wheel D is mounted loosely. This stud is inserted through a central perforation of the boss *f* and secured therein by a nut *h*, the reduced body of the stud that enters the boss producing a square offset or shoulder upon the body of the stud, which bears against the rear surface of the boss *f*, so as to cause the stud *g* to project at right angles rearwardly from the upper end of the arm C.

The tying-wheel D is made with a recessed front face that affords a central projecting hub *i* and a flange *i'*. Between the hub *i* and boss *f* a bevel-pinion E is mounted upon the stud *g*. This pinion may be formed integral with the tying-wheel D or be attached rigidly to it, so that its revolution will communicate motion to the wheel. Upon the rear end of the shaft *c* a mating bevel-pinion F is fixed, so that a revolution of the shaft *c* will rotate the pinion E and through it the wheel D.

Upon the inner face of the vertical arm C in a position immediately below the outer edge of the bevel-pinion E an integral offset portion or arm C' is made to project at a right angle to this face of the arm C.

At the lower end of the arm C an arm C^2 is inwardly extended. This arm is parallel to the upper arm C', a proper distance intervening between them. Both arms C' C^2 are centrally and vertically perforated to afford box-bearings for the vertical shaft *k*, which is journaled in the same.

Between the short parallel arms C' C^2 just mentioned a bevel-pinion G is mounted upon the shaft *k* and is affixed to it, and upon the lower projecting end of this shaft *k* are the knotting-jaws H H'.

The lower jaw H of the knotting-bill is firmly secured to the lower end of the shaft *k*; or it may be made an integral portion of this shaft. This jaw is extended a proper length at a right angle to the shaft, and consequently lies in a horizontal plane. It is flattened upon its top surface; or this surface may be slightly hollowed out or channeled lengthwise to afford gripping-edges that will act to retain the binder-cord when it is introduced and clamped upon these edges. The upper jaw H' is inserted through a slot made in the vertical portion of the lower jaw H, and is pivoted to vibrate vertically in this slot. The portion *m* of this upper jaw is of a similar length to the lower jaw H and engages it with its lower surface. The heel of the jaw H' is extended beyond the vertical shaft *k* and is turned upwardly to form a toe *m'*, which is of proper form to impinge with its inner surface against the rounded lower portion of the arm C, this contact of parts being effected when the knotting-bill is in the position shown in Figs. 5 and 8, when the jaw H' is lifted by the cam end of the arm C, to permit the strands of the tying-band to enter between the two bills and be clamped there.

The bevel-pinion G, which is secured to the shaft *k* to give rotary motion to the knotter-jaws, has its toothed bevel-face opposite the recessed surface of the tying-wheel D, and this wheel is provided with a toothed segment D', this segment lying in the grooved face of the wheel in such a relative position as to mesh its teeth with the teeth of the bevel-pinion G, so as to transmit motion to the pinion when it is in contact therewith and the wheel D is in motion. The length of the curved segment D' is so proportioned to the diameter and number of teeth of the pinion as to cause this pinion G to make a complete revolution, and this meshing contact of the segment and pinion is so timed that it will always leave the knotter-jaws H H' in axial line with the shaft *c*, or, in other words, parallel to the face of the tying-wheel D. The lower horizontal inwardly-projecting arm C^2, which affords a support to the bevel-pinion G, is extended below the flange *i'* of the tying-wheel D and has a depending flange *n* formed on it, this flange affording support to the clamping-disk I, which is pivoted to it.

The tying-wheel D has a flange D^2 extended from the peripheral face of this wheel at a proper point to allow the forward face of the flange D^2 to press against the adjacent face of the clamping-disk I and lock the parts in proper alignment. The thickness of the flange D^2 is sufficient to afford a dividing-wall between the disk I and a star-wheel I', this wheel I' being integral or connected with the disk and supported upon the same stud or pivot-bearing *p* that projects from the flange *n*.

The clamping-disk I is notched at spaced intervals on its edge to permit the body of the cord or tying-band to lie in said notches, and the star-wheel I' is scalloped on its edge between its points, the curvature of these scalloped surfaces of the star-wheel coinciding with the peripheral surface of the tying-wheel D, its points *q* being located directly opposite the notches O' in the clamping-disk I.

That portion of the rim of the tying-wheel D which extends behind the flange D^2 affords a thin rim D^3.

The rim D^3 of the tying-wheel D is cut away at a proper point to allow a point of the star-wheel I' to enter the notch, and thus permit the wheel to move on its pivot, this movement being effected by an engagement of the projecting pin *r* (see Fig. 7) with one of the notches of the clamping-disk I, so that the star-wheel will move one point and engage its scalloped surface again with the surface of the rim-edge D^3, to prevent a rotative movement of the star-wheel and the attached

clamping-disk I until an entire revolution of the tying-wheel D is made.

Upon the lower portion of the depending arm B a guard-piece J is attached, which extends rearwardly toward the tying-wheel D, and near the face of this wheel it is downwardly bent and flattened to produce a thin flange r'. The edge of the flange r' nearest the notched disk I is curved to conform to the periphery of the disk, and the flange is slotted vertically to admit the body of the disk between the parallel flanges thus produced, so that a strand of binder-cord introduced between the guard-flange r' and the notched edge of the disk I will fall into one of the notches made in the edge of this disk and be clamped tightly to prevent its displacement.

Upon the rear face of the tying-wheel D a bent arm K is attached, the arm being curved to clear the depending flanges of the guard-piece J when the wheel D is rotated. At a point immediately in front of the flange r' of guard J a knife-blade K′ is affixed to the arm so that its edge is in close proximity to the flange r' to cross the path of a binder-cord when the wheel rotates, as will be explained. The free end of the arm K is extended so that it will lie just below the lower jaw H of the knotter-bill, and is provided with an upwardly-projecting short finger s, which enters a slot S′, made lengthwise in the lower knotter-jaw H, and another bent finger S^2 extends upwardly from the top surface of the arm K in such a relative position to the knotter-bill that its upper bent end will enter a longitudinal groove made in the side of the lower knotter-jaw H when the parts of the mechanism are in the position shown in Figs. 4 and 8.

The lower hollow arm b of the bracket A affords support to the rock-shaft b', which latter is provided on one end with a crank connected with a crank c^2 on the end of shaft c by a link c^4, these two cranks being arranged to operate in unison with each other, the ends of the cranks always being equidistant from each other. The opposite end of the rock-shaft b' has the needle-arm N secured to it, the length of the shaft being so proportioned as to permit the bent needle-arm to project its free end u immediately above the upper knotting-jaw H′ when the parts are in position shown in Figs. 2 and 3. An eye or small hole u' is made through the needle-arm N near its free end or point u. The curvature of the needle-arm and its length are such that the point or free end u will lie below or in a line with the top surface of the grain-platform of the harvester, so as to receive the cut grain and permit the formation of a bundle or gavel by the rocking upwardly of the needle-arm.

The binding-cord O is held on a spool. (Not shown.) It is threaded through the eye u' of the needle-arm N. The length of this arm is so proportioned as to allow its free end u to pass through the opening between the guard-piece J and the flange on the knotter-operating wheel above the guard-flange r' and near to the notched edge of the clamping-disk I, so that a rotation of the disk toward the guard-flange r' will carry the cord or band O down between the disk and guard-flange and cause it to enter one of the notches of the disk, which will clamp it firmly.

In operation the cut grain will be transported by endless chains or other approved means and deposited in the bight of the band O, the arm N lying below the gathered bundle. The knotter-bill will now lie with its jaws closed below the single strand of the band O, which has previously been clamped by its end in a notch of the clamping-disk I. At the beginning of the binding operation the cranks and pitman will rock the needle-arm N, so that its end u will pass over the tying-bills and carry the band through the space above the guard-flange r'. This will encompass the bundle or gavel with a band; but the knot must yet be made and the band severed. The position of the eye of the needle-arm N which was last stated will carry the band again into another notch of the disk I, and it will be clamped by it. It will be remembered that both strands of the band now rest upon the top of the knotter-bill. The rotative movement of the tying-wheel in the direction indicated by the arrow (see Figs. 1 and 2) will cause the toothed segment attached to it to engage the bevel-pinion G and rotate the shaft K, which supports the knotter-jaws. The rotation of the knotter-bills, as just stated, will twist both strands of the band which encircles the gavel or bundle, and when the shaft k is so moved as to bring the toe m' of the upper jaw H′ in contact with the rounded lower end of the arm C these bills or jaws will be separated by the elevation of the upper jaw H′, and it will be seen that this separation will take place when the jaws are nearing the clamping-disk I, so that the opening between these knotter-jaws H H′ will permit the strands of the band O to enter between them. A further rotation of the shaft k will cause the toe m' to run off the depressed portion of cam c^2, and thus allow the tension of the loop to close the upper jaw H′ upon both strands of the band. The knotting-jaws will now have made a complete revolution and the arm K, that carries the knife-blade K′, will have assumed a position to permit its fingers s s^2 to enter the slots made in the lower knotter-jaw H for their accommodation. The contact of the stripping-fingers s s^2 with the twisted loops of the band which encircles the knotter-jaws will push these coils toward and off of the points of the knotter-bill and form the knot, the expansion of the compressed stalks of grain tightening the knot when the loop leaves the bill, and to allow this action to be performed the knife-blade K′ will sever the band

close to the disk I. The binding of the gavel is now completed, and it will be discharged by any preferred approved form of bundle-ejector in use.

It will be seen from the foregoing description that the knotting mechanism herein described is of compact form and combines the gavel-forming, tying, knot-stripping, and band-cutting operations in a manner to permit their reliable execution by the positive motion of simple devices which co-operate to accomplish the work rapidly and automatically.

Slight alterations of mechanical details might be made without a departure from the spirit or exceeding the scope of my invention. Hence I do not desire to restrict myself to the exact forms shown; but,

Having fully described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The combination, with a tying-wheel having a flange thereon and a clamping-disk and a star-wheel arranged to receive the flange of the tying-wheel between them, of a rotary knotter and a stripper moving with the tying-wheel, substantially as set forth.

2. The combination, with a tying-wheel having a flange thereon and carrying a cord-cutter and a clamping-disk and a star-wheel arranged to receive the flange of the tying-disk between them, of a rotary knotter actuated by the tying-wheel.

3. The combination, with a tying-wheel having a flange thereon and carrying a cord-cutter and knot-stripper, and a clamping-disk and star-wheel arranged to receive the flange of the tying-wheel between them, of a rotary knotter actuated by the tying-wheel, substantially as set forth.

4. The combination, with a tying-wheel having a flange thereon and pins or studs, of a rotary knotter actuated by the tying-wheel, a rotary cord-holding disk located on one side of the flange and actuated by said pins or studs, and a star-wheel located on the opposite side of said flange.

5. The combination, with a tying-wheel having a flange thereon, of a clamping-disk and a star-wheel arranged to receive the flange of the tying-wheel between them, substantially as set forth.

6. The combination, with a tying-wheel having a flange on its periphery and also a flange at right angles thereto, the latter having an opening therein, and a pin on the peripheral flange opposite the opening, of a bracket-arm, a knotter-bill journaled therein, and an integral clamping-disk and star-wheel loosely mounted on the arm, said disk and star-wheel adapted to receive the peripheral flange on the tying-wheel between them, substantially as set forth.

7. The combination, with a fixed bracket having a cam-surface on its lower end and a tying-wheel journaled on a shaft projecting from the bracket and rotating in a plane parallel with the jaws of a tying-bill when the latter are in their normal position, of a knotter-bill journaled in this bracket, said bill consisting of a shaft, a jaw secured on the lower end of the bill-shaft, said jaw being grooved longitudinally on its side and lower face, a jaw pivoted to the fixed jaw, and an arm projecting from the tying-wheel, this arm carrying stripping-fingers adapted to pass through the longitudinal grooves in the fixed jaw when the tying-wheel makes a revolution, substantially as set forth.

8. The combination, with a knotter-bill consisting of a shaft having a gear-wheel thereon, a jaw having a longitudinal groove on its side and one on its lower surface, and a pivoted jaw, of a tying-wheel having teeth thereon adapted to mesh with the gear-wheel on the knotter-bill, this tying-wheel having an arm secured thereto, the latter being bent around to pass in close proximity to the knotter-bill when the tying-wheel rotates, said arm having a cutting-knife affixed thereto, and a pair of stripping-fingers in position to enter the grooves in the lower jaw, substantially as set forth.

9. The combination, with a binder-gear standard having a pair of hollow arms projecting therefrom, a rocking shaft supported in one arm and a rotary shaft in the other, said shafts having connection with each other, a needle affixed to the rocking shaft, and a bracket supported on the rotary-shaft arm, of a knotter-bill and a cord-holder disk carried by said bracket, the said cord-holder disk being located adjacent to and in the same plane with the tying-wheel and actuated directly thereby, and a tying-wheel having projections for periodically engaging the bill and cord-holder, said tying-wheel being in a plane parallel with the rotary and rocking shafts, substantially as set forth.

10. The combination, with a binder-gear standard having hollow cylindrical arms, shafts supported in said arms, crank-arms on the shafts, a connecting-link, and a curved needle-arm, of a tying-wheel journaled in a bracket attached to one of the hollow arms, a bevel-pinion on the tying-wheel, a mating bevel-pinion on the revolving shaft, a toothed segment on the face of the tying-wheel, a star-wheel and notched disk supported to rotate and be moved by the tying-wheel, a vertical shaft supported to revolve, a bevel-pinion on this shaft to engage the toothed segment, a knotter-bill located on the lower end of the vertical shaft, a bent arm attached to the tying-wheel and provided with stripping-fingers, and a knife-blade, substantially as set forth.

11. The combination, with a rotary knotter, of a rotary tying-wheel the axis of which is at right angles to that of the knotter, an arm carried by the tying-wheel, a cutter affixed to the arm, a cord-holding disk located

on one side of and in close proximity to the periphery of the tying-wheel, and a star-wheel actuated by the tying-wheel and located on the opposite side of said tying-wheel and in close proximity to the periphery thereof, the said star-wheel and cord-holding disk being opposite each other and connected together, substantially as set forth.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

ALVIN O. CARMAN.

Witnesses:
GEO. A. PERRY,
W. S. TITUS, Jr.