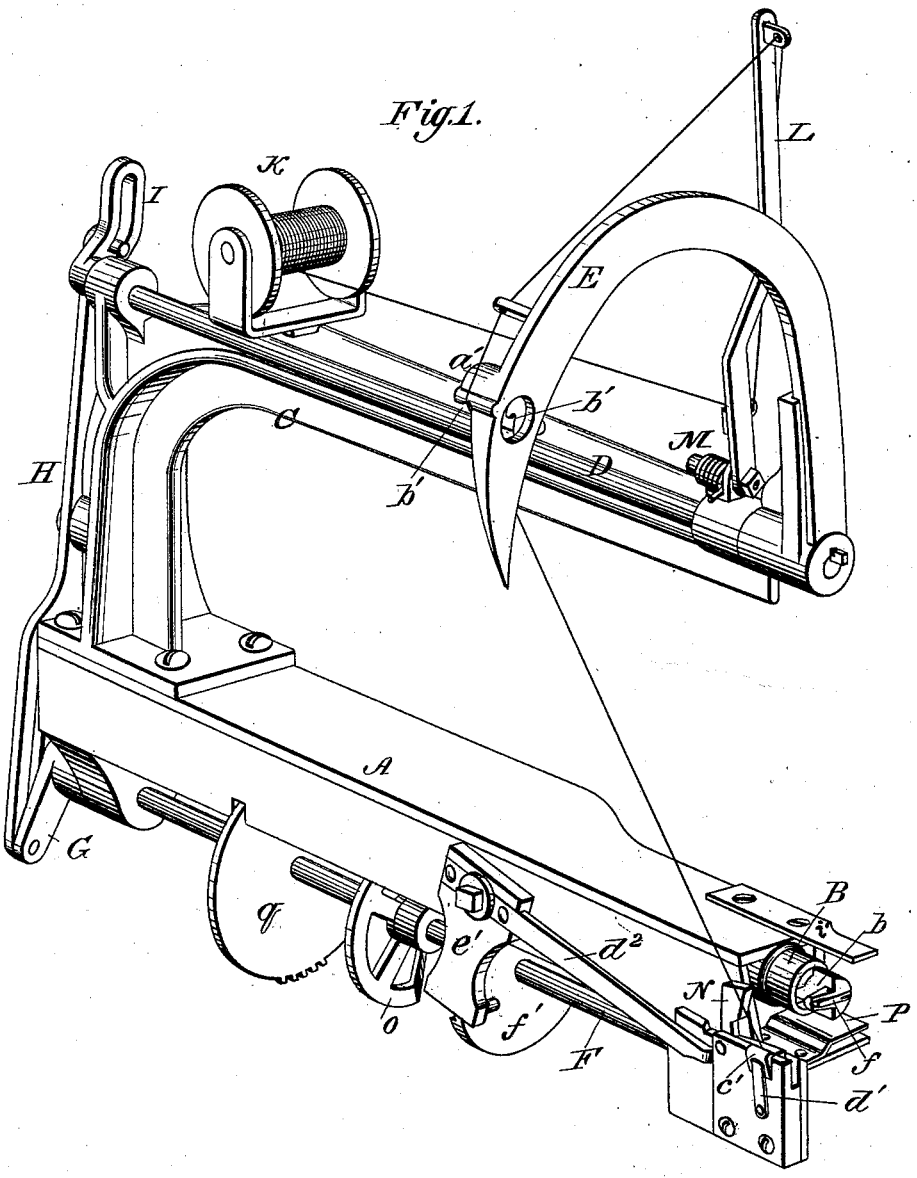
5 Sheets—Sheet 1.

C. L. TRAVIS.

Grain-Binder.

No. 216,241. Patented June 3, 1879.

Fig. 1.



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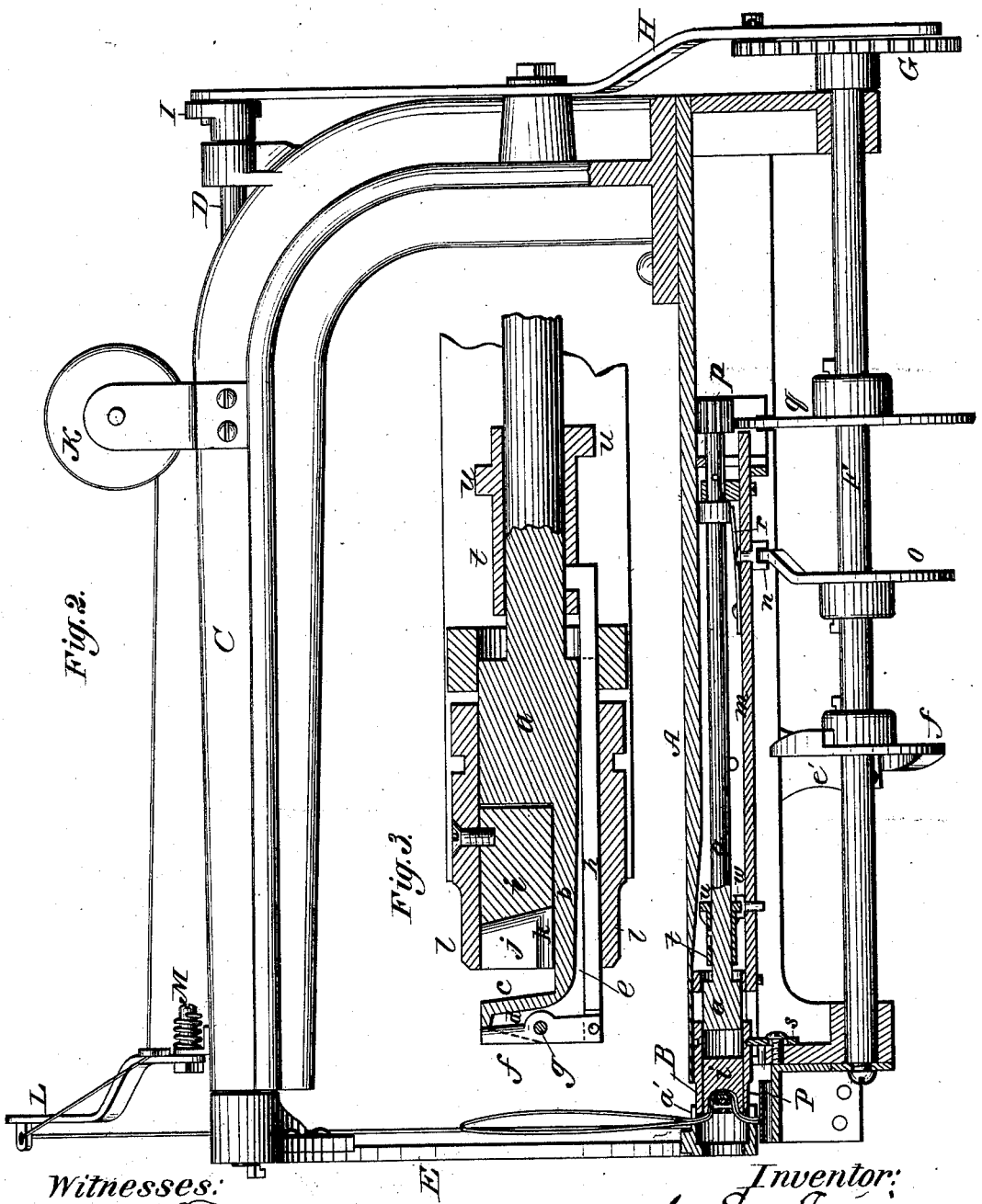

Fig. 2.

Fig. 3.

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Fig. 4.

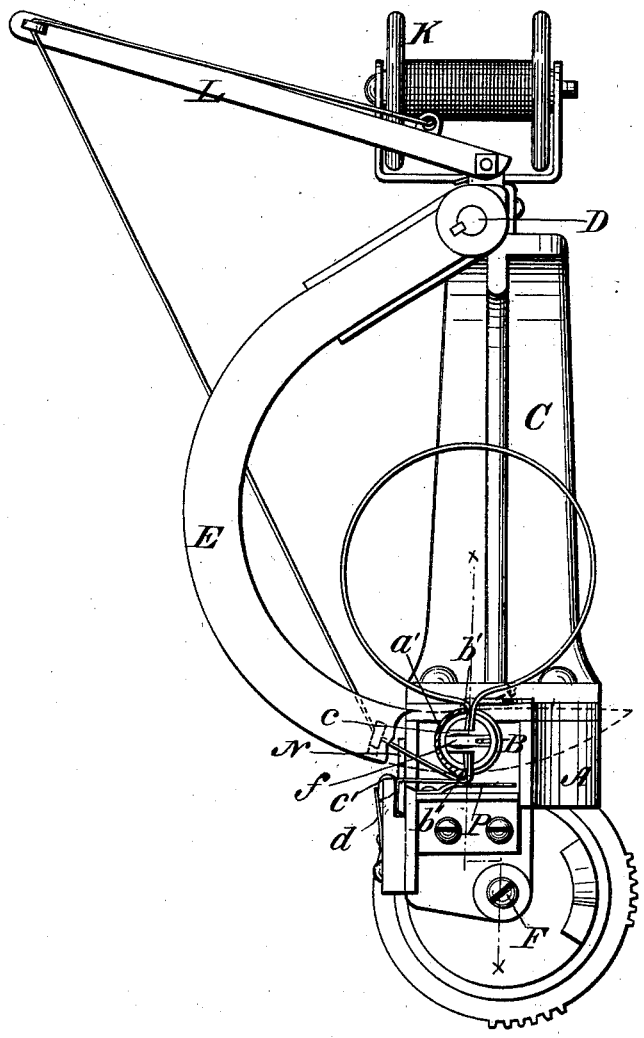

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Fig. 5.

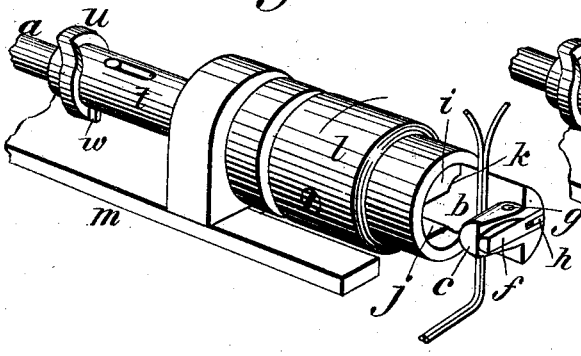


Fig. 6.

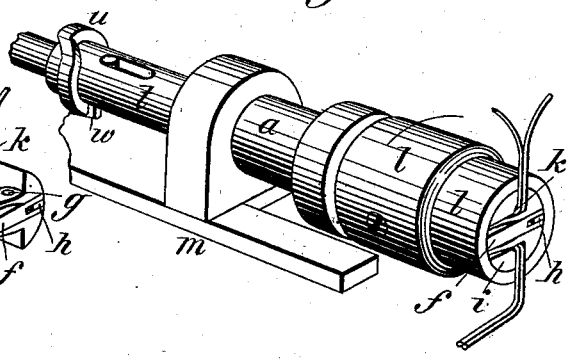


Fig. 7.

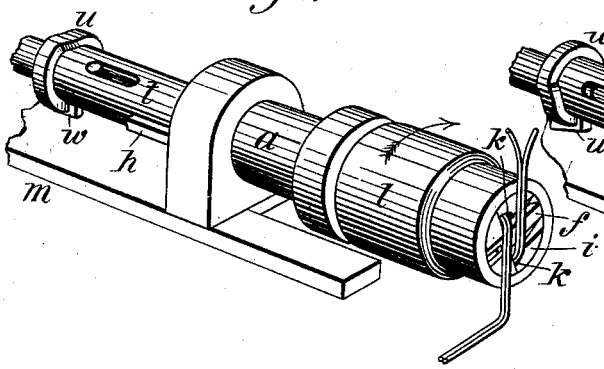


Fig. 8.

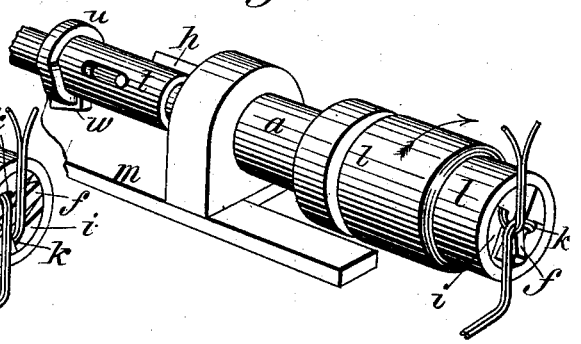


Fig. 9.

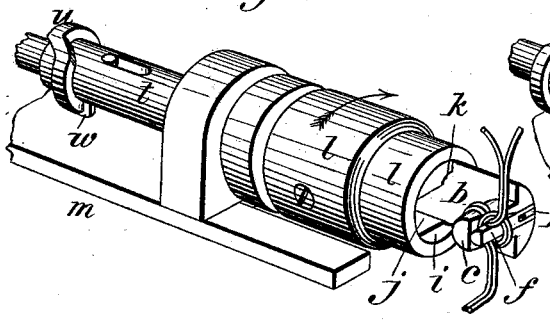
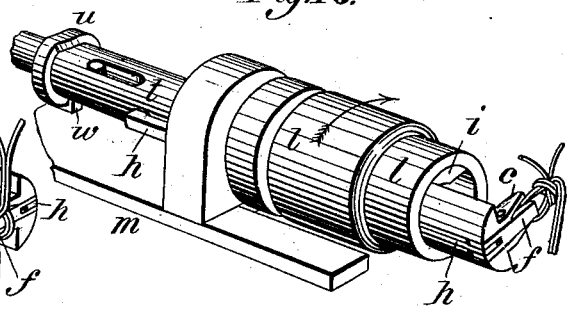


Fig. 10.



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5 Sheets—Sheet 5.

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Fig. 11.

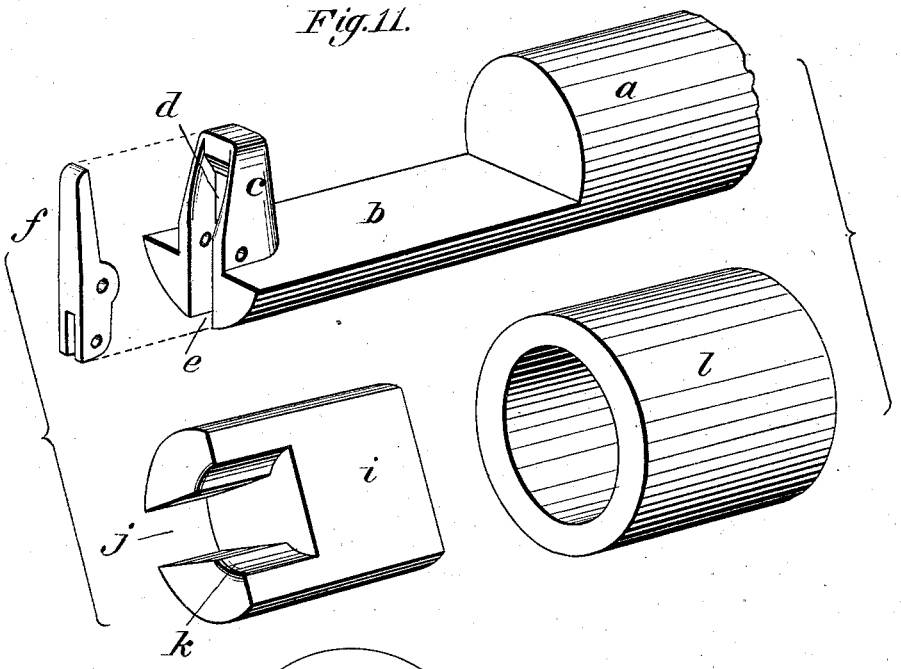


Fig. 12.

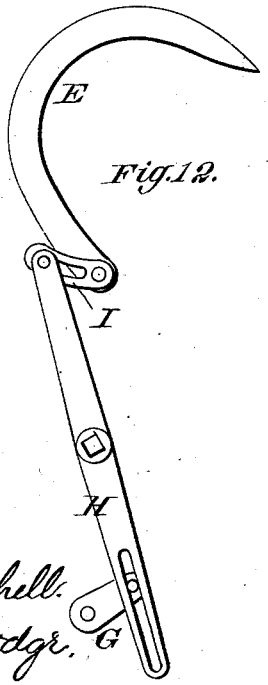
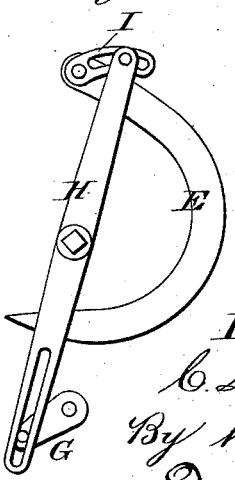


Fig. 13.



Witnesses:
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UNITED STATES PATENT OFFICE.

CHARLES L. TRAVIS, OF MINNEAPOLIS, MINNESOTA.

IMPROVEMENT IN GRAIN-BINDERS.

Specification forming part of Letters Patent No. **216,241**, dated June 3, 1879; application filed March 28, 1879.

To all whom it may concern:

Be it known that I, CHARLES L. TRAVIS, of Minneapolis, Hennepin county, Minnesota, have invented certain new and useful Improvements in Grain-Binding Machines, of which the following is a specification.

This invention relates to that class of machines in which the grain is bound with cord; and consists in certain peculiarities and improvements in the knotting or cord-tying devices, in the mechanism for driving the same, and in the means for presenting the cord to the tying devices.

Figure 1 represents a perspective view of my entire machine, with the exception of the grain table or receiver, which is omitted in order to expose other parts to view; Fig. 2, a side elevation of the same, with the lower portion in section on the line *x x*, Fig. 4; Fig. 3, a longitudinal central section of the rotary tying-head; Fig. 4, an end elevation, with the end of the binder-arm shown in dotted lines; Figs. 5 to 10, inclusive, perspective views of the tying-head, showing its various positions during the operation of forming a knot; Fig. 11, a perspective view, showing the parts of the binder-head separated from each other.

Referring to the drawings, A represents a base-frame or table, sustaining at one end the rotary knotting or tying head B, and at the other the rigid overhanging arm or bracket C, which, in turn, sustains a horizontal rock-shaft, D, carrying a curved binder-arm, E, the office of which arm is to carry the binding-cord around the bundle of grain and present it to the knotting-head.

Beneath the base-frame A, in bearings thereon, is mounted a horizontal rotary driving-shaft, F, from which motion is transmitted to both the tying-head and the binder-arm. The motion is communicated by cams and a pinion on the shaft directly to the different parts of the binder-head, as hereinafter described; but in order to actuate the binder-arm the driving-shaft is provided with a crank-wheel, G, which vibrates the lower end of a lever, H, which latter is pivoted at the middle on a fixed stud, and provided at its upper end with a stud arranged to travel in a slotted arm, I, secured rigidly to the end of the binder-arm shaft, as represented in Figs. 2, 12, and 13. The slot in the lower end of the lever in which the crank-pin works is straight, or nearly so; but the slot in the arm I is curved in the arc of a circle, corresponding with that in which the upper end of the lever vibrates, at its outer end. The stud at the upper end of the lever vibrates over or above the binder-arm shaft.

The crank-wheel G being turned in the direction indicated by the arrow, it throws the lever to the position shown in Fig. 12, causing its upper end to turn the arm I over backward, and thereby raise the binder-arm, which remains practically at rest during a considerable portion of the downward movement of the crank-pin. As the crank-pin approaches its downward position and moves backward, as shown in Fig. 13, the upper end of the lever turns the arm I forward, and causes the binder-arm to swing downward until its end meets the knotting-head, the arm remaining at rest in this position until the upper end of the lever passes to the outer end of the arm I and thence inward again.

It will be seen that a continuous rotation of the crank thus serves to raise and lower the binder-arm, and to hold it momentarily at rest in its elevated and in its depressed positions.

The construction of the tying-head, which consists of but four simple pieces, is clearly represented in Figs. 3 and 11, the latter figure illustrating the form of the separate pieces. The first and main piece, *a*, is formed by taking a round shaft, which also serves as the driving-shaft, and cutting away and flattening one end, as shown at *b*, leaving, however, at the extreme end a narrow finger, *c*, extending upward from the flattened portion, as represented in the drawings. The shaft should be cut away to or beyond the center, in order that the cord may pass inward to the center of the tying-head, as hereinafter described. The upright finger *c*, which stands radially in relation to the shaft, has in its outer side a longitudinal groove or recess, *d*, commencing at or near the point of the finger, and extending to the rear side of the shaft, where it joins a groove, *e*, formed lengthwise in the shaft, as shown. In

the groove or recess J I seat a small nipper or finger, *f*, mounted at or near its middle on a pivot, *g*, passing transversely through the finger *c*; and in the longitudinal groove *e* I mount a sliding bar, *h*, the end of which is pivoted to the rear end of finger *f*, as shown, so that by moving the bar endwise the free end of the finger *f* may be closed into and flush with the finger *c*, as in Fig. 3, or thrown outward therefrom, as indicated by the dotted lines in the same figure.

The construction of the parts is such that when the finger *f* is open the cord may be carried inward between it and finger *c* to a point in line with the center of the shaft and tying-head. The construction and arrangement of the parts are also such that when the finger *f* is closed it bears upon finger *c* at the outer end only, the recess into which the finger *f* closes being cut away, as shown in Figs. 3 and 11, so that the cord may slide freely outward between the two fingers until it reaches their outer ends, where it is retained. Into the recessed or cut-away portion of the shaft *a* I place a half-round block, *i*, of the same shape and size as the portion cut away, except that it is shorter; and in the forward end of the block *i* I form a recess, *j*, of such size as to admit the rigid finger *c*, which is drawn back therein at the proper times to clamp the ends of the applied band. The inner corners of the block *i* are cut away in such manner as to form two grooves, *k*, at the sides of the finger *c* when it is drawn back within the block, these grooves being for the purpose of permitting the cord to be drawn into the block behind and around the finger, and of retaining the cord in place at the center of the head. Around the end of the shaft *a* and the block *i* there is mounted a tube or sleeve, *l*, fastened to the block, as shown. The sleeve and the block jointly form a solid head, surrounding and rotating with the shaft *a* and its nipper *c*, and through which the shaft can move endwise to a limited extent, in order to draw the nipper or finger *c* into the block or force it outward, as shown in Fig. 3.

It is to be noted that when the finger *f* is closed within the finger *c*, and the latter moved back within the block, the entire binding-head presents a smooth flush end, as shown in Fig. 2, in which it will be seen that the faces of the two fingers, the end of the block, and the end of the sleeve all stand in the same vertical plane.

The seating of the outer finger, *f*, within instead of against the inner finger, *c*, is advantageous, in that it causes the cord to be bent or doubled around finger *f*, and clamped thereon by the other finger so as to be held with great firmness; in that the finger *c* sustains and supports the finger *f* when subjected to its greatest strain, and in that it avoids the necessity of moving the finger *c* as great a distance as would otherwise be required.

In applying the knotting-head to the machine, the shaft *a* is mounted in bearings on a longitudinally-sliding horizontal plate, *m*, supported in guides beneath the bed-plate or frame A, the arrangement being such that the end of the tying-head encounters the binder-arm when the latter descends.

The sliding plate *m* has on the under side a swiveled fork, *n*, which straddles the irregular edge of a cam-plate, *o*, fixed upon the driving-shaft F, whereby the plate and shaft are moved endwise at the proper times.

On the rear end of the knotter-shaft *a* there is mounted a pinion, *p*, which is acted upon by a mutilated gear, *q*, on the driving-shaft F, as shown in Fig. 2, so that an intermittent rotary motion is imparted to the shaft *a* and the entire knotting or tying head. In order to prevent the head from being turned accidentally when the driving-gear is not in action, a friction-spring, *r*, is arranged to bear upon a collar on shaft *a*, as represented in Fig. 2.

The sleeve *l* is permitted to rotate freely with the remainder of the tying-head, but is prevented from moving endwise by means of a fixed plate, *s*, which bears in a groove in the circumference of the sleeve, as shown in Fig. 2.

As a means of operating the sliding bar *h*, by which finger *f* is opened and closed, I mount on the knotter-shaft *a* a sleeve, *t*, provided with a circumferential cam, *u*, which works within a swiveled fork, *w*, on the sliding plate *m*, as shown in Fig. 2.

The sleeve is prevented by a slot and pin or a feather from rotating on the shaft *a*, but is free to move endwise thereon, and is connected with the end of the sliding bar *h*, as shown in Fig. 3, so that as it rotates with the shaft *a* the sleeve is moved endwise by its own cam upon the shaft, and caused through bar *h* to open and close the small finger *f*.

Owing to the fact that the fork or stud in which the cam of the sleeve bears is mounted on the sliding plate *m*, the movement of the latter does not change the relation of the fingers or nippers to each other.

In order that the binding-arm may properly present the cord to the binding or tying head, it is provided on the inner side with a semi-circular or crescent-shaped projection, *a'*, adapted to fit down over and around the side of the tying-head and partially encircle the same, as shown in Figs. 2 and 4, the edges of this projection being provided with notches *b'* to receive and guide the cord, as shown in Fig. 1.

At any suitable point on the machine I mount a cord spool or drum, K, and directly above the binder-arm I mount a guiding and take-up arm, L, pivoted so as to rise and fall in the same plane as the binder-arm, and provided with an adjustable spring, M, by which its end is urged upward.

On the front side of the base plate or frame I mount, as shown in Fig. 1, a rotary knife, N, having four radial arms or blades, which act successively, and serve each to sever the cord and clamp the newly-formed end. To assist the knife in retaining the end of the cord, I mount at its side a toothed eccentric,

c', which is urged inward by a spring, d', these parts being arranged in substantially the same manner as in the machine hitherto patented to Olmstead, Travis, and Chute, for binding grain with paper bands.

The rotary knife receives an intermittent rotary motion from a vibrating spring arm or pawl, d'', secured to a pivoted block, e', the lower end of which has two studs, embracing the edge of a cam-plate, f', mounted on the main driving-shaft F. The rotation of the cam causes the end of the arm or pawl to rise beneath one of the arms of the cutter and turn the same forward a quarter of a revolution, and then ride down over the next arm and engage thereunder preparatory to the next movement of the cutter.

By the action of the cutter and its attendant parts there is removed from the cord more or less lint or loose fiber, which, if permitted to accumulate upon and between the knife and the eccentric-clamp, would interfere seriously with their operation. In order, therefore, that the lint may be discharged with certainty, the knife is mounted in a support which is recessed to the extent required to admit the cutter and left open at one edge, so that each arm of the cutter sweeps a waste end before it and out through the side of the support. The discharge of the lint will also be facilitated by leaving a space at the side of the knife-arms within the support or bearing.

At any suitable point near the tying-head, preferably beneath the same, as shown, I mount a spring, P, or other equivalent device, designed to hold the severed ends of the applied band during the formation of the knot, in order that the latter may be drawn tight, and that the slack produced in drawing up or tightening the loop may be taken up toward the bundle, so as to apply the band closely and tightly thereto. This holding of the ends during the formation and the tightening of the knot by means outside of the tying-head is a feature of great importance. Directly above the tying-head there is located a rigid arm or guard, i', the purpose of which is to hold the cords at their junction with the bundle directly in line with the center of the head, so as to insure the proper action of the head, and reduce to a minimum the length of the cord between the bundle and the head.

The binding mechanism, constructed as above described, is applied in any suitable manner to a harvesting-machine, in connection with any suitable raking or conveying mechanism which will deliver the grain within reach of the binder-arm; and being thus applied, the action is as follows: The cord is passed from the spool through a guide, and thence through the outer end of the take-up arm, through an eye on the side of the binder-arm, over the outside of projection a', and finally its end clamped by the knife, as shown in Fig. 1. The binder-arm being elevated, as shown in Fig. 1, grain is delivered within its reach, and it descends, carrying the cord down over and around a sufficient amount of grain to form a bundle, and presenting the cord to the tying-head, as represented in Fig. 4.

As the arm descends the cord is caused to draw across the two edges of its projection a', from one to the other. At the time that the arm descends with the cord the knotting-head stands in the position represented in Figs. 1, 3, and 5, with the finger f closed and the finger c moved outward, and as the binder-arm completes its descent its projection a' forces the two ends of the cord forming the applied band inward to the center of the binding-head behind the finger c, as shown in Figs. 4 and 5, the cord being at the same time clamped firmly against the outside of the projection a' by the spring P, as shown in Fig. 2.

As soon as the cord is laid behind the finger c the latter is drawn backward within the rotary head, thereby forcing and clamping the cord behind it into the center of the head, as represented in Figs. 2 and 6. The knife then rotates and severs the applied band at a point in rear or outside of that at which the ends are held by the spring P. The knotting then turns bodily in the direction indicated by the arrow, and, as the cord is still clamped behind the finger c, it is wound into a loop around the two fingers and at the center of the head, as shown in Fig. 7. As the head completes its first revolution the small finger f opens outward, and the ends of the cord outside of the loop pass between the two fingers, as shown in Fig. 8. The finger f then closes and clamps the extreme ends within the finger c, and as the parts continue their rotation the two fingers move outward from the head without separating from each other, thus releasing the loop from the head, so that it may be drawn off over the ends of the fingers, but retaining the ends of the cord and drawing them in a doubled or looped condition through the main loop, forming a bow-knot, as shown in Fig. 10. The loop is drawn tight and cast off at about the middle of the second revolution, at which time the finger f is opened in order to release the cord. The ends of the cord will be drawn from the spring P by the rotation of the tying-head, or released by the upward movement of the binder-arm, which takes place immediately upon or just prior to the completion of the knot.

Having thus described my invention, what I claim is—

1. The combination of the binder-arm shaft having the arm I, the vibrating lever H, and the crank or crank-wheel G, substantially as described and shown.

2. In a rotary tying-head, the combination of a recessed rotary block or head, a grooved finger or nipper, c, arranged to close therein, and a second finger or nipper, f, arranged to close within the grooved side of finger c, substantially as shown.

3. In combination with the rotary finger c,

the rotary head or block, recessed to admit the finger, and provided with the groove *k*, to retain the cord in place at the center of the head.

4. In combination with the rotary and reciprocating finger *c*, the finger *f*, seated and pivoted at its middle in a recess in the outer side of finger *c*, as shown.

5. The combination of the rotary head or socket, the rotating and sliding shaft *a*, having the recessed finger *c*, the finger *f*, pivoted within the finger *c*, and the sliding bar *h*, mounted in the shaft and connected to finger *f*, as shown and described.

6. As an improvement in the construction of knotting or tying heads, the combination of a round shaft, *a*, having one end flattened and fashioned into a finger, *c*, a flattened and recessed block, *i*, seated in the side of the shaft, and an encircling-ring, *l*, secured to the block, as shown and described.

7. In combination with a rotary head or socket, two knotting-fingers and operating mechanism, whereby both fingers are closed within the head during its first revolution, then the outer finger opened and closed, and, finally, both fingers moved outward and held in front of the head without being separated from each other during its second revolution.

8. The combination of the knotting-head, the binder-arm, and the retaining-spring P, to hold the severed ends of the applied band.

9. The combination of a rotary knotting-head, adapted to clamp and hold the applied band, and a device, P, below said head, adapted to retain the severed ends of the band with a frictional or yielding hold thereon.

10. In combination with the tying-head and the retaining device P, a knife or cutter, arranged to sever the ends of the applied band in rear or outside of the retaining device prior to the formation of the knot.

11. In a cord-binding mechanism, the combination of the tying-head rotating in a vertical plane and provided with the rotating and laterally-moving, clamping, and knotting fingers, and the vertically-vibrating binder-arm provided with the notched shoulders, and arranged to present and hold the cord across the center of the head, behind the fingers, until it is clamped thereby.

12. In combination with the knotting-head, rotating in a vertical plane, the guard *i'*, located directly above the same, as and for the purpose described.

13. The combination of the tying-shaft *a*, mounted on the sliding plate, the rotary head or socket *i l*, secured against end movement, and finger *f*, connected with sleeve *u*, having cam *w*, arranged to act in a bearing on plate *m*.

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In presence of—
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H. E. DAY.