(Model.) 2 Sheets—Sheet 1.

LA VERNE W. NOYES.

CORD KNOTTER FOR GRAIN BINDERS.

No. 398,175. Patented Feb. 19, 1889.

Fig. 1.

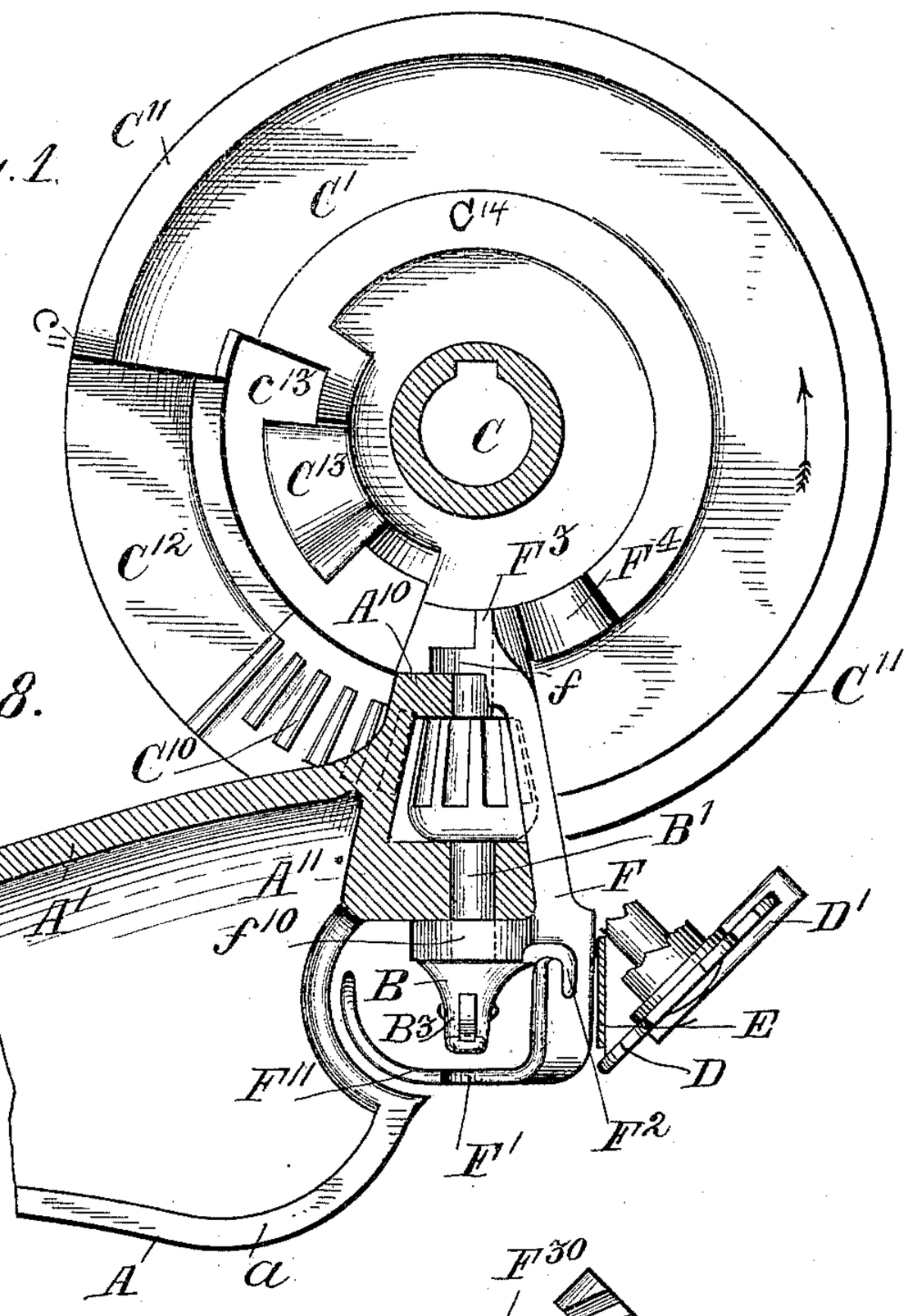


Fig. 8.

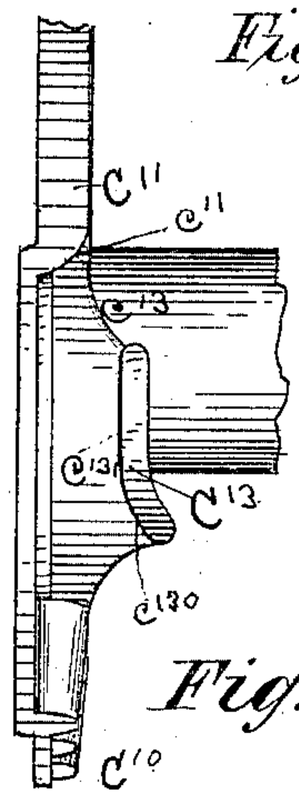
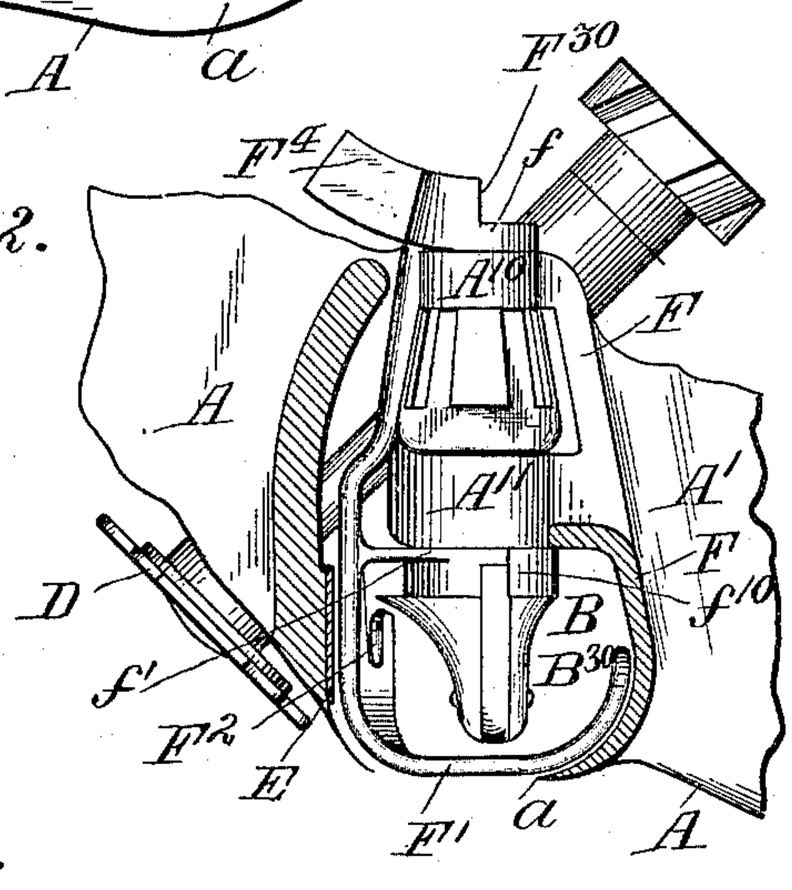


Fig. 2.



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(Model.) 2 Sheets—Sheet 2.

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No. 398,175. Patented Feb. 19, 1889.

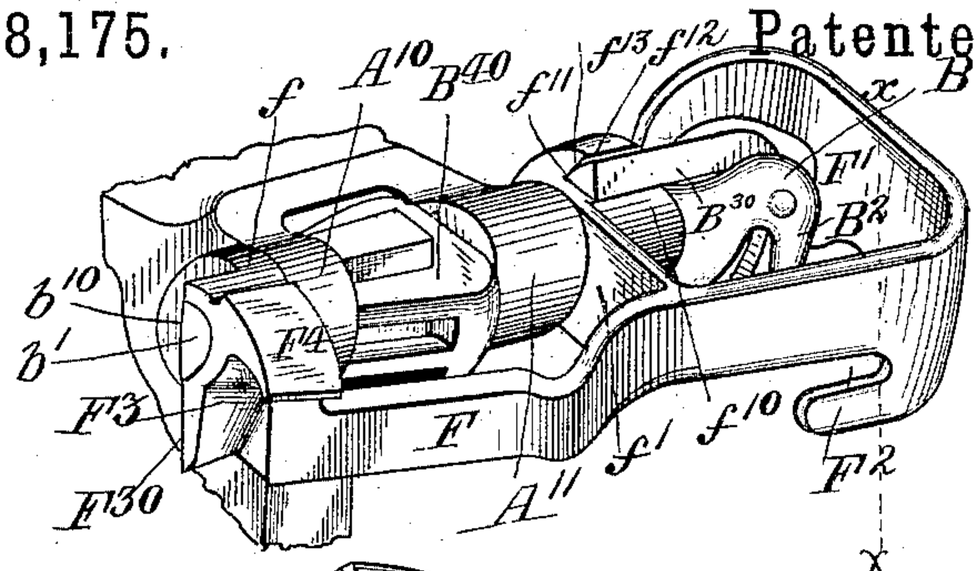

Fig. 3

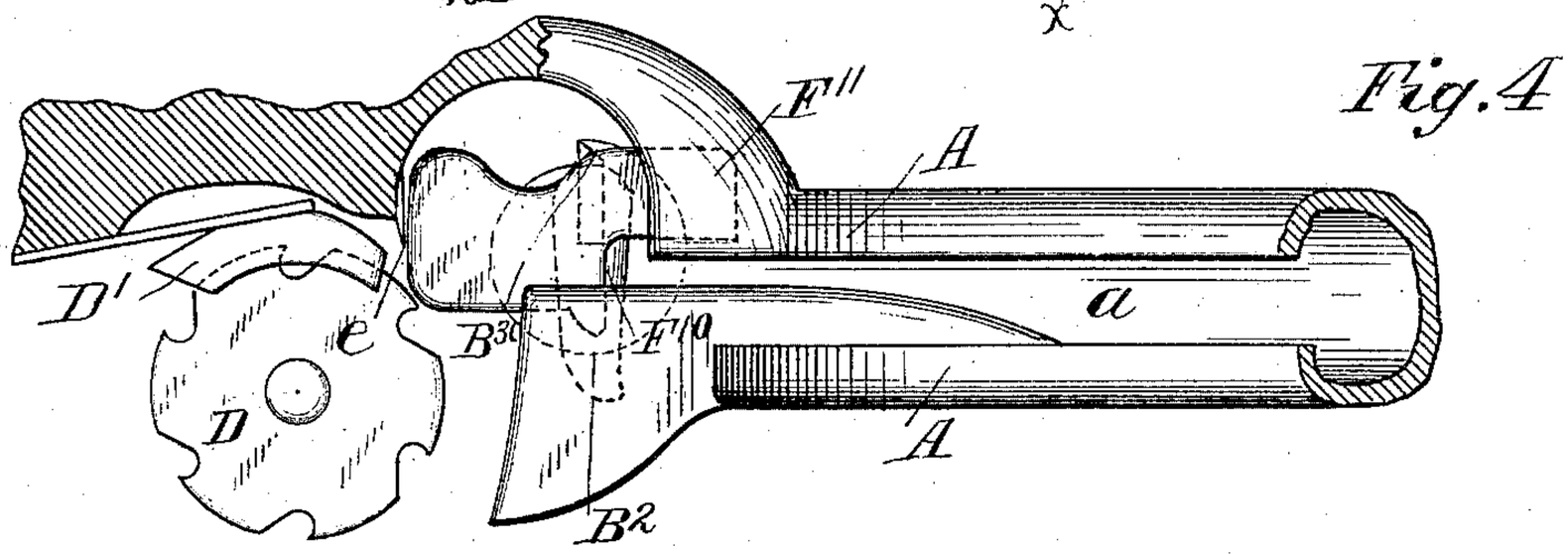

Fig. 4

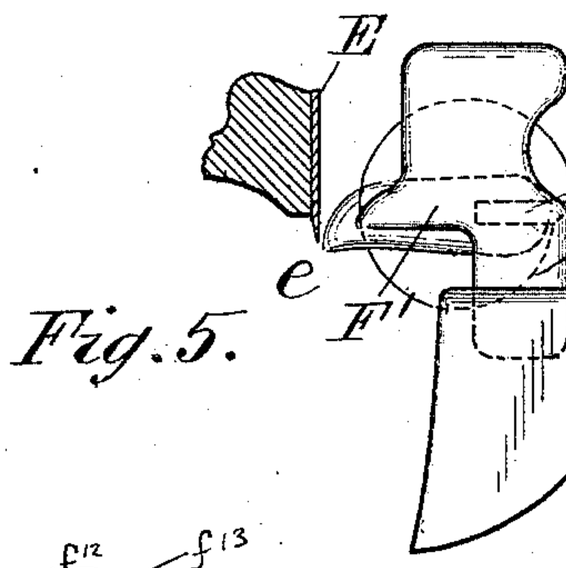

Fig. 5.

Fig. 6

Fig. 9.

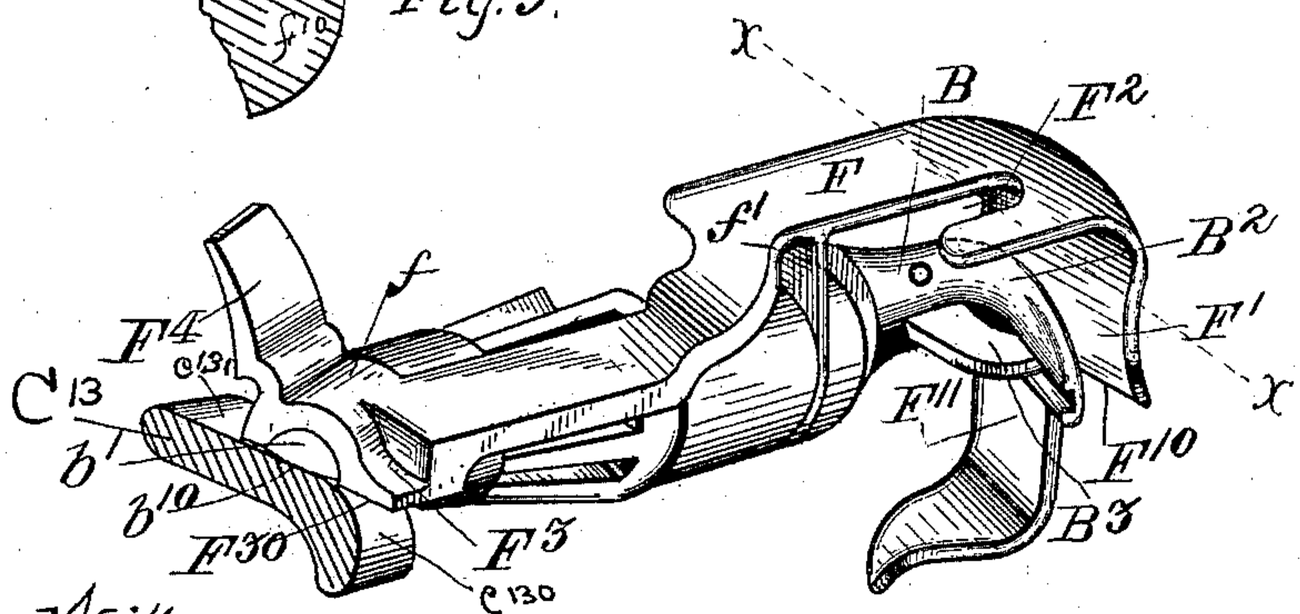

Fig. 7.

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UNITED STATES PATENT OFFICE.

LA VERNE W. NOYES, OF CHICAGO, ILLINOIS.

CORD-KNOTTER FOR GRAIN-BINDERS.

SPECIFICATION forming part of Letters Patent No. 398,175, dated February 19, 1889.

Application filed April 13, 1886. Serial No. 198,673. (Model.)

To all whom it may concern:

Be it known that I, LA VERNE W. NOYES, a citizen of the United States, residing at Chicago, in the 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 part thereof, wherein my invention is represented as applied to a grain-binder which binds the grain standing on end, the needle moving in a horizontal plane and the knotter-actuating shaft being vertical—

Figure 1 being a reverse plan of my knotter, as seen looking up from below, showing the breast-plate and frame in section as cut by a plane through the needle-slot, the cord-holder bearings being omitted. Fig. 2 is a direct plan, the knotter-actuating wheel being omitted, the breast-plate broken away, and part of the frame shown in section, as cut by the same plane as in Fig. 1. Fig. 3 is a perspective of the cord-looper and a frame pivoted on its shaft, the bearings of the looper in the knotter-frame being also seen. Fig. 4 is a stubble-side elevation of the breast-plate and the frame which is pivoted on the looper-shaft and the cord-holder—the position of the cord-looper being shown in dotted lines, the position of the parts being as just before the discharge of the bundle and stripping of the knot from the looper-jaws commences. Fig. 5 is a similar view, part of the breast-plate being broken away and the cord-holder being omitted, the position of the parts being as while the knot is being stripped and the bundle discharged. Fig. 6 is a detail sectional elevation of the cord-looper and the frame which is pivoted thereon, and the cutter, the position being as in Fig. 4, the portion of said frame in front of plane indicated by the dotted line *x x*, Fig. 3, being cut away and the cutter being shown in section at that plane. Fig. 7 is a perspective of the looper and the frame which is pivoted on it, the position of the parts being as in Fig. 5, and the point of view being from above the outer rear corner. Fig. 8 is a detail elevation of the knotter-actuating wheel, showing the relative position of the cams. Fig. 9 is a transverse section of the bill-opening cam in modified form.

For the further and fuller understanding of these views it may be noticed that, as referred to a knotter in more usual position, with the main shaft horizontal and the knotter-actuating wheel or "cam-wheel" revolving in a vertical plane, the foregoing plan views would be elevations and inner and outer elevations would become plan views.

In the main this invention relates to the frame which rocks on the looper-shaft and its several functions and the devices for actuating it and adapting the action of the other parts to co-operate with it. The said frame performs five distinct functions: First, it has an extension which bridges the needle-slot and forms the stop for the cord, the bundle hanging, as it were, suspended over it while the looper forms the knot; second, it has the bill-opening cam, and by revolving with the looper in the reversal of the latter to strip the knot, and so keeping the cam in the same relation to the bill during such reversal, it prevents the bill reversing its vibration upon the reversal of the revolution of the looper, as it would do were the cam stationary; third, it has a projection for engaging the looper to restore it to its initial position after its reversal; fourth, it has a notch or hook in which the cord is received and carried against the cutter to sever it after the knot is completed; fifth, by reason of the peculiar form of the bill-opening cam carried by this frame it holds the bill closed upon the cord while the knot is being stripped without the use of a spring for the purpose.

A is the breast-plate, which is integral with the frame A′.

a is the rift in the breast-plate for the passage of the needle and cord.

A^{10} A^{11} are the bearings of the cord-looper spindle.

B is the cord-looper; B′, the spindle, and B^2 the lower rigid jaw of the bill; B^3, the upper vibrating jaw.

C is the knotter-actuating shaft.

C′ is the knotter-actuating wheel.

D is the cord-holder disk; D′, the clamp.

E is the cutter—a rigid knife fastened to the knotter-frame.

F is a frame, which is pivoted on the looper-shaft or in any case concentrically therewith. As shown, it has two bearings on the looper-shaft—at *f* beyond the bearing A^{10} of the looper, and at *f′* beyond the bearing A^{11} in the opposite direction.

Around the bearing *f′* is formed the bill-

opening cam f^{10}, which is in the form of a helix commencing at the back or under side at f^{11} and terminating after one complete widening circuit at f^{12}, forming between the two points the shoulder f^{13}, which is undercut slightly, for a purpose hereinafter explained. The vibrating jaw B^3 of the looper has the heel B^{30} about at right angles with the jaw proper and standing up alongside the cam f^{10} and subject to its action, as hereinafter explained. The frame F extends along the further side of the looper—the side toward the cutter and holder—and at the end of the looper, between it and the breast-plate, it is bent back about at right angles and forms a bridge or gate, F′, having the edge F^{10} about parallel with the rigid jaw B^2 of the looper.

The frame F stands at rest with said edge F^{10} in a position transverse to the needle-rift a and quite close to the breast-plate, so that it operates to obstruct the cord carried by the needle, as hereinafter more fully explained. Said gate or bridge has preferably the extension F^{11}, forming a lateral guard for the cord coincident with and overlapping the edge of the rift a, and preventing the cord being swung aside out of the rift by the revolution of the looper.

In the portion of the frame F which extends along the farther side of the looper is formed the cord-receiving notch F^2, which stands at rest near the cutting-edge e of the cutter E, so that its movement in the direction of the cutter causes it to carry the cord in it against that cutting-edge.

At the end of the frame F toward the knotter-actuating shaft it is provided with two short lever-arms, F^3, in a plane radial to the looper-axis and curved in an arc about the point of intersection of said axis with the axis of the shaft C and F^4 in a plane at right angles to the first and a little aside from the looper-axis, and curves similarly to the arm F^3, the said curvature corresponding to the curvature of the flange C^4 of the wheel C′. The upper end of the shaft B′ is cut away on one side of a diametrical plane beyond the bearing f, leaving the semi-cylindrical end b', having its flat surface b^{10} coinciding with the surface of the lever-arm F^3 at one position, as seen in Figs. 3 and 7.

The knotter-actuating wheel C′ has the usual gear-segment, C^{10}, and delay-surface, C^{11}, to rotate and delay the looper by engagement with its pinion B^4; but an interval, C^{12}, between the last engaged tooth of the gear-segment and the beginning of the delay-surface allows the looper to be actuated independently of the engagement of the pinion, the pinion being at that interval free from engagement with the wheel C′. While this portion of the wheel C′ is revolving past the pinion B^4 the flat surface b^{10} of the looper-spindle b', which at this stage stands at right angles to the plane of the wheel C′, is engaged by the corner c^{130} of the flange or cam C^{13} of the wheel C′. Said flange is included between the axial planes which bound the interval C^{12}, but stands in a plane parallel to that of the gear-segment C^{10} and delay-surface C^{11} and on the opposite side of the plane of the axis of the shaft B′, so that when it engages the said flat surface b^{10} it rotates the spindle ninety degrees in the direction reverse to that in which it has been revolved. The cam-surface of the flange C^{13} at the end c^{130}, which first engages the spindle, is beveled slightly, so that it may strike the flat surface b^{10} slightly beyond the center on the opposite side from the plane of the segment C^{10}; but the remainder c^{130} of said cam-surface is substantially in the plane of the axis of the spindle B′ and acts as a delay-surface lying in contact with the surface b^{10} until the revolution of the wheel C′ carries the flange C^{13} beyond the spindle B′ and leaves the end b' at the point c^{13} in the wheel C′ free from any engagement whatever. At this point delay-surface B^{40} of the pinion B^4 stands at right angles to the plane of the delay-surface C^{11} and in contact with the rounded corner c^{11} thereof, and the further revolution of the wheel C again reverses the revolution of the looper by the engagement of said delay-surfaces and the looper makes a quarter-turn, bringing the two delay-surfaces into contact. When the corner c^{130} of the flange C^{13} first engaged the flat surface b^{10} of the spindle B′, the lever-arm F^4 had just passed beyond the delay-surface C^{14}, upon which it had been riding thitherto, and the frame F, which up to that time had been restrained from rocking over the spindle-axis—the pressure of the cords sustaining the bundle hanging over the gate F′ tending so to rock it—becomes at liberty to rock in the same direction as the spindle itself is rocked by the engagement of the surface b^{10} with the cam C^{13}, as described, and the lever-arm F^3, having its face coinciding with the flat surface b^{10}, is engaged by the said cam C^{13}, and thereby the frame F is positively rocked in the direction described, and the gate F′ swings around ninety degrees to the position shown in Fig. 5, so allowing the cords which hung over it free exit, while the guard F^{11} follows in behind the cord and insures that it is not detained by any accidental cause. The cam C^{13}, by means of its delay-surface c^{131}, holds the frame in the position shown in Fig. 5, while the knot is stripped off the looper-bill, and an instant after the delay-surface C^{11} has come into engagement with the pinion B^4 the delay-surface C^{14} in similar comes into engagement with the lever-arm F^4 and rocks the frame F back with the looper-bill and holds it in the position in Figs. 1 and 4 during the remainder of the revolution.

Comparing the movements of the looper and of the frame F, it will be seen that the frame is stationary during the whole of the direct revolution of the looper caused by the engagement of the gear-segment C^{10} with the pinion B^4. During and by means of this revolution the looper forms the knot, and the bill-opening cam f^{10} has remained stationary with

the frame F, of which it is a part, and has opened the bill of the looper by its engagement with the heel B^{30} of the jaw B^3, and at the conclusion of said revolution and before the frame has commenced to rock the said heel B^{30} has run off the end f^{12} of the helical cam f^{10}, and the strain of the loop encircling the jaws has caused the heel to drop behind the shoulder f^{13}, and immediately afterward, the segment C^{10} having cleared the pinion B^4, the strain of the cord on the bill due to the weight of the bundle and pressure of the discharger tending to reverse the looper forces the heel B^{30} under the undercut shoulder f^{13}, and either the heel or the shoulder, or both, being beveled said movement forces the heel in against the cam, and forces the jaw B^3 down upon the jaw B^2, and causes it to hold the cord which is between the jaws very firmly while the loop is stripped off over them, when at the next instant the looper-bill makes a quarter-turn accompanied by the frame F, as above described, and the bill thereby comes into position pointing in the direction of discharge, so as to be more easily stripped of the knot. Thus the form of said cam-shoulder f^{13} and the structure which permits said cam to accompany the reverse movement of the bill obviates the necessity of the spring or cam commonly employed to close the bill. As shown and hereinabove described, the bevel of the shoulder f^{13} and of the heel B^{30} serves a further purpose. The cord between the jaws, while it should be firmly held until the loop has pulled off and the knot has been tightened, must then be released, and this is permitted by the structure in question, the cord being forcibly drawn toward the point of the bill between the jaws, tending to wedge them apart, and forcing the heel B^{30} back against the shoulder f^{13}, the beveled surfaces sliding on each other, as the radial motion of the heel causes a slight rotary motion of the frame F and the looper relatively to each other. This rotary motion is resisted by the same strain which causes the wedging apart of the jaws—viz., the endwise strain of the cord in the direction of the looper-jaws—the direction of discharge—for the arm F^3 of the frame, being in contact with the delay-surface C^{13}, is prevented from rocking, except to the limit of the play which is due to the looseness of the bearings, and to that limit in one direction it is forced at once upon receiving the pressure described, and the looper, having the surface b^{10} in contact with the same delay-surface, and having a like play at such contact, tends to reach the limit of said play in the other direction, but to do so would carry the point of the bill from which the cord is stretched out of the line of strain, which therefore in part resists said motion. The amount of play allowed between the delay-surfaces is not sufficient to permit the disengagement of the heel from the shoulder, but is sufficient to allow the escape of the cord from between the jaws. Instead of allowing said play and beveling the shoulder and heel in order to take advantage of it, the heel and shoulder may be square and the shoulder may be overhanging and yielding—a spring attached to the cam f', as seen in Fig. 9. The jaws being first closed upon the cord, by the side pulling of the cord upon the loop encircling the jaws before the reversal of the looper to the stripping position is completed the heel is carried under the overhanging shoulder, and when the time comes for pulling the cord from between the jaws the heel B^{30}, being forced outward, causes the spring-shoulder to yield sufficiently to permit the cord to escape. When the cord is first laid over the bill of the looper, it is laid also into the notch F^2 and into a notch of the holder-disk, where it is afterward clamped in the usual manner. When the frame F rocks with the reverse movement of the looper on its axis, the cord lying in said notch F^2, and which at that stage is drawn tense, is carried against the fixed knife E and severed before the looper reaches the position for stripping.

I claim—

1. In combination with the knotter-actuating wheel, the looper, and the breast-plate, a frame pivoted about the looper-spindle engaged directly and actuated positively by the knotter-actuating wheel and bent across the line of the axis of the looper at the end thereof, obstructing the rift in the breast-plate while the looper forms the knot and swung aside by the said wheel when the knot is to be stripped, substantially as set forth.

2. In combination with the looper and breast-plate, the frame rocking over the spindle thereof, and having at one end a projection or finger extending across the line of the looper-axis at the end of the looper, and having at the other end the lever projections F^3 and F^4 at right angles to each other, the knotter-actuating wheel having the sectoral cams and delay-surfaces C^{13} and C^{14} in planes on opposite sides of the knotter-axis, the ends of said tracks engaging the projections F^3 and F^4, respectively, alternately to rock the frame in opposite directions, substantially as set forth.

3. In combination with the knotter-actuating wheel, the looper reversing its revolution to strip the knot, the frame pivoted about the looper-spindle and engaged directly and actuated positively by the knotter-actuating wheel independently of the looper, and having the cam which opens the looper-jaws, said frame rocked by the knotter-actuating wheel and accompanying the looper in its reverse movement, substantially as set forth.

4. In combination with the looper, the bill-opening cam having the undercut shoulder f^{13}, over which the heel of the vibrating jaw drops to allow the bill to close, said looper reversing its revolution after the heel passes

said shoulder, whereby the heel is crowded under the shoulder and the bill is forced shut, substantially as set forth.

5. In combination with the looper reversing its revolution to strip the knot, the bill-opening cam having the undercut shoulder f^{13}, over which the heel of the vibrating jaw drops to allow the bill to close before reversing, the said cam remaining stationary when the looper first reverses, but afterward rocking with it in its reverse motion, substantially as set forth.

6. In combination with the knotter-actuating wheel, the looper reversing its revolution to strip the knot, the frame pivoted about the looper-spindle, engaged directly and actuated positively by the knotter-actuating wheel independently of the looper, and having the cam which opens the looper-jaws provided with the undercut shoulder f^{13}, to engage the heel of the vibrating jaw, said frame accompanying the looper in its reverse movement, substantially as set forth.

7. In combination with the looper which reverses its revolution to strip the knot, the frame pivoted about the looper-spindle having the bill-opening cam provided with the undercut shoulder f^{13}, and having the lever-arm F^3, and the knotter-actuating wheel having the cam C^{14}, to engage the lever-arm and rock the frame, substantially as set forth.

8. In combination with the looper which reverses to strip the knot, the frame pivoted about the looper-spindle having the bill-opening cam provided with the undercut shoulder f^{13}, and having the lever-arm F^4, and the knotter-actuating wheel having the gear-segment engaging the looper-pinion, and the delay-surface C^{13}, engaging the lever-arm F^4 until after the pinion clears the segment, substantially as and for the purpose set forth.

9. In combination with the looper, the frame F, pivoted on the looper-spindle and rocked thereabout by direct engagement with the knotter-actuating wheel, and having the bill-opening cam and the cord-receiving hook F^2, substantially as set forth.

10. In combination with the knotter-actuating wheel and the looper, the frame F, pivoted on the looper-spindle and rocked thereabout by direct engagement with the knotter-actuating wheel, which engages it directly and actuates it positively, and having the bill-opening cam and the cord-obstructing gate both integral with it, substantially as set forth.

11. In combination with the looper, the frame F, pivoted about the looper-spindle and rocked thereabout by the knotter-actuating wheel, and having integral with it the cord-obstructing gate and the cord-receiving hook F^2, substantially as and for the purpose set forth.

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