(No Model.) 3 Sheets—Sheet 1.

W. M. HOLMES.

GRAIN BINDER.

No. 414,839. Patented Nov. 12, 1889.

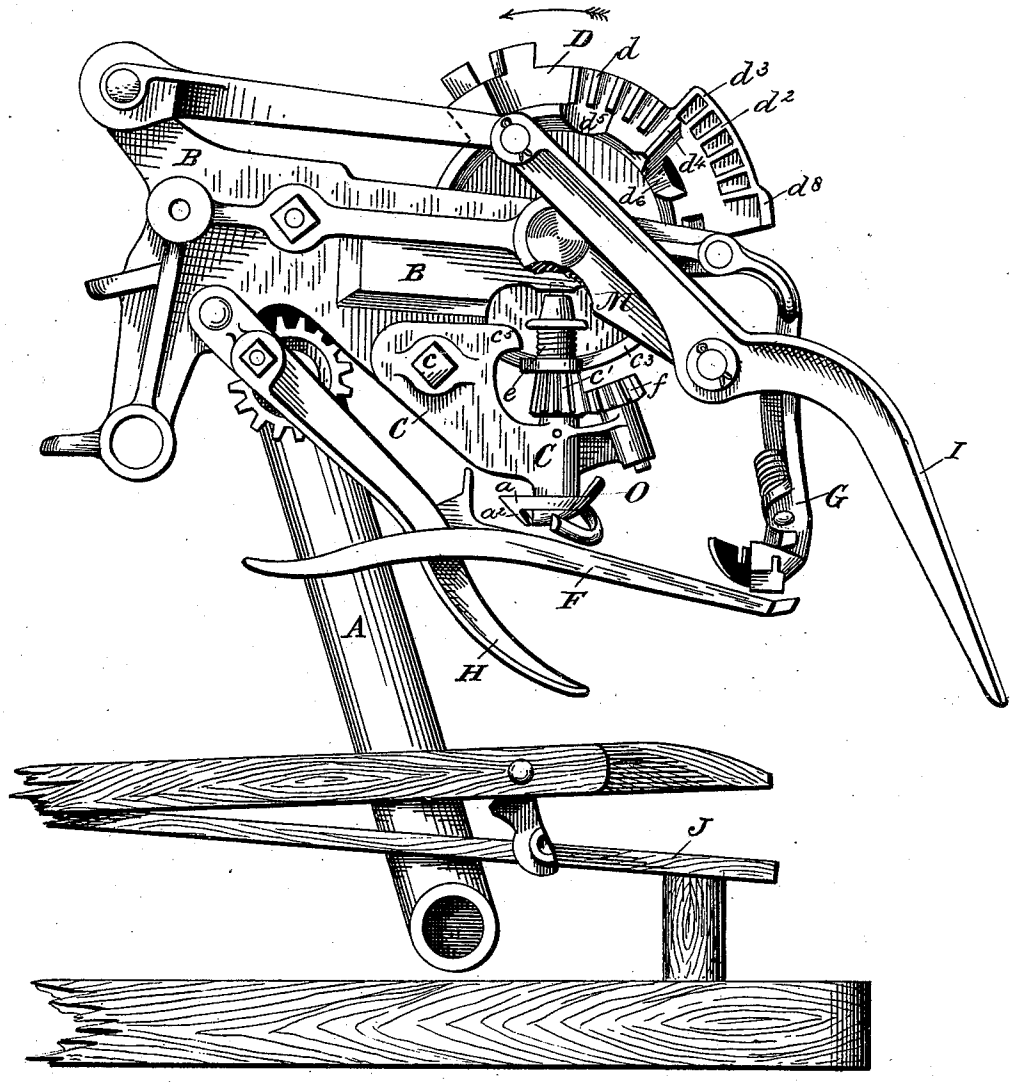

Fig. 1

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W. M. HOLMES.

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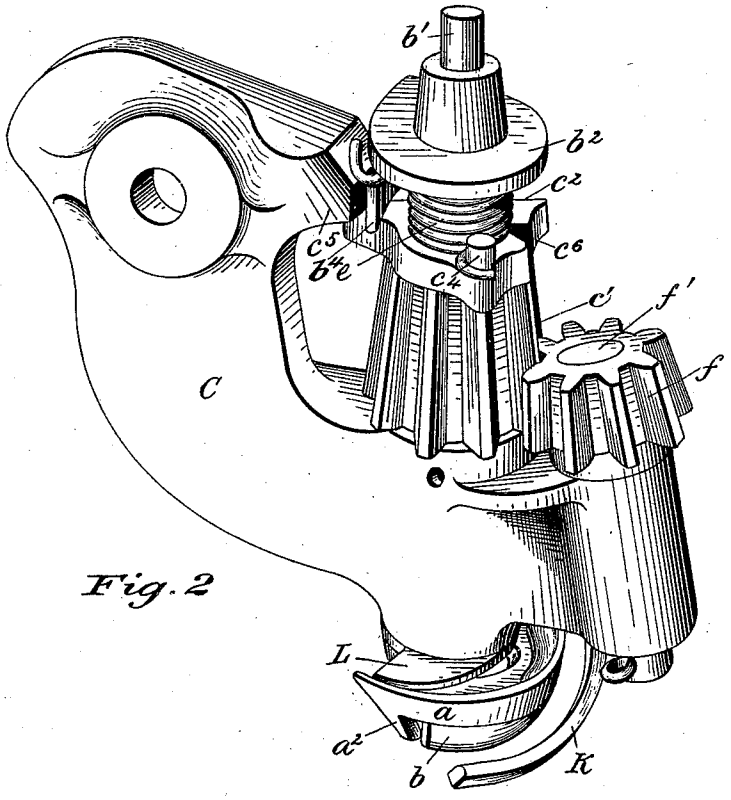

Fig. 2

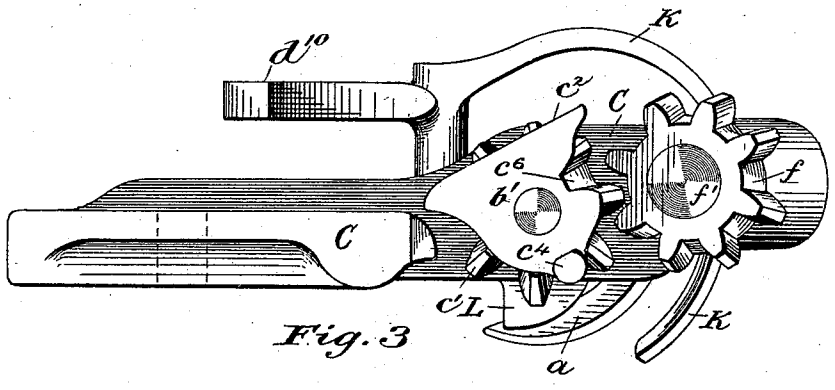

Fig. 3

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W. M. HOLMES.

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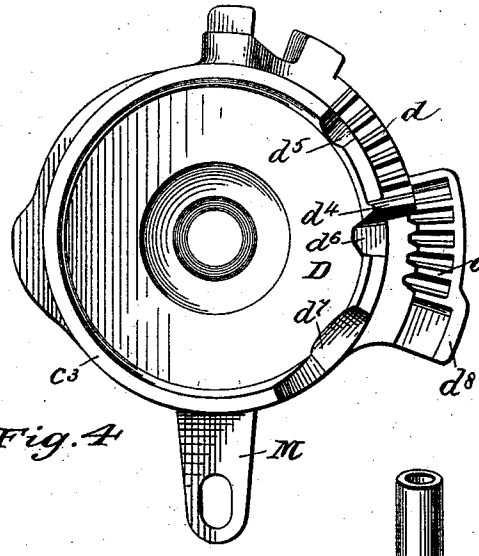

Fig. 4.

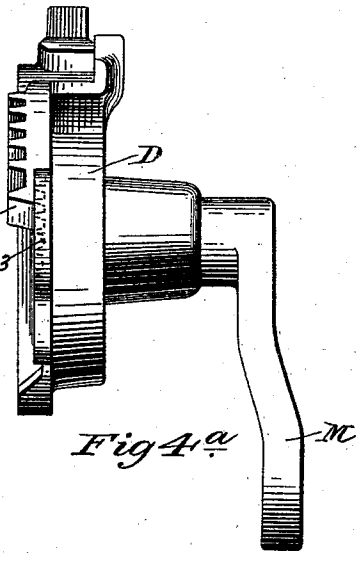

Fig. 4a.

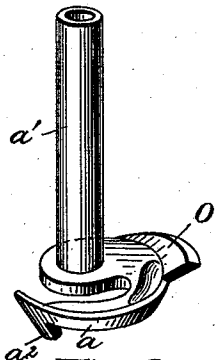

Fig. 6.

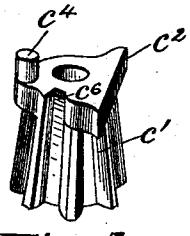

Fig. 5.

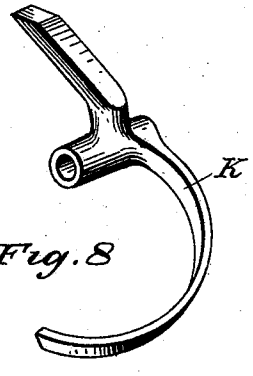

Fig. 8.

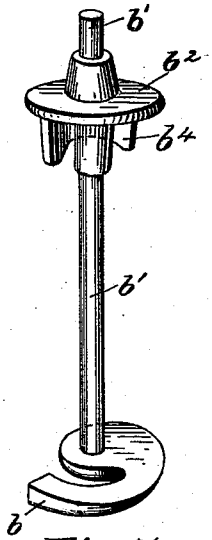

Fig. 7.

WITNESSES.

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UNITED STATES PATENT OFFICE.

WATSON M. HOLMES, OF HOOSICK FALLS, NEW YORK.

GRAIN-BINDER.

SPECIFICATION forming part of Letters Patent No. 414,839, dated November 12, 1889.

Application filed February 20, 1889. Serial No. 300,550. (No model.)

To all whom it may concern:

Be it known that I, WATSON M. HOLMES, a citizen of the United States, residing at Hoosick Falls, county of Rensselaer, and State of New York, have invented certain new and useful Improvements in Grain-Binders, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

My invention relates to the knotting devices of grain-binders, and more particularly to that type known as "vibratory," "reciprocating," or "oscillating" knotters; and it consists in the mechanism employed to impart the reverse rotation to the knotter to form the knot.

My invention consists more particularly in the combination, with the knotter-pinion and its driving-disk, of a pinion journaled on a stud in the knotter-frame and meshing with the knotter-pinion, and also with a suitable rack on the driving-disk whereby the intermeshing pinion turns idly during the forward rotation of the knotter, but subsequently, being positively driven by the rack on the disk, imparts the desired reverse rotation to the knotter.

Referring to the accompanying drawings, in which similar letters of reference indicate like parts, Figure 1 is an end elevation of so much of a grain-binder as is necessary to illustrate my invention. Fig. 2 is a perspective view of a knotter-head embodying my invention. Fig. 3 is a top plan view of the same. Fig. 4 is a face view of the knotter-driving disk. Fig. 4ª is a side elevation of the same. Fig. 5 is a perspective of the knotter-pinion. Fig. 6 is a perspective of the upper knotter-hook and its spindle; Fig. 7, a perspective of the lower knotter-hook, its spindle, and collar. Fig. 8 is a perspective view of the tucker.

A is the binder-frame, Fig. 1.

B is a frame rigidly secured to the upper limb of the binder-frame and supports the knotter-frame C, which is secured thereto by means of a bolt *c*, passing through the frames B and C.

D is the intermittently-operated knotter-driving disk.

F is the breast-plate; G, the grasper and band-cutter; H, the tripping-lever, and I the discharger.

J is the platform on which the grain is bound.

The operation in brief of the binder is as follows: The cord passing through the eye of the needle beneath the platform (the needle is not shown in the drawings) is securely held in the grasper. The grain is forced by the packers (not shown in drawings) beneath the tripping-lever H until enough has accumulated to actuate the tripping-lever. When the needle is put in motion, it brings the band around the bundle, the knotter is actuated to unite the extremities of the band, the new end of the band is held in the grasper, and, the bundle being discharged, the needle and the various binding devices are again brought to a position of rest, ready for another bundle.

The knotter is substantially similar in construction to that shown in Patent No. 329,560, granted to Hector A. Holmes and myself, jointly, the 3d day of November, 1885, to which, for a more detailed description, reference is hereby made.

The knotter consists of the two hooks *a b*. The spindle *a'* of the upper hook *a* is made hollow, and the spindle *b'* of the lower hook fits within this hollow spindle loosely enough, however, to permit the spindle *a'* to turn around the spindle *b'*. The knotter-pinion *c'* is rigidly secured to the spindle *a'*, and the spindle *b'* extends up beyond the pinion *c'*, through the collar b^2, and has a bearing in the tyer-frame, (see Fig. 1,) for the purposes hereinafter to be explained. The collar b^2 is securely pinned to the spindle *b'* above the pinion *c'*. The pinion *c'* is provided at its upper portion with a shoe c^2, having a delay-surface, which, bearing upon the track c^3, formed on the disk D, prevents rotation of the knotter until the pinion *c'* is engaged by the rack *d* on the disk D. The pinion *c'* also has a projecting lug c^4, to which and to the collar b^2 are fastened, respectively, the ends of a spiral spring *e*, the spring surrounding the shaft or spindle *b'*. The force of the spring is sufficient to cause the forward end of the hook *b* to abut against the rearwardly-directed point a^2 of the hook *a*. The disk D

revolves in the direction indicated by the arrow in Fig. 1. The pinion f is journaled on a stud f', which has its bearing or may be rigidly secured in the tyer-frame C. The pinion f has its axis of rotation somewhat nearer the plane of the disk D than is the axis of rotation of the pinion c'. The teeth of the pinion f are also sufficiently shorter than the teeth of the pinion c' to permit the rack d to pass by the pinion f without engaging it, and consequently during the forward rotation of the knotter the pinion f, which meshes with the pinion c', turns idly. The rack d^2, which is formed on a boss d^3, offset some distance from the face of the disk D, subsequently coming in mesh with the pinion f, drives it positively, and, inasmuch as the pinion f meshes with the knotter-pinion c', imparts the desired retrograde rotary movement to the knotter. The boss d^3 is sufficiently offset from the face of the disk D, so that the rack d^2 will pass by without engaging the pinion c'.. As the knotter is completing its forward rotation the lug b^4, formed on the collar b^2, abuts against the knotter-frame at about c^5, and the forward rotation of the lower hook b is stopped thereby; but the upper hook continues to rotate for a short distance, and the end of the hook b is separated from the rearwardly-directed point a^2 of the upper hook. This advance movement of the upper hook is imparted by means of the long tooth d^4 on the rack d, and, as the tension of the spring e must be overcome in such advance movement of the upper hook, the tooth d^4 is made longer than the other teeth in the rack d to withstand the greater work required thereof and to provide an additional wearing-surface. The shoe of the pinion c' is suitably formed at c^6 to receive the long tooth d^4. In order that the spindle b' may not be bent when its forward revolution with the spindle a' is stopped, a bearing is provided for the upper end of the spindle b' in the frame B, as shown in Fig. 1.

The track of the disk D is suitably cut away at d^5 d^6 d^7 to allow the rotation of the shoe on the knotter-pinion when it is being driven through the racks d d^2.

K is the tucker. It is pivoted on the side of the knotter-frame just below the knotter-pinion at d^9, is bent or curved to extend outside of the knotter, as shown in Fig. 1, and is at its forward end raised by the boss d^8 of the disk D striking the heel d^{10} to push the two branches of the band between the upper and lower hooks during their separation.

L is the cord-rest upon which the bands are delivered by the needle to be seized by the knotter.

M is a crank-arm through which the discharge-arm is driven.

The operation of my invention is as follows: The end of the band is held in the grasper, and, lying across the end rest L, extends across the receptacle and through the eye of the needle and the tension device. When the tripping device is actuated, the needle delivers the other strand of the band across the rest L, the band of course being around the bundle. The rack d, coming in mesh with the pinion c', advances both the hooks a and b together until the stop b^4 strikes the projection c^5 on the tyer-frame, and the forward rotation of the lower hook b is stopped; but the tooth d^4 of the rack d continues the forward rotation of the upper hook. The flange O of the upper hook carries the grasper ends of the band over the main bands. During the separation of the upper and lower hooks the lug d^8 of the disk D, striking the tucker, pushes the bands up between the hooks. The disk D continuing its revolution, the rack d^2 comes in mesh with the pinion f, and a reverse rotation is imparted to the knotter, closing the jaws, and the ends of the band are held by the spring e between the forward end of the hook b and the rearwardly-directed projection a^2. The grasper now releases the old end of the band, severs the band, and holds the new end ready for the succeeding bundle. The knotter completes its retrograde movement through the rack d^2 and pinion f, and, the loop having been detached during such retrograde movement from the hooks, the knotter comes to a position of rest for the succeeding bundle, as shown in Fig. 1. The discharge-arms have during the rotation of the disk D been moved back of the bundle and then outwardly, ejecting it from the machine.

It will be apparent from the foregoing that the devices here presented are much more simple and act more directly than those hitherto employed to actuate a vibrating knotter.

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

1. The combination, with the knotter and its pinion, of an intermeshing pinion journaled on the knotter-frame, the knotter-driving disk, a segmental rack thereon to operate the knotter-pinion, and a second segmental rack on the disk to engage the intermeshing pinion, thereby imparting a reverse rotation to the knotter, substantially as and for the purpose specified.

2. The combination, with the knotter-driving disk, of the knotter and its pinion, an intermeshing idle-pinion journaled in the knotter-frame, the axes of rotation of the pinions being in a plane making an angle with the plane of rotation of the driving-disk, and segmental racks on the driving-disk meshing, respectively, with the intermeshing pinions, substantially as and for the purpose described.

3. The combination, with the knotter and its pinion, of an intermeshing idle-pinion journaled in the knotter-frame and mechanism to successively drive the pinions, as and for the purpose specified.

4. The combination, with the knotter-driving disk, of the knotter-pinion having long teeth meshing with a segmental rack on the

driving-disk, an idle-pinion of shorter teeth meshing with the knotter-pinion, and a segmental rack formed on an offset from the periphery of the driving-disk to drive the idle-pinion after the knotter-hooks have reached the limit of their forward rotation, substantially as and for the purpose specified.

5. The combination of the upper and lower knotter-hooks, the spindle of the lower hook being journaled within the spindle of the upper hook, and the frame which supports the knotter-frame, formed with a bearing for the upper end of the inner spindle, substantially as and for the purpose described.

6. The combination, with the hollow spindle of the upper knotter-hook, of the spindle of the lower hook, journaled within the hollow spindle of the upper hook, a spring secured to the spindles, whereby they are both caused to normally rotate together, stops on the knotter-frame and on the spindle of the lower hook to stop the forward rotation of the latter, a driving-pinion on the spindle of the upper hook, and an intermeshing idle-pinion journaled in the knotter-frame, and driving-racks on the knotter driving-disk, one to engage the pinion on the knotter and the other to engage the idle-pinion, substantially as and for the purpose specified.

In witness whereof I have hereunto set my hand this 25th day of October, 1888.

WATSON M. HOLMES.

Witnesses:
WALTER W. LOVEGROVE,
JOHN A. WILSON.