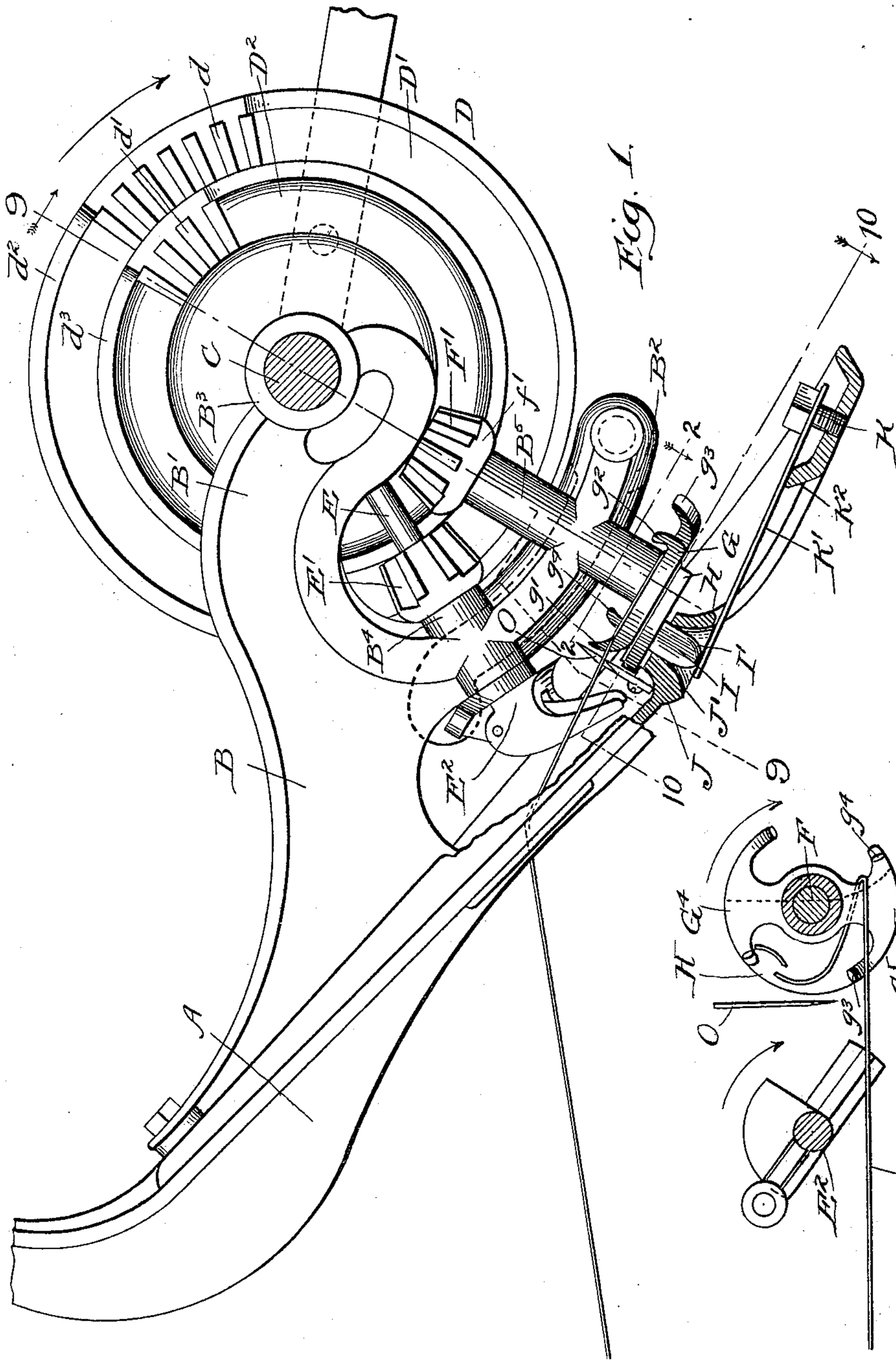
No. 611,775. Patented Oct. 4, 1898.

S. K. DENNIS.

KNOTTER FOR GRAIN BINDERS.

(Application filed Nov. 6, 1896.)

(No Model.) 4 Sheets—Sheet 1.



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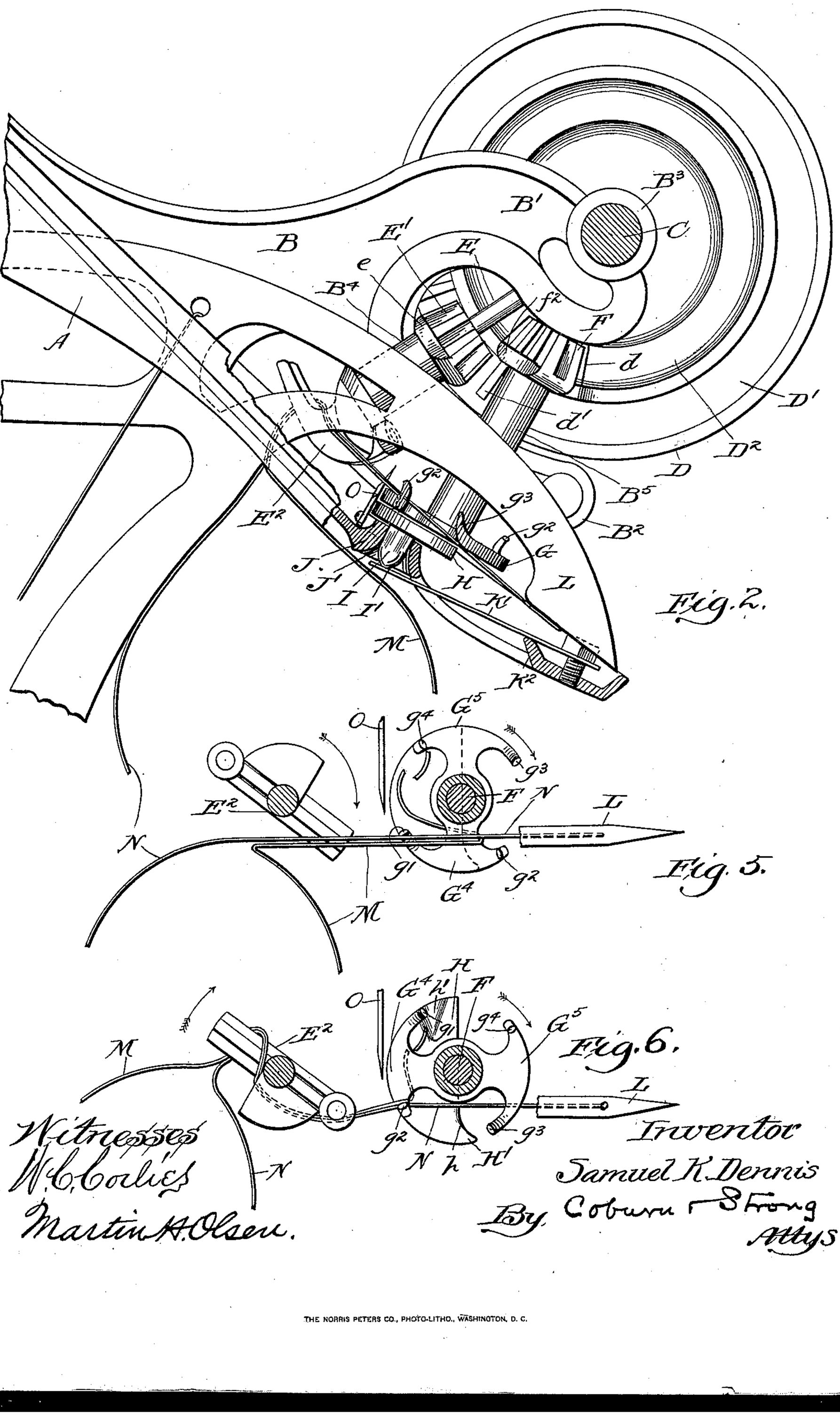

Fig. 2.

Fig. 5.

Fig. 6.

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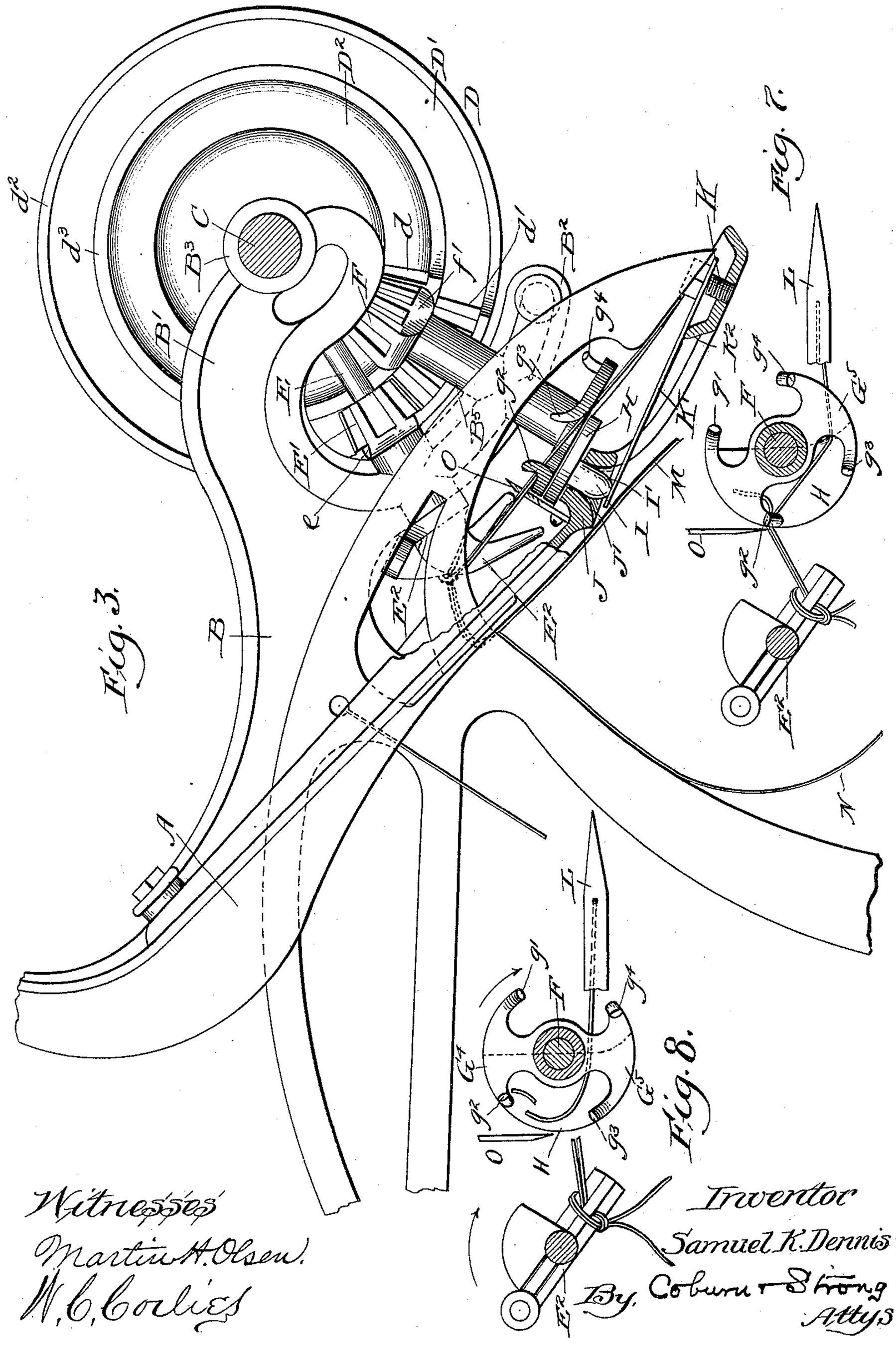

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Fig. 9.

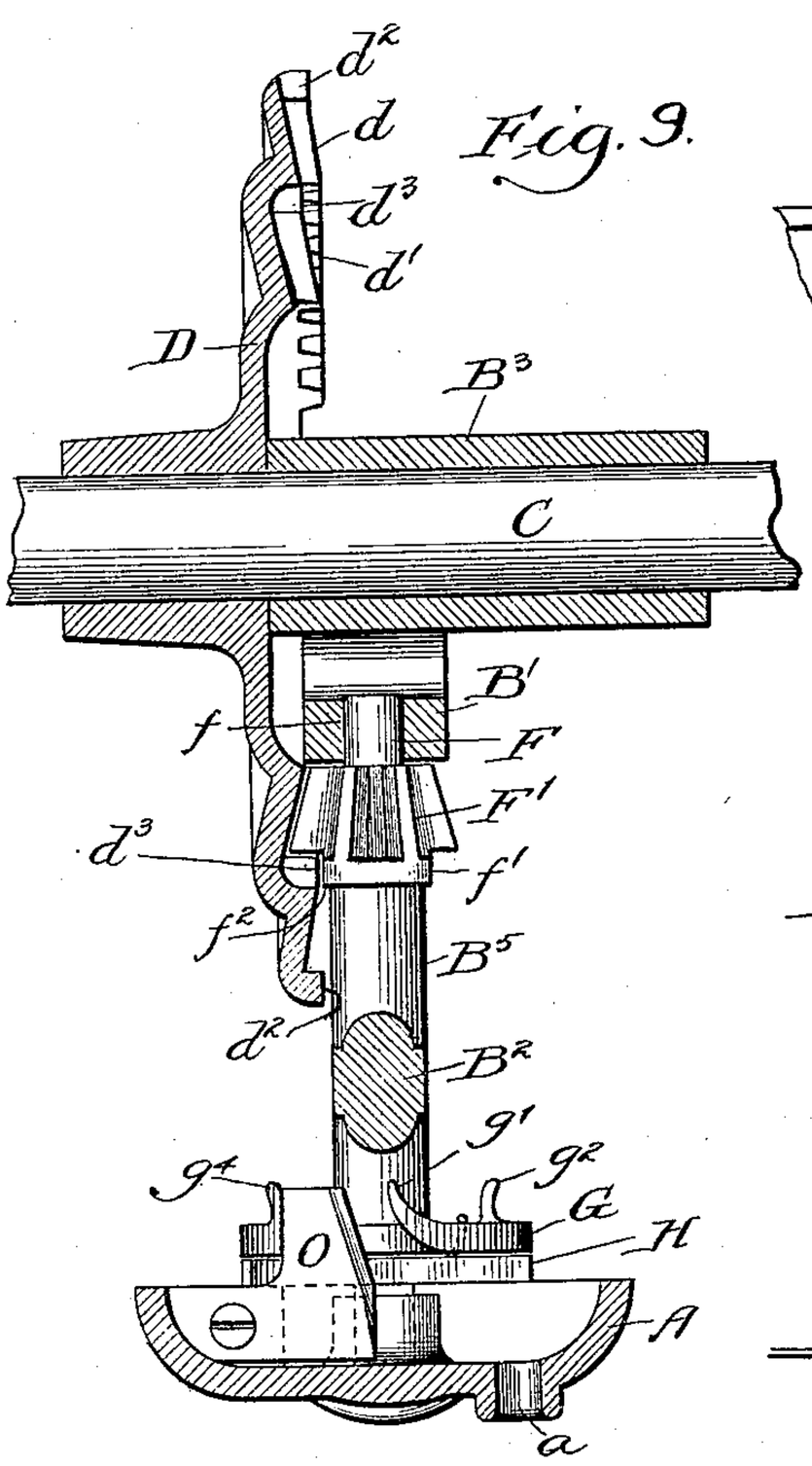


Fig. 10.

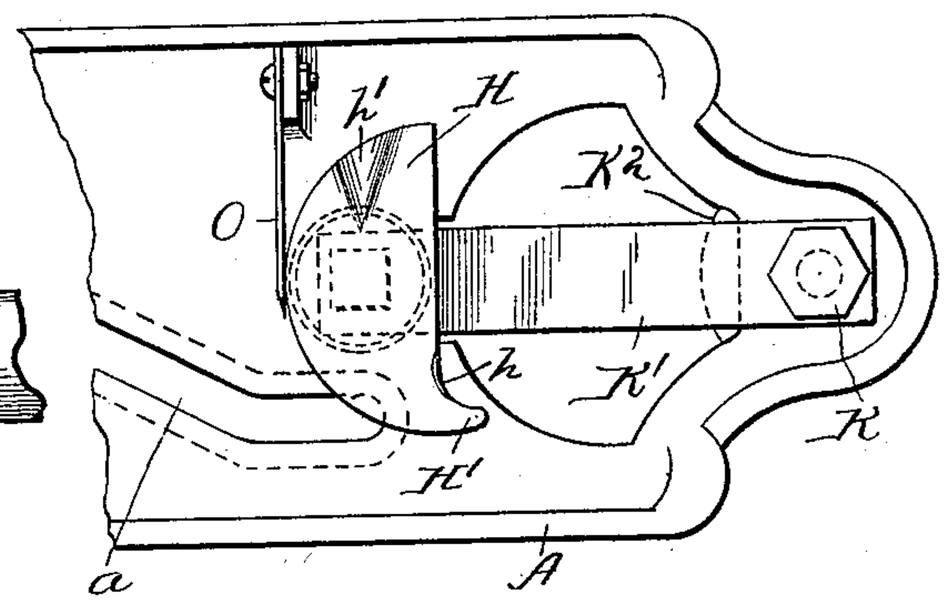


Fig. 11.

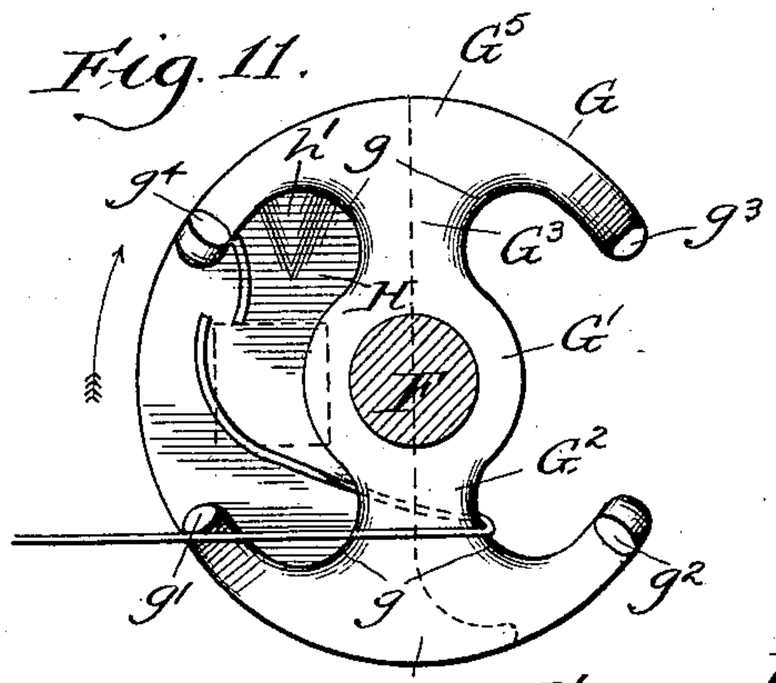


Fig. 12.

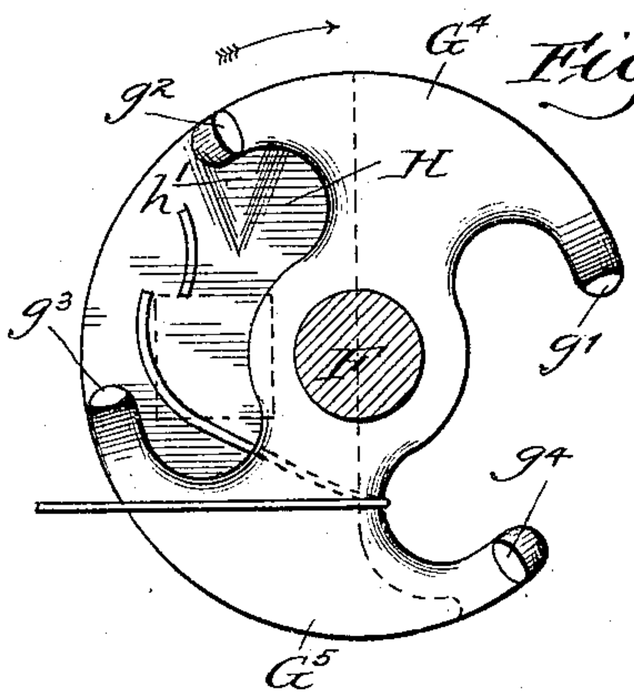


Fig. 13.

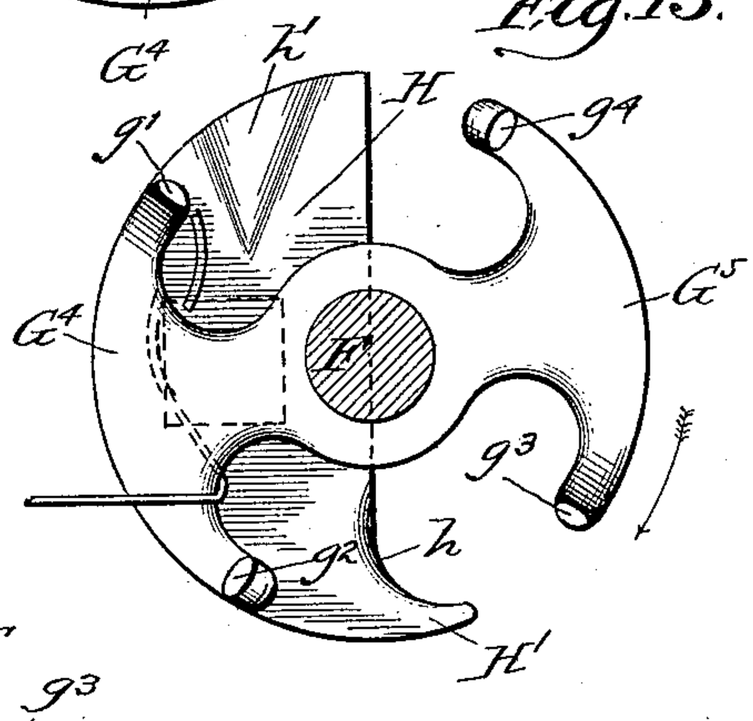
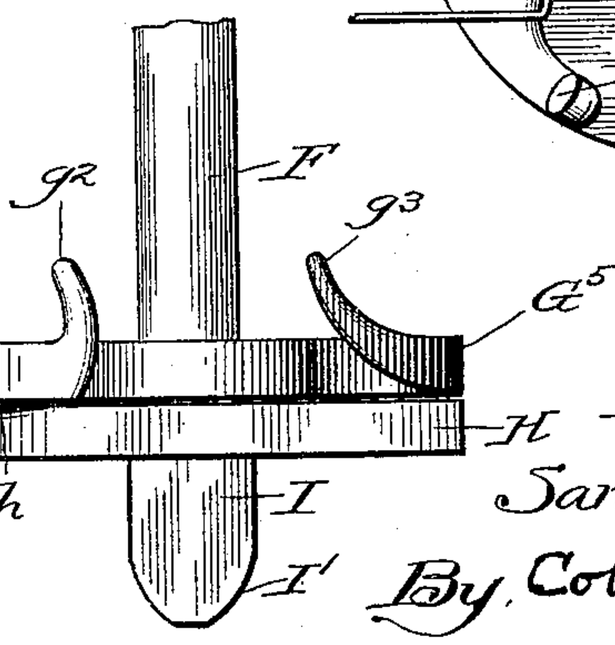


Fig. 14.



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KNOTTER FOR GRAIN-BINDERS.

SPECIFICATION forming part of Letters Patent No. 611,775, dated October 4, 1898.

Application filed November 6, 1896. Serial No. 611,209. (No model.)

To all whom it may concern:

Be it known that I, SAMUEL K. DENNIS, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Knotters for Grain-Binders, which is fully set forth in the following specification, reference being had to the accompanying drawings, in which—

Figure 1 is a side elevation of the knotter with the parts in the position occupied before the binding operation commences. Fig. 2 is a similar view taken with the needle advanced and the binding operation begun. Fig. 3 is a similar view taken before the needle retreats, but with the binding operation nearly completed. Fig. 4 is a diagrammatic plan view of the cord-holder and tying-bill in a position corresponding to Fig. 1. Fig. 5 is a similar view taken at a stage just preceding that of Fig. 2. Fig. 6 is a similar view taken at a stage corresponding to that of Fig. 2. Fig. 7 is a similar view taken at a stage corresponding to that of Fig. 3 and just succeeding that of Fig. 6. Fig. 8 is a similar view taken at a stage just succeeding that of Fig. 7 and showing the strands severed. Fig. 9 is a section on the line 9 9 of Fig. 1. Fig. 10 is a section on the line 10 10 of Fig. 1. Figs. 11 to 13 are detail plan views of the cord-holder, adapted to illustrate particularly the paying out of the cord-holder strand. Fig. 11 corresponds to Fig. 5, Fig. 13 to Fig. 6, and Fig. 12 to a position intermediate to Figs. 5 and 6. Fig. 14 is a detail elevation of the cord-holder.

My invention relates to the knot-tying mechanism employed in grain-binding harvesters, and more particularly to that portion thereof known as the "cord-holder."

It is the object of my invention to avoid some of the defects pertaining to cord-holders as commonly constructed and in general to simplify and render more effective the construction and operation of this device.

The drawings illustrate only such parts of the machine as are immediately connected with the knot-tying mechanism.

Referring to the drawings by letter, A represents the breast-plate, which is of ordinary construction. This breast-plate is provided with a cord-slot *a* in the usual manner. Toward the upper portion of the said breast-plate there is secured thereto or formed integral therewith an upright bracket or standard B, which extends downward over the lower portion of the breast-plate and is branched or forked into the two arms B′ and B^2, of which the former is the upper. There is secured to or cast integral with the upper arm a tubular bearing B^3. (Shown particularly in Fig. 9.) In this bearing is journaled the knotter-actuating shaft C.

Upon the shaft C and close to the bearing B^3 is keyed the knotter gear-wheel D. This gear-wheel is formed with two concentric channels upon its inner face, of which D′ lies next to the periphery of the wheel. D^2 lies inside of D′. Along one portion of the channel D′ is provided a short gear-segment *d*. At a corresponding point in the inner channel D^2 is provided a shorter gear-segment *d*′. These two segments are so relatively disposed to each other that the shorter segment will engage the cord-holder pinion and the longer segment the tying-bill pinion, both of which are later described at approximately the same time. The knotter gear-wheel is further provided with the two delay-flanges d^2 and d^3, the former extending around the outer edge of the channel D′, the latter around the outer edge of the channel D^2, except at those points where the said channels are provided with their respective gear-segments.

In the lower arm B^2 of the bracket B there is formed a tubular bearing B^4, in which is journaled the short shaft E of the tying-bill. The upper end of the said shaft may also have a bearing in the upper arm B′ of the said bracket. Intermediate to these two bearings the shaft is provided with a gear-pinion E′, which is adapted to engage with the gear-segment *d*. Upon one side of the lower edge of the gear-pinion E′ is formed a delay-surface *e*, so disposed as to contact with the delay-flange d^2. The lower end of the shaft E is provided with a tying-bill E^2, which is of the usual construction and need not be more specifically described. It is adapted to make one complete rotation at each operation of tying and come to rest with its jaws pointing outward in the direction of the cord-slot.

The bracket-arm B^2 is provided with a second tubular bearing B^5 outside of B^4, in which is journaled the short cord-holder shaft F. This shaft also may have a second bearing *f* in the upper arm B′ of the supporting-bracket, as is shown in Fig. 9. Intermediate to these two bearings the shaft F is provided with the pinion F′, the two opposite lower edges of which are squared off to form two delay-surfaces *f′* and f^2. The pinion F′ is itself adapted to mesh with the gear-segment *d′* of the knotter gear-wheel. The delay-surfaces *f* and *f′* are so disposed as to engage alternately with the delay-flange d^3.

To the lower end of the cord-holder shaft F is secured the rotating disk G of the cord-holder. This disk G, while consisting of a single integral piece, may be described as comprising a collar G′, by which it is keyed to the said shaft F, and two diametrically-disposed arms G^2 and G^3, connecting the said collar with the two segmental parts G^4 and G^5, respectively. The said two segmental parts form portions of the same circle and are concentric with the shaft F. The four edges where the arms G^2 and G^3 merge into the segmental parts G^4 and G^5 are preferably rounded, as at *g*. The forward end of the segment G^4, as considered according to the direction of rotation of the disk, terminates in an upwardly and forwardly projecting horn *g′*. The rear end of the same segment terminates in an upwardly and forwardly projecting hook g^2. In the same manner the segment G^5 is provided with a similar horn g^3 and hook g^4.

The first or movable part of the cord-holder consists of the rotating disk G, hereinabove last described. The second part consists of the oscillating plate H, disposed immediately below the said disk G. This plate H is approximately semicircular in form, arranged at right angles to the length of the breast-plate and concentrically with the rotating disk G. The plate H on the cord-slot side is provided with the finger H′, connected with the straight edge of the plate by the curved and beveled edge *h*. The opposite side of the plate H is provided with the depression *h′*, flaring outwardly toward the edge of the plate.

The plate H is supported by being secured to the top of a short post I. The said post is mounted in a bracket J, secured to or formed upon the bottom of the breast-plate. This bracket J is provided with a vertical aperture J′, tapering outward toward its lower end. The aperture at its upper end is adapted to fit about the post and prevent rotation or horizontal movement thereof, but to permit a slight rocking or oscillating movement in the direction of either of its sides, for a reason to be hereinafter explained. The lower end of the post is preferably pointed, as at I′.

At the lower end of the breast-plate there is secured by the set-screw K the lower end of a flat spring K′, the upper and free end of which extends underneath and bears against the pointed end of the post I. There is preferably formed upon the breast-plate a rib K^2, intermediate to the set-screw K and the post I. As the set-screw is tightened the free end of the spring is thrown upward by the rib K, acting in conjunction with the set-screw, and the requisite upward tension upon the post I is secured.

The needle L, parts of which are shown in several of the figures, may be of any preferred construction. The cord-holder strand of the binding-cord in the tying operation illustrated in the drawings is designated as M and the needle-strand as N.

Upon the breast-plate, in close proximity to the tying-bill side of the cord-holder, is rigidly mounted a knife O in any suitable manner.

The operation of the parts hereinabove described is fully illustrated in the accompanying drawings. Figs. 1 and 4 show the cord-holder strand held by the cord-holder before the advance of the needle and while the bundle is being formed upon the binding-deck. This is the normal position of the parts when the knotting mechanism is out of operation. When the binding mechanism below is set going, as by the pressure of the grain upon the compressor-arm or in any other usual way, the knotter gear-wheel begins to revolve. At the same time the needle advances and lays the needle-strand across one of the segments of the cord-holder disk in the manner shown in Fig. 5. As yet neither the cord-holder nor the tying-bill have begun to rotate, each being held in its normal position by the delay-surface upon its respective pinion contacting with the corresponding delay-flange carried by the knotter gear-wheel.

When by the revolution of the knotter gear-wheel the segmental racks *d* and *d′* are thereby brought into engagement with the tying-bill and with the cord-holder pinions, respectively, these two devices are rotated thereby. In Figs. 2 and 6 the tying-bill is shown as having completed approximately a half-revolution and the cord-holder disk a quarter-revolution. The cord-holder strand M is paid out to the tying-bill by the rotation of the cord-holder disk. The needle-strand N, which was laid across the segment G^4, is now caught by the hook g^2 at the rear end of the said segment, and both strands are thus held together and approached toward the knife O.

Figs. 3 and 7 show a stage immediately succeeding. The tying-bill has nearly completed its revolution and is about to grasp the two strands of the cord between its extended jaws. The two strands at the same time are about to be severed by the hook g^2 carrying them against the edge of the knife O. Finally, while the cord-holder strand is still held between the segment G^4 of the cord-holder disk and the oscillating plate H the horn g^3 of the segment G^5 has guided the needle-strand into such position that the said strand is caught between the curved edge *g* of the said segment G^5 and the beveled edge *h* of the oscillating plate H. Thus the needle-strand is

about to be engaged between the disk and the plate and form the new cord-holder strand.

At the next stage (shown in Fig. 8) the jaws of the tying-bill have clasped the two strands and the hook g^2 has carried the said strands against the knife O and severed the same. The end of the old needle-strand—now the cord-holder strand—is clamped between the segment G^5, which has taken the place of the segment G^4, and the oscillating plate. The short end bit severed from the old cord-holder strand lies loosely upon the oscillating plate. When the bundle has been discharged, thereby tying the knot, and when the needle has retreated, laying the new cord-holder strand across the disk-segment G^5, the parts will be in the same position as illustrated in Figs. 1 and 4, except that the disk-segments G^4 and G^5 have changed places.

The foregoing describes in general the operation of my knotter. Some of the more particular features thereof, together with the advantages attendant thereupon, remain to be more particularly pointed out. In the first place, the manner in which the cord-holder strand is paid out to the tying-bill is of importance. It is illustrated in Figs. 5, 6, and 7 and is more especially illustrated in Figs. 11, 12, and 13. It will be seen that the extreme end of the cord-holder strand remains practically motionless from the time that it is first severed as the needle-strand from the knot until it is again severed near its end as the cord-holder strand, leaving the small end bit loose upon the plate—that is, the cord-holder strand is not drawn through between the disk and the oscillating plate in order to pay out to the tying-bill, but is paid out by the rotation of the segment G^4 toward the tying-bill. This construction and operation have two important advantages. There is no wear upon the adjacent surfaces of the disk and oscillating plate arising from the constant drawing between them under tension of the cord-holder strand in order to pay out to the tying-bill. The only wear that can arise in my construction is the very slight amount that may come from the slipping of the cord over the curved edge g, which would be quite inconsiderable. Again, there need be no nicety of adjustment of the tension between the disk and the oscillating plate to regulate the paying out of the cord. The tension may be set at any given amount without affecting the operation of the cord-holder in this respect, and the frequent attention to this tension between the cord-holder parts necessary to insure proper operation in the ordinary cord-holder is thereby avoided.

Another particular feature in the operation of my knotter arises from the construction and mounting of the oscillating plate H. It is well known that the binding-twine used in harvesters frequently varies in thickness. If the plate H therefore had only vertical motion, then at such a point as is represented in Fig. 7, when the end of the cord-holder strand is under the segment G^4, while the needle-strand is being caught under the segment G^5 of the cord-holder disk, if either strand were thicker than the other the plate H would be depressed by the thicker one sufficiently to allow slipping of the more slender strand. This possibility is obviated by the oscillating mounting of the plate H, which permits it automatically to adjust itself to the differences in thickness between the two strands and to hold each of the two strands up against their respective segments of the cord-holder with equal tension. The tapered aperture J′ of the bracket J, in which the post I of the oscillating plate is mounted, permits of such oscillation, which is further facilitated by the pointed bearing I′ of the said post against the tension-spring K′.

It is obvious from the foregoing description that the cord-holder disk makes but a half-revolution during each operation of tying a knot, while the tying-bill makes a complete revolution. These movements may be obtained, as is clear from the drawings, by providing the segment d', adapted to operate the cord-holder pinion, with a correspondingly less number of teeth than the segment d, adapted to operate the tying-bill pinion; also, it will be seen that the cord-holder pinion requires two delay-surfaces f' and f^2, which come into operation alternately, while the tying-bill pinion is provided with but a single delay-surface e. It will further be seen that by the employment of a substantially semicircular clamping-plate H, mounted substantially concentric with the rotating disk G, I have overcome one of the serious defects of this class of machines—that is, the tendency of the cut-off ends of the cord-holder strand or any other foreign material to get between the rotating disk and the clamping-plate and to stay there despite their rotation and to cam or force the plate and disk apart, so as to release the cord enough to permit it to slip and thus interfere seriously with the tying operation. By referring especially to Fig. 13 it will be seen if any cut-off end of the strand or other foreign material should get wedged between the rotating disk and the plate that one-half of a rotation of the disk will be sufficient to surely discharge the foreign material, as it will be seen that half of the rotating disk is always entirely beyond and free from the clamping-plate, so that the foreign material will surely be released and discharged, which operation would not necessarily result if the clamping-plate were differently shaped and disposed relatively to the rotating disk. Finally, the depression h' upon the oscillating plate permits the small severed end of the twine to be more readily discharged from between the said plate and the cord-holder disk.

Many of the details entering into the construction which I have shown and hereinabove described may be altered and various modifications in the construction may be ef-

fected without departing from the general principles of my invention. I do not, therefore, limit myself to the specific mechanism shown and described; but

What I claim, and desire to secure by Letters Patent, is—

1. In a knotter, a cord-holder comprising a substantially semicircular clamping-plate pivotally mounted at substantially its actual center, and a rotating disk parallel thereto and concentric with the curved edge of said plate adapted to hold fixedly the end of the cord-holder strand between the adjacent surfaces of said disk and plate while the rotation of the disk pays out said strand to the tying-bill, with means for rotating said disk, and supports for said plate and disk whereby the disk may be rotated but not rocked and the plate may be rocked but not rotated to accommodate any variation in the cord, substantially as described.

2. In a knotter, a cord-holder comprising a rotating disk, and a clamping-plate normally parallel with the plane of the rotating disk and pivotally mounted so that it can be tilted at an angle to said plane, said disk and plate adapted to hold fixedly the end of the cord-holder strand between their adjacent ungrooved surfaces while the rotation of the disk pays out the said strand to the tying-bill; supports for said plate and disk whereby the disk may be rotated but not rocked and the plate may be rocked but not rotated to accommodate variations in the size of the cord; and mechanism adapted to rotate the said disk through a fractional part of a rotation at each knotting operation, substantially as described.

3. In a knotter, a cord-holder comprising a substantially semicircular clamping-plate and a rotating disk concentric therewith, parallel thereto, and extending above and beyond the said plate in a direction away from the tying-bill, and adapted when rotated to hold fixedly the end of the cord-holder strand, while the said strand is paid out to the tying-bill by that portion of the disk approaching the said tying-bill; and means adapted to rotate the disk through a half-circle at each knotting operation.

4. In a knotter, a cord-holder comprising an approximately semicircular clamping-plate H, and a rotating disk G, concentric therewith, parallel thereto, and located thereover, provided with two oppositely-disposed segments G^4 and G^5, each such segment terminating at its forward end in a horn and at its rear end in a hook; and means adapted to rotate the said disk through a half-circle at each knotting operation.

5. In a knotter, a cord-holder comprising a substantially semicircular clamping-plate and a rotating disk concentric therewith, parallel thereto, and located thereover, consisting of the collar G′, oppositely-disposed arms G^2 and G^3 and segments G^4 and G^5, each such segment terminating at its forward end in a horn g' and at its rear end in a hook g^2; and means adapted to rotate the disk through a half-circle at each knotting operation.

6. In a knotter, a cord-holder comprising a clamping-plate; a mounting for said plate adapted to prevent its rotation but to permit the same to oscillate; a spring adapted to force the said clamping-plate toward the cord-holder disk; and a rotating disk parallel to and located above said plate adapted to hold the cord-holder strand and the needle-strand between the adjacent surfaces of the said disk and the said plate.

7. In a knotter, a cord-holder comprising an approximately semicircular clamping-plate H; a post, I, adapted to oscillate in its mounting in the knotter-framework; a spring K′ adapted to bear against the post I; a rotating disk G adapted to hold the cord-holder strand and the needle-strand between the adjacent surfaces of the said disk and the said plate; and mechanism adapted to rotate the disk through a half-circle at each knotting operation.

8. In a knotter, a cord-holder comprising an approximately semicircular clamping-plate H, and a rotating disk G concentric with said plate, parallel thereto, mounted thereover, and provided with two oppositely-disposed segments G^4 and G^5, each such segment terminating at its forward end in a horn and at its rear end in a hook; a fixed knife against which the strands are carried by the rotation of the disk; and means adapted to rotate the said disk through a half-circle at each knotting operation.

9. In a knotter, an approximately semicircular clamping-plate provided with the finger H′ and beveled edge h; a rotating disk G mounted concentrically with said plate and beneath it, and comprising the collar G′, the arms G^2 and G^3, and the segments G^4 and G^5 connected with the said arms by the curved edges g, and each provided at its forward end with a horn g', at its rearward end with a hook g^2; a fixed knife disposed adjacent to the said cord-holder and adapted to sever the strands carried against the knife by the hook g^2; and means adapted to rotate the disk through a half-circle at each knotting operation.

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