(No Model.) 2 Sheets—Sheet 1.

A. STARK.

CORD KNOTTER FOR GRAIN BINDERS.

No. 457,169. Patented Aug. 4, 1891.

Fig. 1.

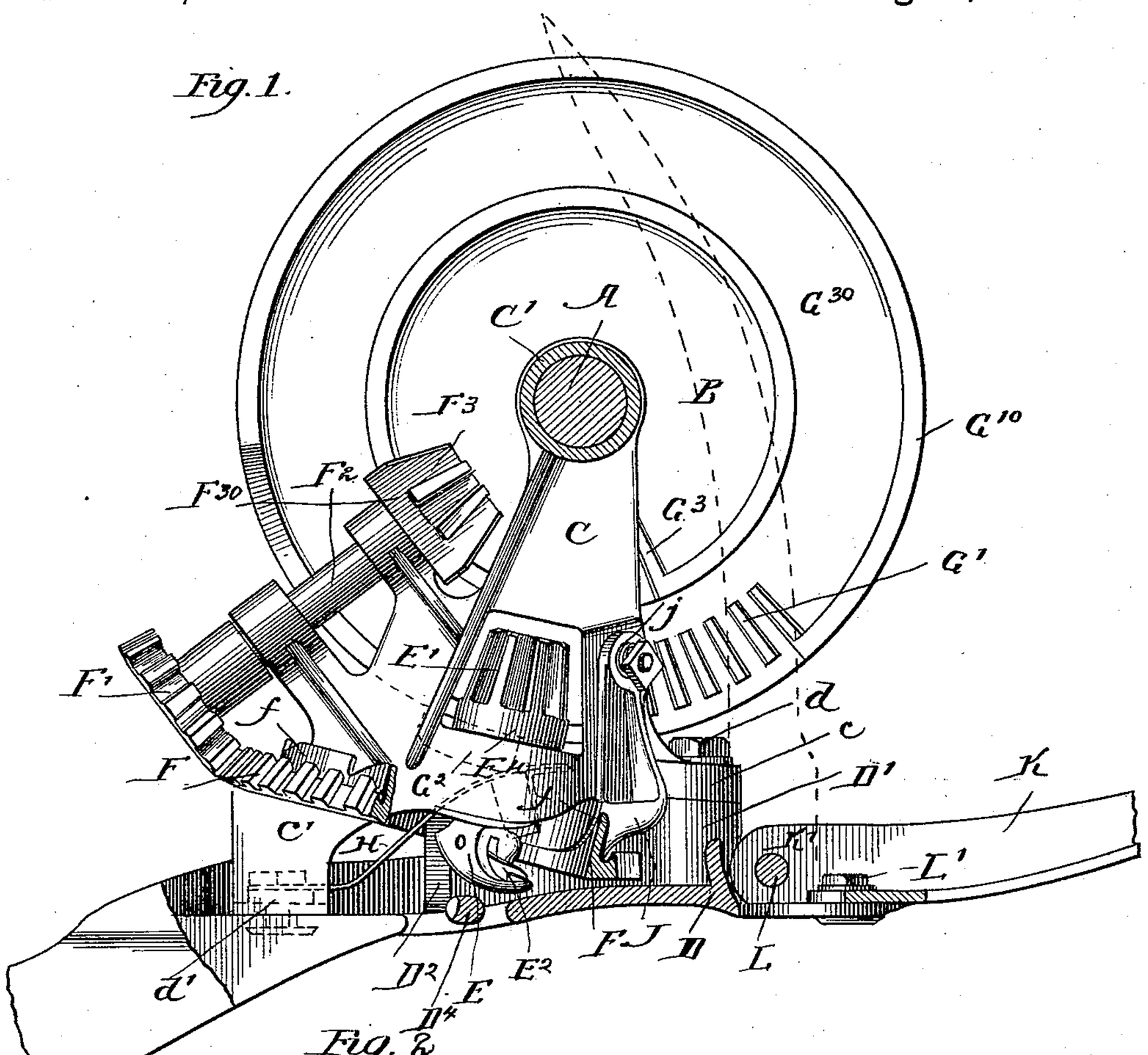
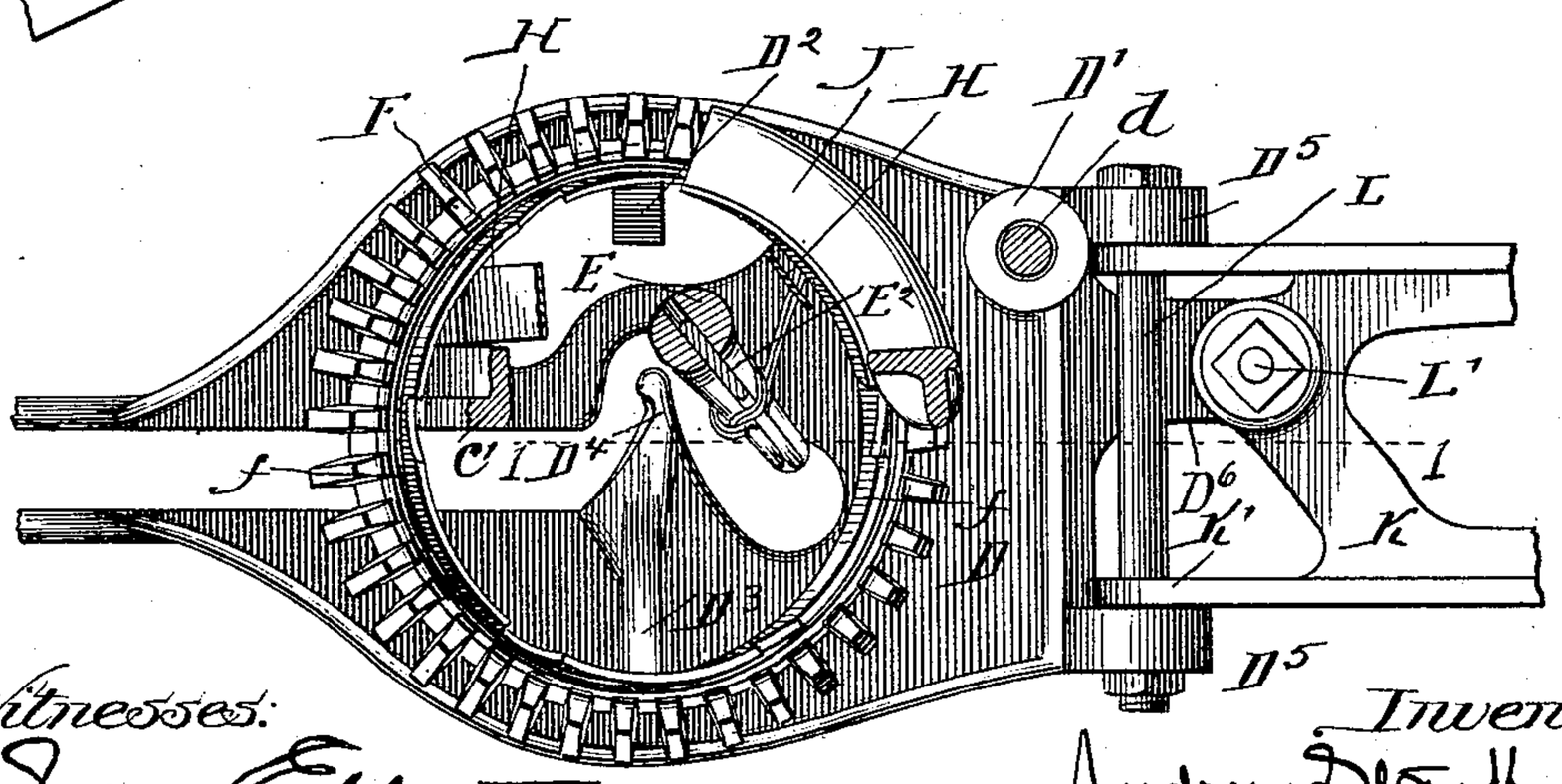


Fig. 2.



Witnesses:
Jean Elliott
Celeste P. Chapman.

Inventor:
Andrew Stark
By Burton & Burton
His Attys

(No Model.) 2 Sheets—Sheet 2.

A. STARK.

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Fig. 3.

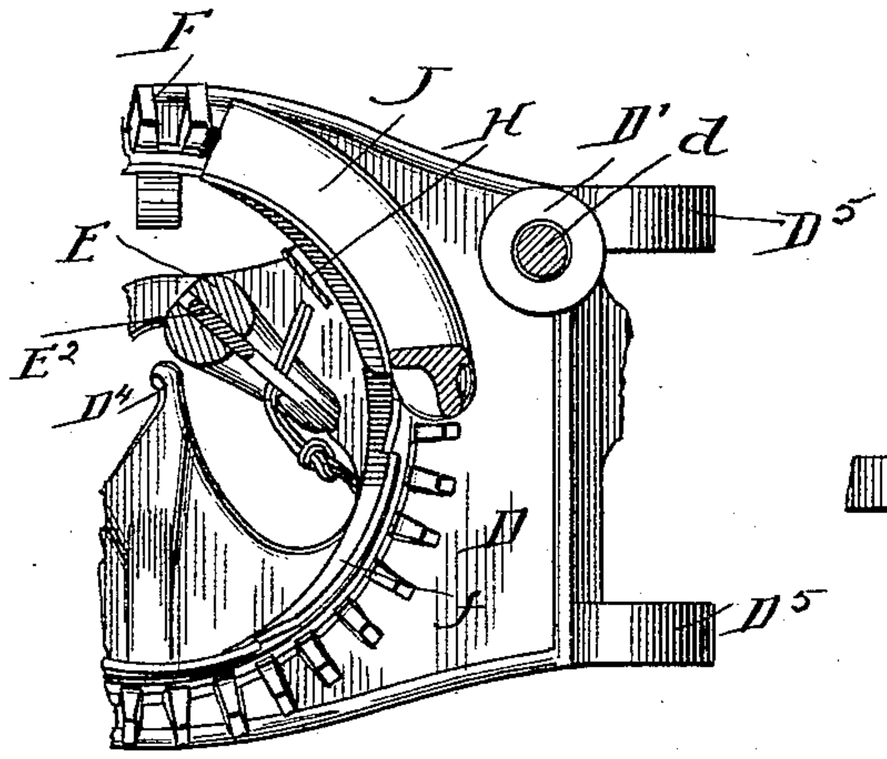


Fig. 4

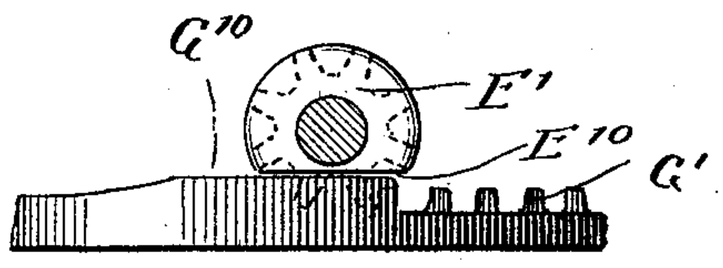


Fig. 5

Fig. 7

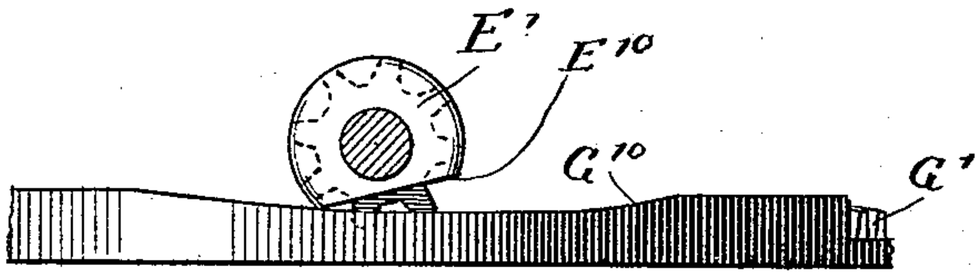
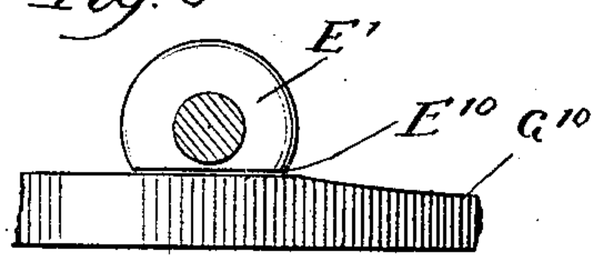


Fig. 6



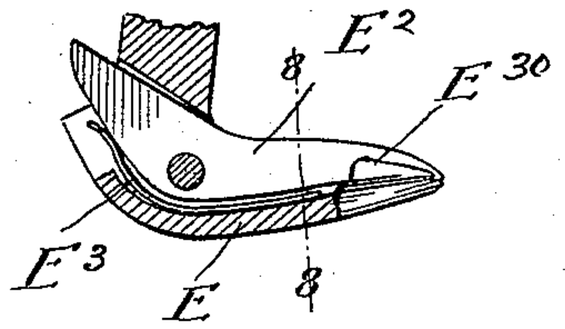
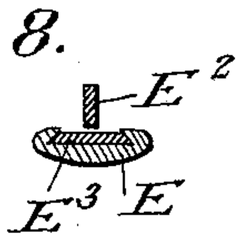


Fig. 8.



Witnesses:
Jean Elliott
Celeste P. Chapman.

Inventor:
Andrew Stark
By Burton & Burton
his Attys.

UNITED STATES PATENT OFFICE.

ANDREW STARK, OF CHICAGO, ILLINOIS.

CORD-KNOTTER FOR GRAIN-BINDERS.

SPECIFICATION forming part of Letters Patent No. 457,169, dated August 4, 1891.

Application filed December 4, 1889. Serial No. 332,510. (No model.)

To all whom it may concern:

Be it known that I, ANDREW STARK, a citizen of the United States, residing at Chicago, county of Cook, and State of Illinois, have invented certain new and useful Improvements in Cord-Knotters for Grain-Binders, which are fully set forth in the following specification, reference being had to the accompanying drawings, forming a part thereof.

In the drawings, Figure 1 is a sectional elevation of my knotting mechanism looking rearward, section being made across the knotter-driving shaft and through the cord-slot in the breast-plate, as at the line 1 1 on Fig. 2. Fig. 2 is a sectional plan of the cord-holder and adjacent portion of the breast-plate, the knotter-bill being shown cut off above the jaws, the parts being shown at the position of cutting the cord, which is also the position of final rest of the knotter-bill. Fig. 3 is a detail plan of a portion of the breast-plate and holder and knotter-bill, the parts being shown at the position of pulling off the knot. Fig. 4 is a detail elevation of the knotter-actuating wheel, showing the knotter-pinion in bottom plan, the parts being at the position corresponding to that shown in Fig. 2. Fig. 5 is a similar view of the same parts in the position corresponding to Fig. 3. Fig. 6 is a similar detail view of the same parts, the position being that of final rest of the bill. Fig. 7 is a section through the knotter-bill made by a plane passing alongside the vibrating jaw, and showing the spring by which said jaw is closed. Fig. 8 is a section at line 8 8 on Fig. 7.

This invention is an improvement upon the cord-knotter for which Patent No. 354,813 was granted to me, dated December 21, 1886, and is also an improvement upon the construction shown in my pending application, Serial No. 205,050, filed June 14, 1886, which is a division of my application, Serial No. 176,742, upon which my said patent, No. 354,813, was granted.

The improvement relates particularly to the operation of the knotter-bill in its relation to the slot in the breast-plate, and particularly to that portion of it over which the cord is drawn in discharging the knot, and also in its relation to the cord-cutter, an important purpose of the improvement being to cause the cord to be more tightly strained at the instant of cutting to facilitate that operation.

It also includes certain changes in the form of the knotter-bill to render it better adapted to co-operate with the other parts to complete and strip the knot by the action of the discharge-arms.

It also includes an improvement in the bundle-stripper, or arm which strips the bundle off of the discharger, preventing it from being carried up around the knotter-driving shaft.

A is the knotter-driving shaft.

B is the knotter-actuating wheel.

C is the knotter-frame, having the bearings for the knotter-bill and cord-holder-driving shaft and supported on the driving-shaft by its sleeve or bearing C′ in a familiar manner.

D is the breast-plate, which is bolted to the knotter-frame and supported in rigid relation thereto, one of the fastenings appearing in the drawings—to wit, the bolt *d*, passing through the lug *c* on the bracket C′ and through the boss D′ on the breast-plate casting—another fastening consisting of the bolt *d′*, passing through the lug *c′* and through the breast-plate at the opposite side of the cord-holder ring.

E is the knotter-bill.

E′ is the knotter-bill pinion.

E^2 is the upper or vibrating jaw of the bill.

E^3 is the spring which closes said jaw. This spring is secured at one end to the lower jaw well forward toward its point, and extends thence along the upper surface of that jaw in a suitable space provided for it between the two jaws to the heel of the same lying below and being bent up behind the upper jaw and contacting the latter above and back of its pivot—that is to say, so that it tends by its free upbent end to close the upper jaw down onto the lower. This spring, as illustrated, is held in place in the lower jaw by being forced and bound tightly between the edges of the dovetailed groove formed in that jaw to receive it, as shown by section, Fig. 8. The manner of securing it, however, is not material, and it may be riveted, as indicated in dotted lines, Fig. 7.

F is the cord-holder ring actuated by the pinion F′ on the shaft F^2, on which there is

also a mutilated pinion F^3, through which motion is communicated from the knotter-actuating wheel B.

G′ is the rack on the knotter-actuating wheel, by which the knotter-pinion E′ is engaged and the knotter actuated in proper time.

G^{10} is the delay-surface which corresponds to the delay-surface E^{10} of the knotter-pinion E′, to hold the knotter at rest in proper time.

G^3 is the rack which engages and actuates the pinion F^3 and thereby the cord-holder ring F.

G^{30} is the delay-surface which corresponds to the delay-surface F^{30} of the pinion F^3, to hold the cord-holder at rest in proper time. The cord-holder ring is supported upon shoulders D^2 and D^3, formed on the breast-plate, and one formed on the bracket C′.

The cord-cutter consists of a knife H, which is a spring fastened on the bracket C′ by the bolt d', and is operated by the projection G^2 upon the wheel G, whereby it is caused to descend upon the cord and cut it at proper time, as hereinafter explained. The cutting portion of this knife H is located adjacent to the clamp J, which is in the form of a saddle striding the flange f of the cord-holder ring F, being supported and kept in place by being pivoted at j to the bracket C′. The general operation of this structure is substantially like that of the construction shown in my said patent, No. 354,813, but differs therefrom in particulars which will appear as its operation is further described in detail. The parts being in the position of rest, which is substantially the position shown in Fig. 3, the cord laid by the needle from the holder extends back over the knotter-bill and over the finger D^4 in the breast-plate, and when the needle rises, encircling the bundle with the cord, and lays the inner end of the cord alongside of the outer end portion, the rack G′, coming into engagement with the pinion E′, rotates the knotter-bill, causing it to wrap the cords around itself in the usual manner of forming a knot and at a proper time to receive the ends of the cords between the jaws and afterward close its jaws upon the cord, the operation up to this stage being performed by the time the bill is in the position shown in Fig. 3. The bill does not halt at this position, but continues to revolve still farther to the position shown in Fig. 2, and thereby to draw the cords tightly into the bill and tighten the knot around the latter, and also to stretch the cord taut from the holder, as seen in Fig. 2. At the instant the knotter-bill has reached the extreme position in its rotary motion and the knot is fully tightened and the cords drawn taut the knife is operated by the projection G^2, which controls it, and made to descend upon the cords, which are easily severed because of their rigidity. While this is being accomplished the relation of the wheel G to the pinion E′ is as shown in Fig. 4, the delay-surface E^{10} being engaged upon the short portion G^{100} of the delay-surface G^{10}, holding the pinion fixed in the position described long enough for the cord to be cut. By the time the cutting is accomplished the recessed portion G^{101} of the delay-surface G^{10} has reached the delay-surface E^{10}, and, the discharger being now operating against the bundle, the strain thus brought upon the knotter-bill by the band—the knot still hanging on the bill—pulls the bill around as far as the recess in the delay-surface permits, causing the pinion to stand in respect to the delay-surface as shown in Fig. 5, and the bill to fall back to the position shown in Fig. 3. When in this position, the cord being drawn over the edge of the slot in the breast-plate at the point d', the strain produced by the discharger operating upon the bundle coincides approximately in direction with the direction which the jaws of the bill are pointing, so that the knot is readily stripped off from the bill.

In order to avoid the necessity of a heavy spring to hold the jaws closed to insure the formation of the knot by pulling the ends through the loop, I provide the spur or tooth E^{30} upon the lower jaw, such tooth projecting alongside the upper jaw near the point on the side on which the cord is received between the jaws—that is to say, the side toward which the bill revolves. The cord which is laid between the jaws, therefore, being held immediately behind this projection, is detained by it when the loops are pulled off over the end of the jaw, and thus remains between the jaws, while the loop is pulled off over the end, thus insuring the perfect formation of the knot, the end being pulled entirely through the loop and not left in a bow, as is frequently the case in other constructions. This permits the knot to be pulled off easily and the end to be pulled out easily, because reliance is not necessarily placed upon the grip of the jaws on the cord to insure the formation of the knot, and a very light spring is sufficient to keep the upper jaw down on the cord, and, indeed, the spring is not essential at this point in the process, because the strain of the loops around the jaws will hold the upper jaw down. The knot having been pulled off while the recess G^{101} is passing the pinion and while the knotter-bill therefore stands in the position shown in Fig. 3, the delay-surface G^{10}, of full height, comes next into engagement with the delay-surface E^{10} and restores the pinion and knotter-bill to the position shown in Figs. 2 and 4, the position of the pinion in Fig. 4 being the same as that shown in Fig. 6, the latter figure showing the proper portion of the delay-surface G^{100} in engagement with the delay-surface E^{10} at this concluding portion of the action. The parts come to final rest with the knotter-bill, therefore, in the position farther advanced in its rotary action than it was when the knot was stripped off.

I do not confine myself to the degree of change in position of the knotter-bill which

is permitted by the recessed portion G^{101} of the delay-surface on the cam-wheel, nor to the precise positions of the knotter-bill at the several stages. The essential characteristic of the construction is that the knotter-bill is first brought up to the position wherein the cord is strained as tightly as desired in order to tighten the knot and produce the best conditions for cutting the cord, and then by the recess in the delay-surface is permitted to fall back under the strain of the cord produced by the action of the discharge-arms upon the bundle to a position sufficiently near in the direction of discharge so that this strain will strip the knot off, and then by the engagement of the delay-surface on the knotter-pinion the knotter-bill is restored to the position from which it receded in order to permit the knot to strip and comes to final rest in this restored position. When the position of final rest of the knotter-bill is as oblique as shown in the drawings, the finger D^4 to detain the cord while the bundle is being accumulated is essential; but the construction described does not necessitate the oblique position as the position of final rest, and therefore does not necessitate the presence of the finger.

K is a part which I call the "bundle-stripper," being substantially an extension of the breast-plate toward the discharge side and serving the usual purpose of such extended portion, to strip the bundle off the discharge-arms as the latter revolve with the driving-shaft A. I employ the construction illustrated for the purpose of adapting the machine to be contained in the least possible lateral compass by folding up this bundle-stripper or breast-plate extension, as shown in dotted line in Fig. 1. The breast-plate proper being formed with lugs D^5 D^5, between which the bundle-stripper K is pivoted on the bolt L, which passes through the lugs K′ K′ on the bundle-stripper and the lugs D^5 D^5 on the breast-plate, the bundle-stripper is held rigidly in place when the machine is in use by means of the bolt L′, which passes through the web of the stripper L and through lug D^6, which projects outward a short distance farther than the lugs D^5 and forms a stop for the bundle-stripper K as it is rocked down from the dotted position shown in Fig. 1 to the position of use.

I claim—

1. In a grain-binder, in combination with the breast-plate and the discharge-arms, the bundle-stripper pivoted to the breast-plate at the discharge side of the knotting mechanism and stopped on the breast-plate at a proper position to operate to strip the bundle from the discharge-arms and releasably bolted to such stop and adapted to be folded upward and inward from the stop when not in use, substantially as set forth.

2. In a cord-knotter, a knotter-bill having, in combination with the upper vibrating jaw, its lower jaw provided with a tooth near the point projecting up alongside the end of the upper jaw on the side thereof toward which the knotter-bill revolves, substantially as set forth.

3. In a cord-knotter, a knotter-bill having, in combination with the lower jaw, an upper jaw pivoted thereto, and a spring E^3, the lower jaw being provided with a cavity in which said spring lies underneath the upper jaw, the spring being secured in the lower jaw at the forward end forward of the pivot of the upper jaw and reacting against the upper jaw rearward of its pivot, substantially as set forth.

4. In a knotter-bill, in combination with the lower jaw having a spring secured to it on its upper surface, the upper jaw pivoted to the lower jaw above the spring and having an arm extending rearward from its pivot at an angle to its forward arm, the spring being secured to the lower jaw at the forward end forward of the pivot and extending past the pivot and bent up rearward thereof and reacting against said rear arm of the upper jaw, substantially as set forth.

In testimony whereof I have hereunto set my hand, in the presence of two witnesses, at Chicago, Illinois, this 25th day of November, 1889.

ANDREW STARK.

Witnesses:
CHAS. S. BURTON,
JEAN ELLIOTT.