(No Model.) 6 Sheets—Sheet 1.

L. MILLER.

GRAIN BINDER.

No. 419,154. Patented Jan. 7, 1890.

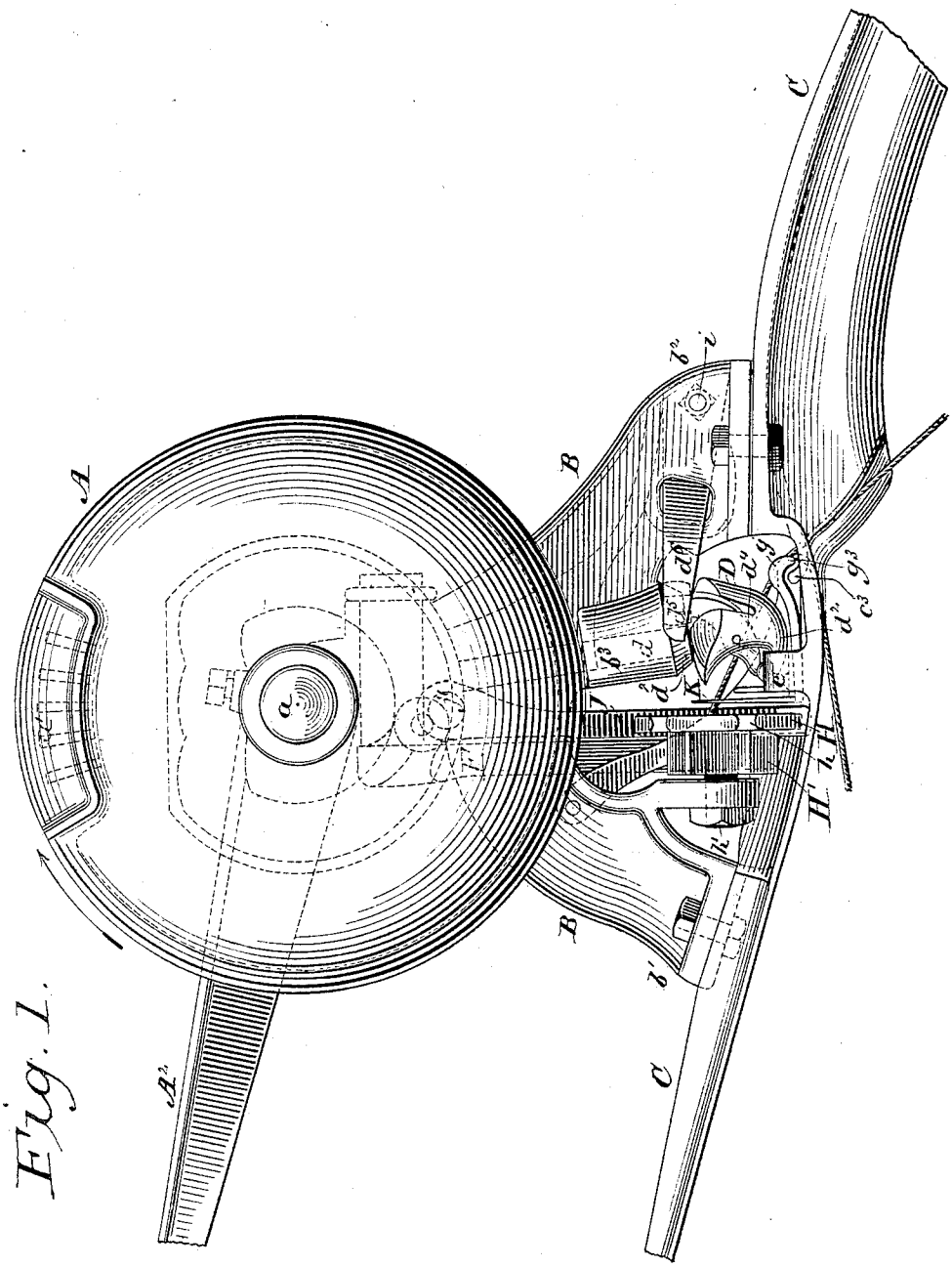


Fig. 1.

Witnesses

H. C. Newman

O. D. Newman

Inventor

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By his Attorneys

Baldwin Davidson & Wright.

N. PETERS, Photo-Lithographer, Washington, D. C.

(No Model.)

6 Sheets—Sheet 2.

L. MILLER.

GRAIN BINDER.

No. 419,154. Patented Jan. 7, 1890.

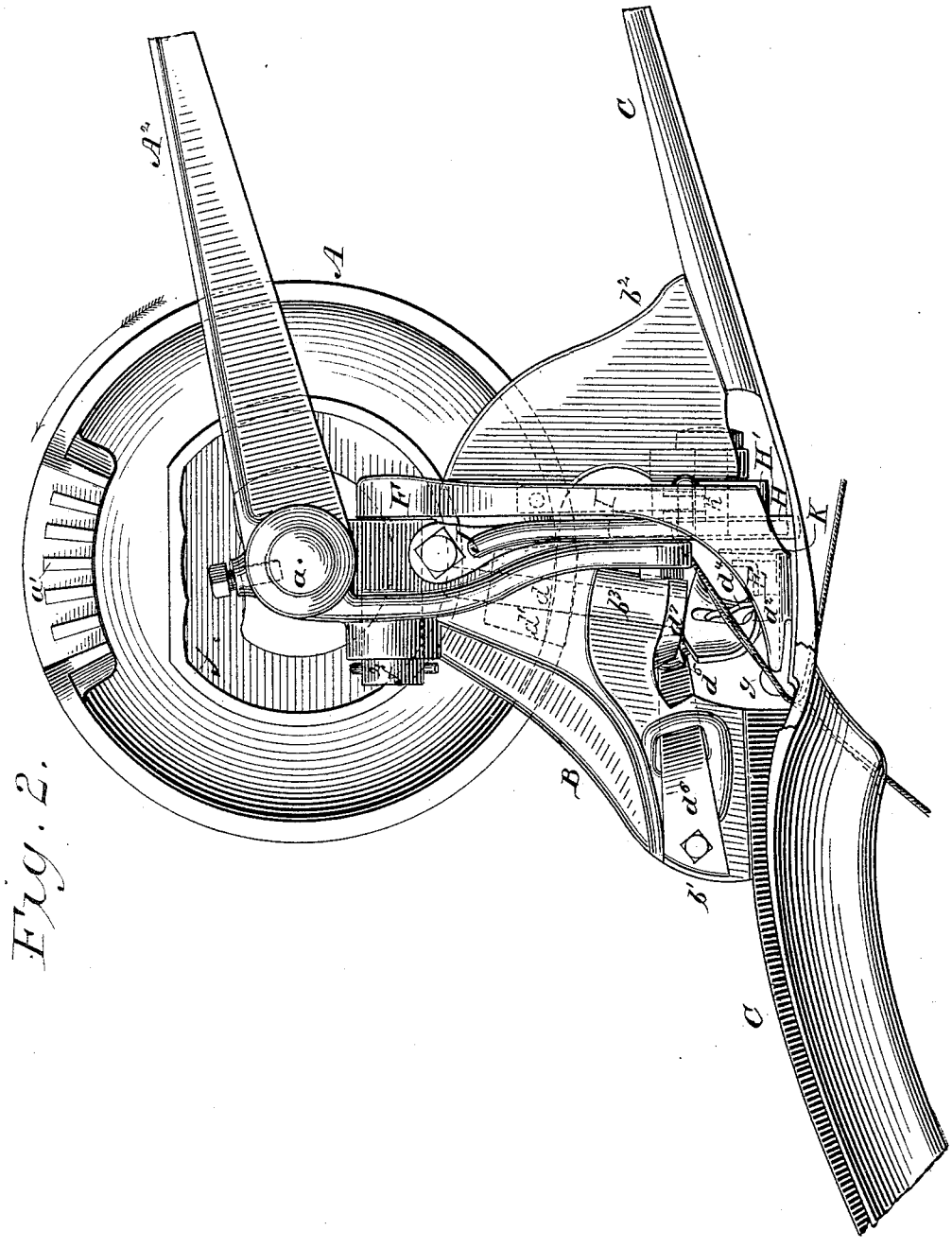


Fig. 2.

Witnesses

H. C. Newman.
E. S. Newman.

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(No Model.) 6 Sheets—Sheet 3.

L. MILLER.

GRAIN BINDER.

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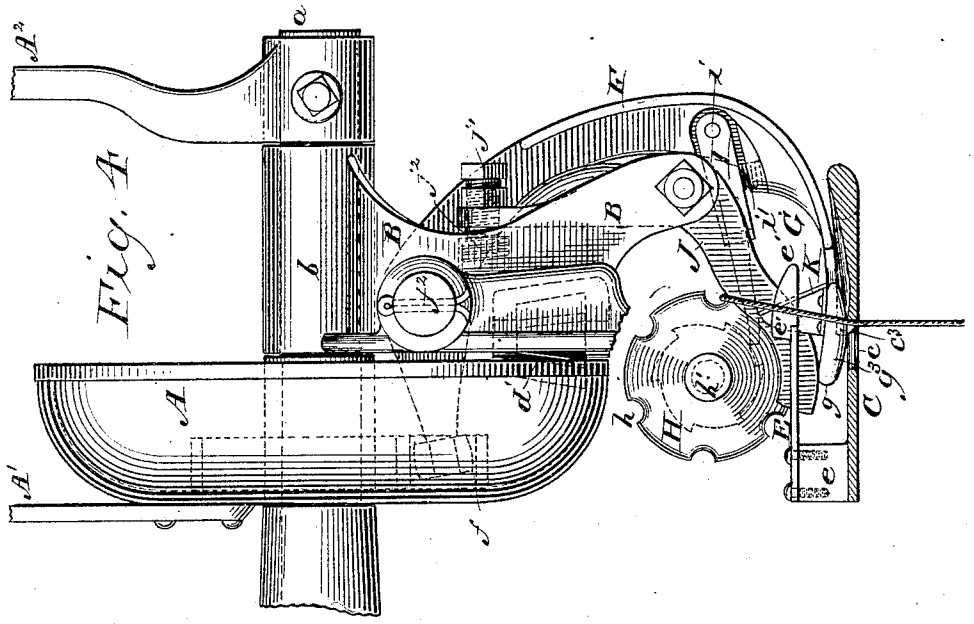


Fig. 4.

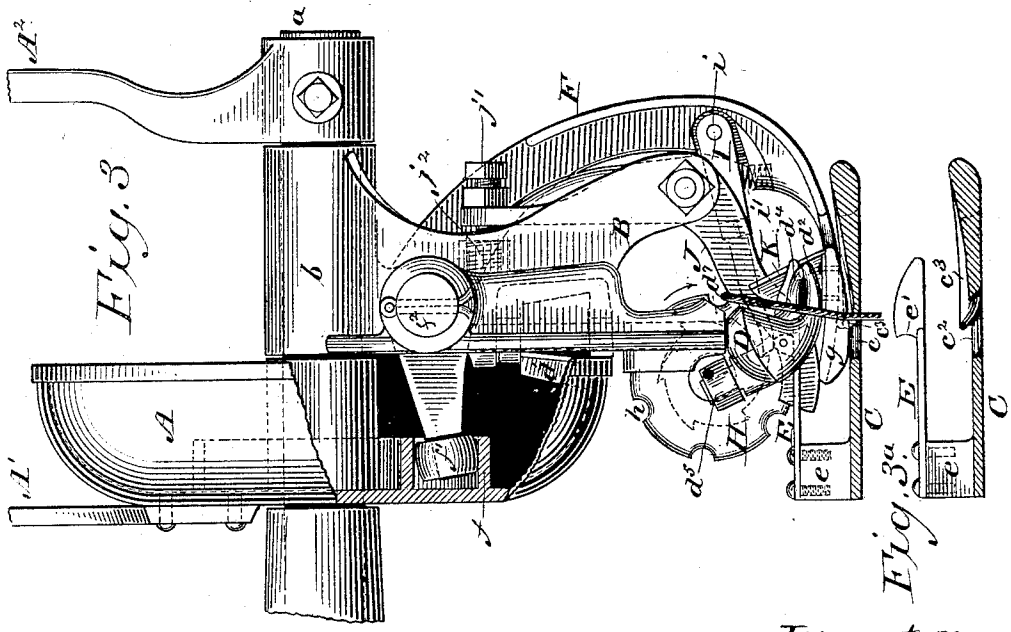


Fig. 3.

Witnesses

H. C. Fenwick

C. L. Fenwick

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(No Model.)

6 Sheets—Sheet 4.

L. MILLER.

GRAIN BINDER.

No. 419,154. Patented Jan. 7, 1890.

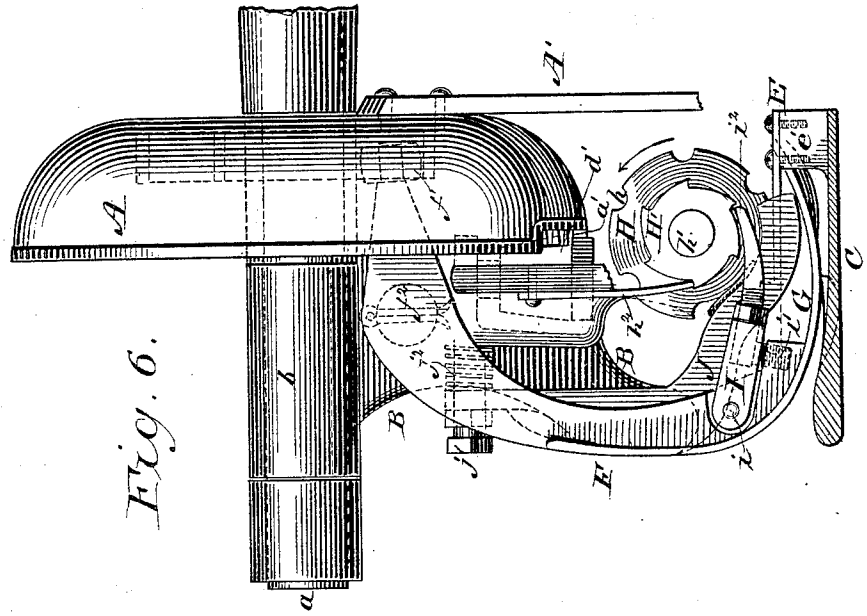


Fig. 6.

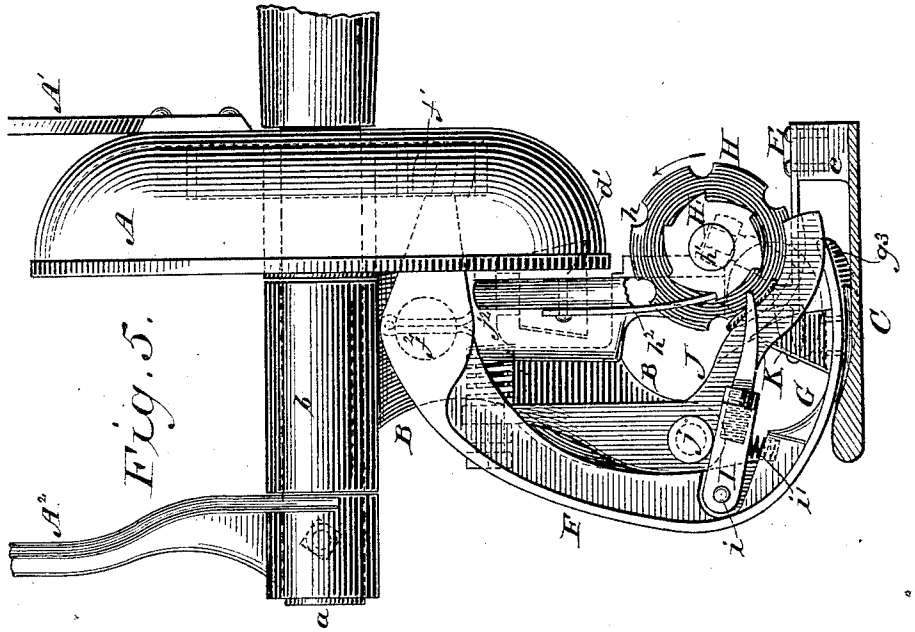


Fig. 5.

Witnesses

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E. L. Neuman.

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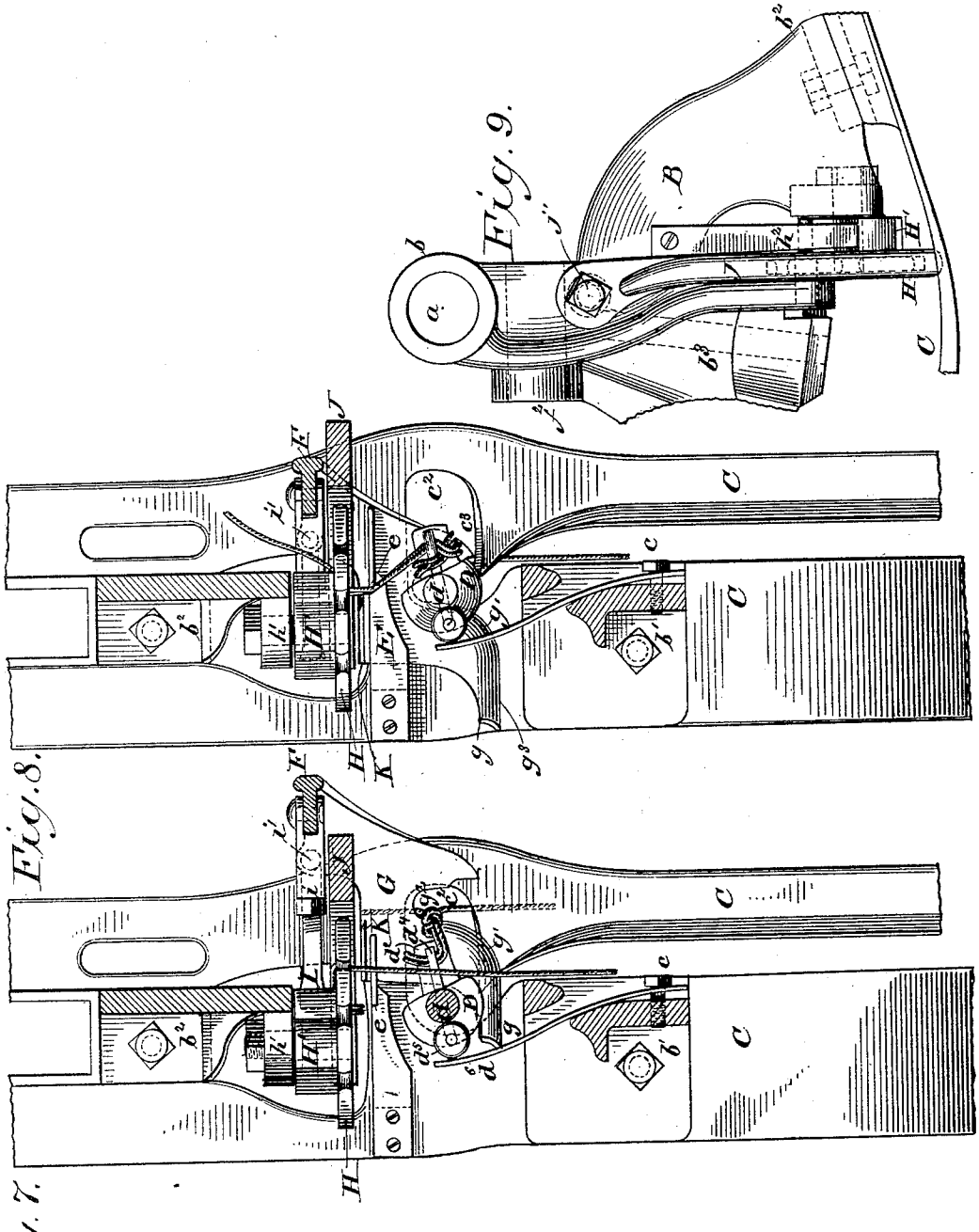
(No Model.)

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L. MILLER.

GRAIN BINDER.

No. 419,154. Patented Jan. 7, 1890.



Witnesses
H. C. Neuman.
E. L. Neuman

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(No Model.)

6 Sheets—Sheet 6.

L. MILLER.

GRAIN BINDER.

No. 419,154. Patented Jan. 7, 1890.

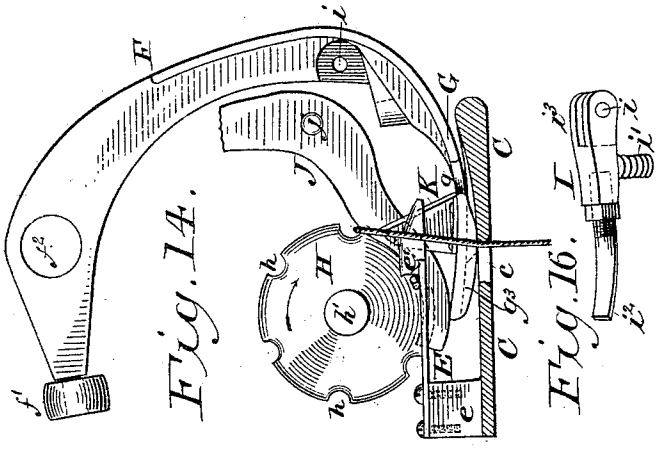


Fig. 14.

Fig. 16.

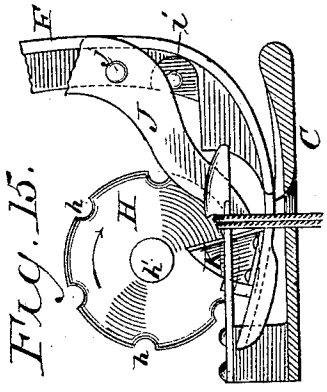


Fig. 15.

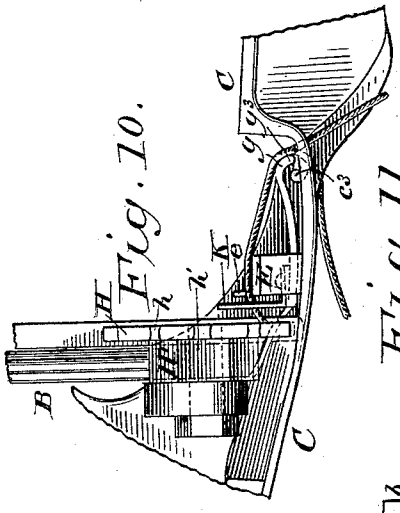


Fig. 10.

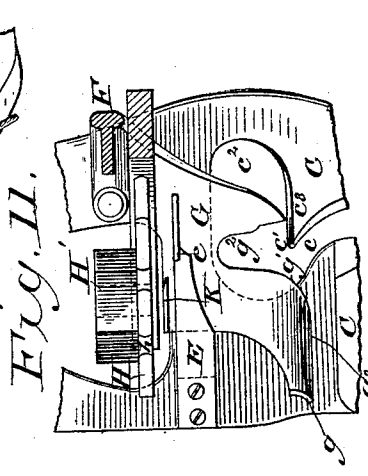


Fig. 11.

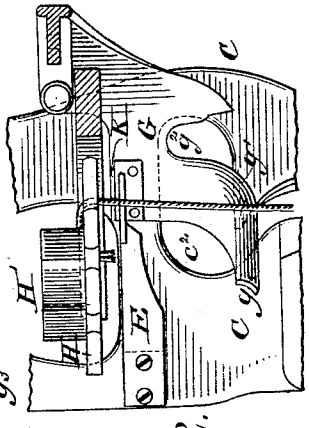


Fig. 12.

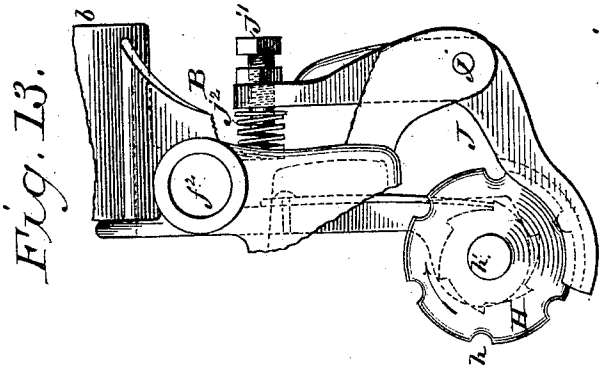


Fig. 13.

Witnesses

H. C. Neuman,
E. L. Neuman.

Inventor

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N. PETERS. Photo-Lithographer, Washington, D. C.

UNITED STATES PATENT OFFICE.

LEWIS MILLER, OF AKRON, OHIO.

GRAIN-BINDER.

SPECIFICATION forming part of Letters Patent No. 419,154, dated January 7, 1890.

Application filed November 20, 1888. Serial No. 291,373. (No model.)

To all whom it may concern:

Be it known that I, LEWIS MILLER, a citizen of the United States, residing at Akron, in the county of Summit and State of Ohio, have invented certain new and useful Improvements in Grain-Binders, of which the following is a specification.

My invention relates more especially to that class of automatic cord-knotting grain-binders exhibiting the following characteristics—viz., a slot in the breast-plate through which the cord passes over a supporting-finger normally extending athwart the slot, but movable laterally and intermittently to clear the passage for the cord, the supporting-finger being mounted on a recessed foot carried by an elbow-lever pivoted on the frame and vibrated by a cam on a cam-and-gear wheel, a knotter rotating once during each operation on an axis substantially perpendicular to the breast-plate over the slot and foot and stopping with its jaws pointing outward relatively to the line of the slot, and a cord-holder rotating intermittently to carry the cord into suitable relations to the bridge straddled by the knotter-jaws and to the knife which cuts the cord as the knot is formed.

The objects of my invention are to simplify the construction and increase the efficiency of the apparatus, which ends I attain by certain novel organizations and combinations of instrumentalities hereinafter specifically designated.

My invention contemplates the embodiment of these improvements with the most complete apparatus of the present day.

The accompanying drawings represent so much only of an automatic cord-knotting grain-binding apparatus as is necessary to elucidate the subject-matter claimed with my improvements embodied therein. Some of these improvements may be used without the others and in apparatus differing somewhat in details of construction from those shown.

Unless otherwise indicated, the parts hereinafter referred to are of well-known construction.

Figure 1 is a front elevation showing the parts in the attitude assumed (with both strands of cord in the holder) before the knotter begins to rotate; Fig. 2, a rear elevation showing the same parts and attitudes as Fig. 1; Fig. 3, a grain-side elevation, partly in section; Fig. 3ª, a detail section showing the overhung bridge or cord-guide bar behind the eye or enlarged opening at the termination of the cord-slot; Fig. 4, another grain-side elevation with the knotter and its spindle removed to show the cord-holder more clearly; Fig. 5, a stubble-side elevation, partly in section, showing the side of the elbow-lever and cord-holder opposite that shown in Figs. 3 and 4, with the elbow-lever and holder-actuating pawl retracted; and Fig. 6, a similar view with these parts advanced. Fig. 7 represents a sectional plan showing the relation of the cord-supporting finger, knotter, holder, and cord just as the knot is being stripped from the jaws; and Fig. 8, a similar view showing the relation of these parts just before the strands are cut. Fig. 9 is a detail view, similar to that shown in Fig. 2, of the knotter-frame and holder. Fig. 10 is a detail view, similar to that shown in Fig. 1, showing the cord-supporting finger, overhung bridge or guide-bar, and cord-holder, with the cord carried and held at its lowest point thereby. Fig. 11 is a detail sectional plan showing the relations of the cord-holder, slot, and foot, with its supporting-finger and recess in the most advanced position of the foot; and Fig. 12, a similar view of the same parts in their normal or retracted position. Fig. 13 shows a grain-side detail elevation, similar to Figs. 3 and 4, of the rotary cord-holder disk and its oscillating spring-clamp or holder-shoe, illustrating the devices for adjusting the pressure of the clamp. Fig. 14 shows a similar view of the cord-holder, clamp, elbow-lever, foot, and overhung bridge, showing the relation of the parts with the strands severed and the new strand in the holder. Fig. 15 shows a similar view with the foot advanced and the double strand held down on the bridge by the holder just before the knife cuts, and Fig. 16 is a detail view of the cord-holder-actuating pawl detached.

In this instance I call the grain side of the machine the "forward," "inner," or "left," and the stubble side the "rear," "outer," or "right" side. The front of the machine is that side next the horses, and the other side the rear.

A driving-shaft a, mounted and driven in usual ways, carries an ordinary cam-and-gear wheel A and discharging-arms A′ A². The bracket-frame or knotter-frame B has a pipe-box bearing b at its upper end encircling the shaft a. The knotter-frame is forked or arched, so as to leave a central opening, its legs b' b^2 being provided with laterally-projecting feet secured to the breast-plate C, which is provided with a cord-slot c. This slot is shown as having a straight front wall back to a point just within the sweep of the knotter-jaws, where it is deflected laterally and forwardly, terminating in an eye or enlarged opening c^2. The rear wall of this slot curves forward slightly within the sweep of the knotter-jaws, forming a guide-finger c', which extends athwart the slot and forms the inner or grain-side wall of the enlarged opening c^2, above mentioned, in which the slot terminates, the longer axis of which opening lies at a right angle to the front wall of the slot, or nearly so. The front branch or leg b' of the knotter-frame, it will be observed, Figs. 7 and 8, lies close to but in front of the front wall of the slot, while the rear leg b^2 is secured to the breast-plate beyond the end of the slot, but in the same line.

The knotter D, which is shown of the usual tying-bill pattern, has a shaft d, mounted in a pendent bearing b^3 on the bracket-frame, and carries a bevel-pinion d' on its upper end, meshing with sector-teeth a' on the cam-and-gear wheel A. The lower jaw d^2, in this instance, is the fixed one. The upper jaw d^4 is pivoted to move vertically relatively thereto and provided with the usual friction-roller d^5, spring d^6, and actuating-cam d^7 on the knotter-bearing.

The knotter-spindle, it will be observed, is practically perpendicular to the breast-plate in advance of the front line of the slot and over the forward end of the enlarged eye or opening c^2. The knotter-jaws, Figs. 7 and 8, preferably normally stand pointing slightly outward and backward relatively to the slot, being so organized as to make a single revolution at each operation or knot-forming and then stop.

An elastic or yielding overhanging bridge or guide-bar E, Figs. 3, 3ª, 4, and 7, is shown as secured at one end on an upright post e on the breast-plate, as extending backward above and parallel with the breast-plate, and within the sweep of the knotter-jaws, which straddle it during the latter part of their revolution and sweep the overlying strands therefrom as they are cut. A hook or shoulder e' on the rear end of this bridge or guide-bar serves to prevent the strands escaping prematurely therefrom.

A cam-guide f on the cam-and-gear wheel A acts on a friction-roller f' on an elbow-lever F, vibrating on a pivot f^2 on the knotter-frame B. This elbow-lever is shown as oscillating on the outer or stubble side of the knotter-frame in a plane parallel therewith, but transverse to the line of the cord-slot c, and as carrying a cord-guiding foot G, Figs. 11 and 12. This foot terminates at its inner front corner in a cord-supporting finger or toe g, extending laterally athwart the cord-slot, and in such relation thereto that in its normal or retracted position it extends entirely across the slot and bars the passage of the cord. When in its advanced position, however, the strands slip past the heel g' into the recess g^2 in the foot, and thus pass into the eye c^2 of the slot. The front edge of the toe is bent down so as to form a flange g^3, which overlaps a corresponding upturned flange c^3 on the rear line of the cord-guiding finger c' of the breast-plate, Figs. 1 and 10, the effect of which is to prevent any possibility of the cord working beneath the toe into the eye c^2 until the toe moves out of the way.

The cord-holder consists of a disk H, provided with cord-receiving notches h on its periphery and mounted on a shaft h' on the knotter-frame. Figs. 7 to 11 show this disk as practically perpendicular to the breast-plate and parallel with the knotter-spindle. It is intermittently turned at suitable intervals by means of a ratchet-wheel H′ on its outer side, actuated by a pawl I, rocking on a pivot i on the elbow-lever and upheld by a spiral spring i', Fig. 16. The head i^2 and shank i^3 of this pawl are connected by a screw to adjust the pawl properly relatively to the ratchet-teeth, which adjustment is important to insure accurate co-operation of the pawl and holder. A detent-spring h^2 prevents backward movement of the ratchet.

The cord-clamp, Fig. 13, is shown as consisting of a bell-crank arm J, trough-shaped and curved at bottom to encompass the holder-disk H, and rocking vertically on a pivot j on the knotter-frame. A set-screw j' on the upper end of the holder-shoe J varies the pressure of a spiral spring j^2, interposed between the holder-shoe and frame, and thus regulates the pressure of the clamp on the disk, and consequently the bite on the binding-cord.

A knife K is fixed on the foot G, near the forward edge of its hinder part, its front edge being blunt, curved, and sloping backward, Figs. 14 and 15, to slide readily under the cord, while its rear edge is sharp and inclined upward and forward, so as to make a sliding cut on its backward stroke.

The other parts of the mechanism, being well known, need not be described.

The apparatus operates as follows: The binder-arm rises through the cord-slot, laying a strand of the cord over the cord-supporting toe g, which lies athwart the slot, and over the nose of the knotter into one of the notches h of the cord-holding disk, Figs. 1, 2, 3, 4, and 7, and then retracts, leaving the cord fast therein. After the gavel is formed the binder-arm again rises, laying the second strand of cord in the same position as the former one. The sector-teeth a' on the cam-and-gear wheel A then mesh with the pinion d of the knotter,

and the latter begins to turn in the direction of the hands of a clock, the jaws passing under the strands, as usual, (see Fig. 3,) and sweeping them to the front. Simultaneously with this movement the foot advances from the position shown in Fig. 12 to that shown in Fig. 11, the cord-supporting toe g moves to the front of the line of the cord-slot, and the strands slip over the heel g' into the recess g^2. The effect of this movement, obviously, is to slacken the strands and thus give up cord to the knotter during the latter part of its rotation. As the elbow-lever carrying the foot advances, the pawl I carried by it rotates the cord-holding disk H in the direction shown by the arrows in the drawings and carries the strands downward and forward from the position shown in Figs. 3, 4, 7, 12, and 14 to that shown in Figs. 8 and 15. The forward movement of the foot carries the knife K in front of the strands. At the same time the latter are carried downward over and in front of the shoulder or hook e' on the cord-guide or bridge E. (See Fig. 15.) The knotter continues its rotation, while the holder and foot remain still in their advanced position. As the knotter reaches the front line of the slot and moves backward, its jaws open and straddle or embrace the strands lying on the cord-guide E, which is made slightly elastic to accommodate the passage of the jaws, as well as to compensate slightly the strain on the strands. The fixed jaw of the knotter in this instance passes under the bridge or cord-guide, while the movable one passes over it, and the strands thereon are caught in the jaws in the usual way. The shoulder e' on the cord-guide prevents the strands from slipping off it, and the parts assume the relation shown in Fig. 8, which draws the strands well within the jaws. The latter now stop while the foot retracts, and the knife cuts the strands in front of the holder-disk. The strand connected with the binder-arm still, however, remains clamped at the back of the holder, as usual. (See Figs. 5, 7, and 12.) The continued backward movement of the foot causes the front wall of its recess g^2 to strain on the cut strands, tying the knot tightly and pulling it from the jaws. The operation above described is then repeated.

The mechanism, it will be observed, under my organization is compactly and conveniently arranged in the arch or space between the legs of the knotter-frame, and all the parts are driven directly from the cam-and-gear wheel without superfluous connecting-gearing. The cord-supporting toe and recess effectually prevent the escape of the cord, insure its being properly held and guided, yield the required slack cord to form the knot without breaking the cord, and strip the knot from the jaws. The bridge or cord-guide with its shoulder presents and retains the strands in proper relation to the knotter and holder, while the latter by its revolution carries the cord past the rear line of the knotter-spindle and lays it well on the jaws of the knotter.

The construction of the arched or forked knotter-frame with its feet on the front side of the cord-slot and the arrangement of the knotter-spindle and holder-disk axis in front of the plane of the slot enables the binder-arm to lay the cord close to the knotter-spindle, and yet leaves the mechanism readily accessible. The rocking arm or clamping-jaw of the cord-holder, it will be observed, is pivoted well back of the line of the cord-slot, so as to leave plenty of room for getting at the mechanism.

The elbow-lever, which carries the cord-guiding foot, knife, and the actuating-pawl of the cord-holder, rocks on a pivot transverse to but just below the actuating-shaft, slightly behind the axis of the knotter-spindle and the line of the cord-slot, and the elbow-lever itself vibrates in a vertical plane transverse to the line of the cord-slot back of the knotter and cord-holder, while its foot extends forward underneath the knotter, thus keeping the arm well out of the way of the knotter and cord. The springs are arranged out of the path of the cord to avoid liability to entanglement therewith.

I am aware that some of the above-described results have been attained by others as well as by myself in various ways. I am also aware that much of the mechanism hereinbefore described is shown in application for Letters Patent of the United States filed by me April 27, 1886, Serial No. 200,321, and in Letters Patent No. 410,427, dated September 3, 1889. I therefore limit my claims herein to the organizations and combinations hereinafter specifically designated.

Having thus fully described the construction and operation of my improved automatic cord-knotting grain-binding apparatus, what I claim therein as new and of my own invention, and desire to secure by Letters Patent, is—

1. The combination, substantially as hereinbefore set forth, of the breast-plate having a cord-slot therein, the arched or forked knotter-frame parallel with and on the front side of the cord-slot, the knotter rotating in the arch between the feet in front of the plane of the cord-slot, the holder-disk, also rotating on a pivot in front of the plane of the cord-slot, the holder-disk-actuating pawl and the movable holder-shoe, both pivoted on the opposite or rear side of the slot, by which organization the knotter mechanism is rendered readily accessible and the binder-arm can traverse close to the knotter-spindle.

2. The combination, substantially as hereinbefore set forth, of the breast-plate having a cord-slot therein, the knotter-frame parallel with the cord-slot, the knotter-spindle, and the holder-disk, all substantially in front of the plane of the cord-slot, the elbow-lever and its pivot in the vertical plane of the bearing

of the actuating-shaft, but in rear of the knotter-spindle, and the cord-holder-actuating pawl pivoted on the elbow-lever and crossing the cord slot, by which organization both the knotter mechanism and the parts attached to the elbow-lever are rendered readily accessible and removable.

3. The combination, substantially as hereinbefore set forth, of the breast-plate having the cord-slot therein, the knotter-frame, the rotary knotter, the elbow-lever, the cord-guiding foot carried thereby, the rotary disk-holder, the yielding cord-supporting bridge traversed by the knotter-jaws in their rotation, the shoulder e' on the bridge to prevent the escape of the strands therefrom, and the knife carried by the foot to sever the strand on its back-stroke while clamped in the holder.

4. The combination, substantially as hereinbefore set forth, of the breast-plate having the cord-slot therein, the fixed finger in the slot to deflect the cord toward the knotter, the knotter-frame, the elbow-lever and its pivot in rear of the knotter-spindle, the laterally-movable cord-supporting toe which normally bars the slot, so as to hold the cord on the knotter, and the foot on which the toe is mounted, both rigidly secured on the elbow-lever and carried thereby, the recess in the foot into which the cord passes as the toe advances and by which the strands are guided, the knife also carried by the elbow-lever, the knotter rotating on a spindle practically perpendicular to the breast-plate over the enlarged opening of the slot, the disk cord-holder which carries the strands downward toward the knotter, the bridge or cord-guide, and the shoulder thereon interposed between the knotter and holder to retain the strands laid thereon until severed by the knife.

5. The combination, substantially as hereinbefore set forth, of the breast-plate having a cord-slot therein, the arched or forked knotter-frame parallel with and on the front side of the cord-slot, the knotter rotating in the arch between the feet on a spindle in front of the slot, the disk cord-holder rotating step by step on a pivot in front of the cord-slot, its ratchet-wheel, the laterally-oscillating elbow-lever, the cord-guiding foot carried thereby, the actuating-pawl, and its adjusting devices pivoted on the said lever crossing the cord-slot and acting on the ratchet-wheel.

6. The combination, substantially as hereinbefore set forth, of a breast-plate having a cord-slot therein terminating in an enlarged eye or opening back of the knotter-spindle, a fixed cord-guiding finger in the slot to deflect the cord toward the knotter, a knotter rotating on a spindle practically perpendicular to the breast-plate over the fixed finger and the enlarged opening in the cord-slot, mechanism, substantially such as described, which drives the knotter continuously in one direction only during an entire revolution and stops it with its jaws pointing slightly outward relatively to the normal direction of the cord-slot, a disk cord-holder rotating in a plane substantially parallel with the knotter-spindle on a fixed axis intersecting the knotter-spindle at practically a right angle, and a binder-arm which lays the cord on the same side of the knotter-spindle and the holder-disk axis.

In testimony whereof I have hereunto subscribed my name.

LEWIS MILLER.

Witnesses:
O. L. SADLER,
W. K. MEANS.